PRODUCTIVITY AND THE IRANIAN BUILDING INDUSTRY:

A CASE STUDY OF COMPONENT MANUFACTURE.

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ABSTRACT

This study is concerned with the issue of building industrialisation in Iran. It focuses on the formulation of concepts and policies that are based on the local construction industry. The aim is not to identify which system or technology it is more appropriate to adopt, or to propose ready made solutions but rather to identify a set of 'practical' recommendations. The problem we are addressing is that:

> Despite repeated failure, industrialised production of building has been seen as the only solution to solve the increasing deficit in residential building since 1951. Decisions often continue to be based on the assumption that the traditional building process is inadequate and must be replaced with 'mass housing', using advanced technology and industrialised methods.

The core of this research is based on field surveys, literature studies, and participant observation and experience and, is presented to support the following hypotheses.

> Hypothesis 1 is concerned with the nature and organisation of the local construction industry: *There is a two tier building industry in Iran: the traditional/ conventional (T/C), and the modern sector construction industry (CI), with a rather weak relationship between them.* A lack of recognition for this unique structure may result in the total demise of the traditional sector.

This study argues that 'industrialisation' is only one method of improving productivity, and that productivity can be improved in the context of the local building industry regardless of technological change. The study argues for the mass production of building components, rather than 'mass housing production'.

> Hypothesis 2 is concerned with the improvement of productivity and appropriate building industrialisation based on local potentials: *One of the appropriate ways to increase productivity in the building industry in Iran is by rationalising the design and process of building with the gradual introduction of light-weight, loose fit, low technology building components in a process of 'componentisation'.*

This dissertation sets out to understand the nature of the construction industry in Iran and its socio-economic environment. It attempts to discuss the specific problems affecting its sustainable development and to identify the different ways open to the industry to increase its productivity. The potential role of 'componentisation' is examined by primary interviews, a field survey and follow-up interviews. The 'two tiers' of the industry are examined by separate studies of the structure and organisation of the T/ C and CI sectors.

The major arguments raised in the course of the study and the two hypotheses are examined in a final recapitulation, leading to conclusions and recommendations.

CHAPTER 1

Introduction and context

1. Synopsis

This research intends to: 1) Study the nature and organisation of the construction industry in Iran, identifying the specific problems affecting its sustainable development whilst at the same time undertaking a study of the different ways open to the industry to increase its productivity; 2) Examine the potential role of standard building components in the rationalisation of the conventional building process. 3) Assess the feasibility of the concept by studying the major aspects of the production and marketing of components.

Several attempts to industrialise building have been made in Iran since 1951. These were often based on high technology system building. Decisions were made regardless of the unique structure and organisation of the local building industry and its potential. The need to industrialise building is often initiated by professionals in the construction industry and supported by government executives, and some academics. It is often justified on the basis of a number assumptions such as low productivity in the context of the traditional building process. It is assumed that 'mass housing', using industrialised building should replace the 'single-unit' house building custom.

This research, while testing the assumptions of those who argue for mass housing and industrialised building, will examine two major hypotheses which have developed through the course of the study:

Hypothesis 1 is concerned with the nature and organisation of the local construction industry: **There is a two tier building industry in Iran: the traditional/ conventional and the modern sector, with a rather weak relationship between them.** The implication of this hypothesis suggests that a lack of recognition for this unique structure may result in the total demise of this invaluable sector and inappropriate decisions being made with regard to 'building industrialisation', or 'mass housing'.

Hypothesis 2. is concerned with the improvement of productivity and appropriate

building industrialisation based on local potentials: **One of the appropriate ways to increase productivity in the building industry in Iran is by rationalising the design and process of building with the gradual introduction of light- weight, loose fit, low technology components (LLLC).**

This concept of 'componentisation' will be discussed as an appropriate approach compatible to both the traditional and the modern sector of the building industry. Both sectors have their role to play and need further development. Instead of damaging one for the benefit of the other, decisions must be made for further development of both sectors. It benefits both sectors to maintain a better link and relationship to help one another in their development. This concept could even be used to rescue those abandoned factories and change their production line from 'mass housing' and system building to the mass production of building components.

2. Background.

The traditional *memars*'[1] system has been responsible throughout Iranian history for the creation of a sophisticated and appropriate built environment necessary for the enhancement of life . For thousands of years it has created a rich mosaique of architecture and construction methods in accord with the social, cultural and environmental conditions of the country. Yet in today's Iran it is referred to, dismissively, as unorganised or informal, and its role and potential is neglected.

The modern construction industry in Iran emerged in 1927. With growing public expenditure on development plans the modern sector continued its growth and developed according to the requirements of these plans. The Construction Industry was shaped according to the requirements of the last six development plans, the first of which was introduced in 1949. Right from the beginning oil revenue had the biggest share in financing these development plans, and thus the modern construction industry.

When 'oil revenues quintupled from 1963/64 to 1970/71, this made it possible for the Plan Organisation to finance most development projects under conditions which protected domestic contractors from foreign competition'.[2] But despite the potential benefits of huge oil revenues[3], the country failed to develop the modern construction

industry in a sustainable way during the former regime. The regime failed to develop a national economy and, despite its bureaucratic largesse, in effect relinquished control of industrial development to the vagaries of the world oil market. In that economic environment very few companies were committed to long term investment, particularly in the development of the related building components industry, or the building materials industry.

Since there was little investment, and capital gains were kept liquid, it was relatively easy for building entrepreneurs to flee abroad and by doing so, drain the Construction Industry of its capital. On the other hand those companies who remained had to suffer from drastic fluctuations of workload and in a period during the 1980s 700 companies were bankrupted and dissolved[4], yet another loss for the modern sector of the industry. This was certainly not an exceptional case. 'Over the five year period 1966/67 to 1970/71 no less than 109 construction companies were dissolved. Early in 1972 40 of the 180 companies belonging to the Syndicate were said to be bankrupt or on the verge of bankruptcy.'[5] The loss and damage to the industry and to the livelihood of construction workers was disastrous.

Developments in Iran during the last 15 years, particularly the rapid growth in population (average birth rate 1967-1992 is 3.00 [6]) and rural-urban migration (average annual rate between 1967-1992 is 1.63 [7]), and the effect of war and natural disasters, have created a situation in which building needs, particularly in the housing sector, are soaring[8]. On the other hand, as a result of a rapid increase in the cost of building the gap between need and demand is widening and those in need of basic shelter in urban areas cannot afford building costs. These conditions have resulted in a situation where the building industry has sunk into its deepest recession of the last 20 years.[9] .

Although 92 percent of residential building is built by the non-modern 'traditional/ conventional' sector of the building industry, this sector and its potential is ignored and its capacity considered to be limited. Despite repeated failure during the last four decades, industrialisation and prefabrication of building has been seen as the only solution. It is interesting that very recently (20-30 January 1992) following a decision by the Ministry of Housing and Urban Development (MHUD) to build 20 new cities[10], a seminar was held by the Tehran Syndicate of Contractors, inviting German firms with a view to transferring German industrial technology.[11] Decisions continue to be based on

the assumption that the traditional/ conventional sector is inadequate and industrial production of building is a necessity, is inevitable, and must be considered as a goal.

3. Previous research

Academic research on the construction industry in relation to Iran is limited, and what there is focuses on the modern sector. Universities in Iran have had very few links with industries particularly in relation to research on planning and development of the construction industry. The Iranian Building and Housing Research Centre (BHRC) of the Ministry of Housing and Urban Development (MHUD) was established in 1973[12]. BHRC, being the only significant research body in relation to the built environment in the country, is busy with a wide area of technical subjects and yet lacks a comprehensive multi-disciplinary study of the problems of the construction industry. It has still not yet carried out any research in relation to the traditional/ conventional building activity. There are a few works related to the methods and systems of building production, buy all in the sphere of industrial building. The World Bank Report's section on the Iranian Construction Industry (1972)[13] is exclusively concerned with the development of the modern sector of the construction industry.

There are a few pieces of academic researches directly related to the Iranian building industry, one in 1973 by J. Spillane [14] and the other in 1989 by A. R. Ghanbari Parsa[15].Since the 1970s, the economic, social, and political situation has drastically changed in Iran to the extent that most of Spillane's findings do not match the current situation. For instance, with the abundant Oil revenues of that period, he concludes that progress in the Iranian building industry should be geared 'to industrialisation comparable to that already achieved by a number of developed countries'.[16] Ghanbari Parsa focuses on the economic and physical development planning policies in relation to building companies. His account on the structure and organisation of the Iranian construction industry[17] is a very brief overview of the formal sector and includes nothing about the traditional/conventional sector.

It is ironic that all the limited research on this subject only mentions the traditional sector of the building industry in their introductions and then only to announce its limited capacity, without any suggestions for its improvement and further development. Another

aim of this dissertation is to draw attention to the two tier nature of the Iranian building industry and to give a profile of each of these two sectors.

Industrialisation and prefabrication of building is repeatedly suggested by government officials and academics[18] in the country as the ultimate solution. As Mr. Rafsenjani states: 'Try to promote the modern methods of building production and the industrialisation of building, whilst at the same time preserving the valuable indigenous principles of architecture and city planning.'[19] But aren't valuable indigenous principles related to those 'industries' which created them? And is industrialised building capable of adapting traditional values, and being sensitive to this indigenous principles. These are questions to which architects, engineers, and in fact all parties involved with the built environment should find a proper answer.

It is obvious that there are different ways to implement modern building science and methods of production, in short to industrialise building. Unfortunately the focus of discussions has been around the trend towards mass production of building and imported high technology system building. It seems that failed experiences are attributed to trivial factors. Not only have we failed to learn the lessons from our past, but there seems to be little awareness concerning the bad record of system building elsewhere.[20].& [21] However in the case of Iran because of geographical diversity, as well as economical, cultural, and technical conditions, heavy industrialisation and mass production of buildings is far from appropriate. There are other approaches to increase production, which may prove more relevant and appropriate.

As the author agrees with Tom Kemp [22] that **Industrialisation is a means to increase productivity,** this dissertation aims to focus on the goal **(improvement of productivity) rather than one particular means of it, industrialisation.** This approach will help in finding more appropriate solutions.

4. Objectives

This study is primarily concerned about the trend and the manner towards mass housing. and industrialisation of building in Iran. This trend affects the traditional conventional building industry. Although sustainable development of the modern sector of the

industry, responsible for the execution of economic development projects, is a viable concern, it will be a great loss if the deep routed, functional and invaluable *memars* sector is sacrificed for the benefit of the modern sector. Numerous attempts and repeated failures on the building industrialisation may be as a result of the lack of understanding of the nature, organisation, potential and problems of different sectors of the local building industry.

Study of the nature and organisation of the construction industry and its socio- economic environment is one of our prime aims. Another aim is to identify the specific problems affecting its sustainable development. Low productivity of traditional building is often mentioned as the main reason to justify policies toward mass housing and high technology system building. another major objective of this study the study of the different ways open to the industry to increase its productivity. European experience have already showed that component building has a significant role in rationalisation of traditional building. The objective is to examine the potential role of light weight loose fit low technology building components in our context.

There are a number of issues and assumptions which need to be studied in depth :

1. There is a false assumption that the *memars* sector is 'unorganised' and inadequate, and that industrial production of building is a necessity and inevitably must be considered as a goal. This leads to the repeated failure of attempts at industrialising building. This assumption leads to wrong decisions on the building industrialisation and repeated failure and loss of resources. Thus the issue needs to be thoroughly examined with due considerations to the unique structure and organisation of the Iranian building industry.

2. There is no realistic assessment of the importance and potentials of both sectors and their role in housing and economic development but rather an atmosphere of total neglect towards the traditional sector among the decision makers and other parties involved. The major implication of this assumption is that: The total neglect of *memars'* sector and lack of support and guidance from the part of government administration and policy makers not only damages the situation of housing supply but may also lead to the total demise of the traditional sector.

3. It is not only drastic fluctuation in oil prices which have inevitably seriously affected

the construction industry, but the fact that oil income has also drastically declined since 1981. There is evidence that this is not a temporary situation, and in fact oil price and the purchase power of oil revenue will continue to decline for the foreseeable future. Clarification of this 'new' situation is crucial for future economic development planning as well as the development of the construction industry.

4. As a result of the uncertain demand situation, the modern sector is increasingly looking to housing (which is the domain of traditional/ conventional sector) for its workload. The implication of this situation is that if this process carries on in an aggressive manner it not only damages the latter sector but the interests of clients and the housing situation as a whole.

5. The increasing number of people in need of housing without the economic power to create a demand in the market leads to a widening gap between need and demand. This suggests that there is a deteriorating housing situation. This is attributed to the increasing cost of building and low productivity in the construction industry. Despite the increasing need the building industry currently suffers low demand and has gone into its deepest recession since the last 20 years. It is, therefore, in the interests of the building industry, as well as the community, for the building industry to be as efficient as possible.

6. Industrialisation in building is considered as a goal in itself not a means to increase productivity. This has lead to wasted investments, import of high technology regardless of the structure of the local building industry. Research must be focused to find various ways open to the industry to increase its productivity with a view to sustainable development of the industry.

All this broad area needs to be studied before any assessment could be made on the most suitable way of improvement of productivity and increasing the efficiency of the construction industry as well as planning for its further development.

Lack of previous research, and a broad area of investigation makes this study an exploratory research. 'Where the researcher is attempting to design an exploratory study in a field as yet little examined, he may start off without any hypotheses, his aim being in fact to produce them. At best a vague type of hypothesis may fulfil his requirement.'[23] At

this stage, it is assumed that standard building components have a role to play in rationalisation of the conventional building process.

5. Methodology.

In order to overcome the difficulties associated with this study, due to: 1) a very limited research on both the subject and the context of this research; 2) the fact that most of the available literature on construction industry in developing countries have little relevance to the Iranian context due to its unique socio- economic structure and building traditions; 3) A lack of data in almost all 'international' publications (secondary sources), and difficulties in the access to the data due to difficulties of the imposed war[24] and socio - political conditions; 4) the absence of a socially conscious and culturally sensitive conceptual framework for the study of construction industry, this research used a combination of empirical evidence and theoretical perceptions.

A study like this touches at its periphery upon many related subjects and different disciplines and all can throw additional light on the subject in its widest context. The study uses a combination of methodologies. Mauch and Birch[25] mention that academic research may legitimately embrace a wide variety of forms of scientific investigation.

> 'In fact, there are many actions that can assist in discovering knowledge, and humanity learned much about human nature long before there was [formal recognition of] scientific method. Any action that lead to accurate statements about nature must be considered as having some methodological legitimacy; the characterisations of contrasting methods are simply arguments that some scientific actions are more effective than others at producing statements of good generality.[26]

Mauch and Birch have distinguished fourteen types of research - and methodologies .As to the definition of case study type, they state:

> Case study, in which the background, development, current conditions, and environmental interactions of one or more individuals, groups, communities, businesses, or institutions is observed, recorded and analysed for stages or

patterns in relation to internal and external influences.

The main body of this dissertation is based upon this methodology which in essence is a 'system approach'. John Bennett[27] a renown researcher on the construction industry employs this approach for the study of the construction industry and project management. He states:

> 'Systems thinking has revolutionised science. In many separate fields new ideas and new ways of thinking about subjects have followed from the adoption of a system approach.. . . . . .In essence the difference between systems thinking and earlier scientific approaches is that it focuses on the whole rather than on separate elements.'[28]

Classical science which takes a subject and divides it into ever smaller elements although has been very successful and have lead to many important discoveries, is however an approach, that works best with inanimate objects: Living and moving things need to be studied as a whole if important features of their behaviour are to be understood. John Bennett[29] who adopted this approach for his study of construction projects organisations believes that: 'systems thinking is specifically designed to help us understand complex subjects. There is no doubt that construction project organisations are extremely complex'[30].

The approach which he suggests for the study of complex project organisations certainly matches the more complex organisation of the construction industry. In fact the same method were used to some extent in his study of the Japanese construction industry.[31] Bennett continues to argue that: 'systems gives us a way of thinking about complete subjects so that we can study their separate elements in context. System force us to consider the interactions between elements.' This perfectly matches our Eastern way of thinking and looking at the world when Saadi Shirazi the 12th century poet compares the society to a human body.[32] However as the construction industry is about the people and consists of many interacting elements working together, responding to its complicated environment, as a living thing. must be studied with a system approach.

The main research methods which have been employed in this study and development of this dissertation are: 1) continuous literature survey of English and Persian primary and

secondary sources; 2) a pilot questionnaire survey in the British context; 3) a number of interviews in the Iranian context before the questionnaire survey; 4) a structured questionnaire survey in the Iranian context; 5) a number of follow up interviews.

This researcher, being from a family of memars, studied to the degree of M.Sc. in Civil Engineering and started a professional career in 1963. For 25 years, the author has been involved in various positions of responsibility in the Iranian construction industry. He has also been actively involved in professional organisations in national and provincial levels and potentials and participated in numerous seminars concerned with a variety of issues related to the built environment and construction industry. The author has drawn upon the knowledge and experience of this period in carrying out this research and analysis of the data.

6. Structure of the study.

In order to investigate the above issues, formulate hypotheses and examine their validity, this study will start by exploring the background to the Iranian building industry to understand the nature and roots of the process, organisation and technology of today's construction industry. Chapter 2 provides a profile of building traditions, the environment in which the 'modern' construction industry emerged, and current socio-economic conditions. After a brief consideration of the historical background, this Chapter continues with a detailed examination of Iranian building traditions, focusing on domestic - residential buildings. This is followed by a discussion of the influence of traditional architecture on today's perceptions and current practices. The effect of Western influences, and the role of modern schools of Architecture in a period of 'departure' from traditional values is examined. Finally current socio-political and economic conditions are examined in order to understand the present opportunities and problems, and the dynamics of change for a possible 're-orientation'.

Chapter 3 will discuss the characteristics of the construction industry and the effects of the socio-economic environment. There is a brief description of the construction industry and its divisions both in general terms, and in relation to the Iranian context. In the last 15 years two major events, war and revolution, have affected both the economic and business environment, but the most influential effect was the drastic decline of oil

revenue in the economy in general and in the context of construction industry in particular. These issues are studied in the final section of this Chapter. The study of divisions in the industry suggests the existence of a two tier building industry; traditional conventional, and the modern sector which became the basis of the first hypothesis.

Chapter 4. is a theoretical discussion which leads to the second hypothesis. It starts with providing a picture of the trends in the supply and demand for residential buildings. The increasing number of people in need of housing without the economic power to create a demand in the market leads to a widening gap between need and demand. This suggests that there is a deteriorating housing situation. This will be looked at from the perspective of the construction industry. Improvement of building productivity will be examined as a basic approach to alleviate this deteriorating situation. Exploring various methods and ways open to the industry to improve its productivity leads to the potentials of 'component building' in a process of rationalisation of traditional building. This serves as the theoretical basis of our second hypothesis.

A description of research methods adopted by the author throughout the study is given in Chapter 5. This Chapter, while giving a more detailed account of the research methodology, the process of formulating concepts and hypotheses, presents an examination of a pilot survey in the context of the British building industry. The survey was made with two goals in mind. Firstly, it was assumed that exploring the issues raised in this survey may help give a better understanding of the issues involved in the improvement of productivity as well as providing more information for examining the issues which may act in the case of Iran. Secondly, it was seen as a pilot study to assist us in the development of the questionnaire and the selection of the method of conducting the field survey.

Followed by the pilot survey presented in Chapter 5, the Field survey and the implications of the findings are presented in Chapter 6. This Chapter presents an analysis of a pre- coded questionnaire addressed to different parties involved in both the conventional and modern sectors of the industry in Shiraz. Problems of manufacturing and marketing of building components, and the situation in relation to the promoting four different building components are surveyed by an analysis of a questionnaire It also includes an analysis of the factors affecting productivity, and a more detailed examination of the role of off-site produced building components. This survey was basically designed

to provide more data for the final assessment on the second hypotheses. Furthermore, some of the data regarding the organisation of the industry helps to support hypothesis 1.

Chapters 7 and 8 are devised to provide a detailed examination of the structure and organisation of the Iranian building industry. These two chapters provide more data on the structure of the industry and serve to examine the first hypothesis. 'Two tiers' of the industry as suggested by the hypothesis are the traditional/ conventional and the modern sector. Each has a separate organisation, and need separate treatment. It is only true that the conventional sector is 'informal' or 'unorganised' in comparison to the degree of formality and the kind of organisation present in the modern sector. But does this really mean that it has been operating all these years without any kind of organisation? Chapter 7 is dedicated to revealing the underlying organisation of the traditional/ conventional sector and identifying its potential and problems; Chapter 8 deals with the study of the organisation, problems and potential of the modern sector.

Chapter 9 draws together the aims of the study set out in the initial synopsis. This provides a recapitulation of the major findings and the issues raised during the study. In this way it re-examines the two hypotheses which have been developed in the course of the research, draws conclusions and makes the necessary recommendations for those who are involved in the industry. The Chapter ends with specific recommendations for the establishment of professional bodies and necessary institutions to help solving problems and pave the way for further development of both sectors of the building industry as well as emerging building component industry.

7. End notes

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1 The closest equivalent to Memar or Mimar in English is master builder. The word 'Me-e-mar' is Arabic and has been used since an unknown date in the Islamic period. The Persian word is 'Mehraz' which is rarely used in modern Farsi. According to currently used dictionary (Aryanpur Persian- English Dictionary, third edition 1983), Mehraz is equivalent to architect in English and 'me-e-mar' in Arabic. from In English the word 'Me-e-mar' is spelled in accordance with its Arabic pronunciation as Mimar which is different from its Farsi pronunciation. So in this work we have chosen the popular and to some extent official translation conventions in Iran. The spelling of authors surname by the Iranian Passport Office can be taken as an evidence to this.

2 Dewilde John C., Gates Marvin, Werth Nicholas, Cockburn Charles, 'A Framework For The Development Of Construction Industries In The Developing Countries'; Report of a Special IBRD Mission; World Bank 1972 vol. I p21

3 See annex 2

4 Put the reference on the bankruptcies from chapter 4

5Op cit. John. C. Dewide et al; Vol. III appendix 2 pp 2-3 1972

6 Ahari Zahra Eng.; A. Arjmandnia Dr. S.M., Habibi Dr. F ,Khosrow Khavar Dr. ; Maskan-e Had-e Aghal (Minimum Housing) Building and Housing Research Centre (BHRC) Esfand 1367 (March 1989) derived by the author from the table on p124. It is notable that birth control policies during the eight year war were abandoned, and the prospects for their success in the near future are not encouraging.

7 Op cit. Ahari et al, p 124 . It is notable that the average rate of growth in urban population between 1967 and 1992 was 3+ 1.63= 4.63. The authors predicted that by the year 2002, two thirds of the population in Iran will live in cities.

8 Moreover the Director of Housing Management of the Ministry of Housing and Development predicts that 'in the year 1390 (2011) the country will face a population of 120 million'. And the situation of housing becomes more critical. (Iranian population was just above 30 million in 1980).

9 Samari Mohammad, (The Director of Housing Management of the Ministry of Housing and Development); 'Barnamehhay-e Dowlat Baray-e Towlid-e Anbooh-e Maskan dar Ghaleb-e Tarhhay-e Melli'. (Government Plans for Mass Production in Housing in the context of National planning).Published in Kayhan Havaie ;issue 1030; 12 May 1993.

10 In this respect Sherkat-e Towlid-e Shahrhay-e Djadid Dar Iran (The Company of Building New Cities in Iran) has been established. The population of each of these 20 cities will be between 200 to 500 thousand. The necessary capital for the building of these cities is to be provided by foreign companies. Low priced land will be provided by the Ministry of Housing in exchange for a part of the completed apartments.

11 Seminar-e Sannaye-e Sakhtemani-e Alman (Seminar of German constructional industries) 28-30 January 1992.

12 Building and Housing Research Centre (of the Ministry of Housing and Urban Development; Five Year Report. 1989 p5. BHRC operates with a total personnel of: 'A total personnel of 137 of whom 52 are technical staff involved in research (of whom 12 are PhD holders) and the remainder in administration services'

13 Op. cit. Dewilde John. C. et al.

14 Spillane James J; 'The Housing Production Process In Iran', PhD dissertation; New York University 1973

15 Ghanbari Parsa Alireza, 'The Interaction of Planning Policies and Construction Technologies In Iran' PhD dissertation,: Department of Town and City Planning : University of Newcastle Upon Tync. 1989

16 Op. cit. Spillane p86

17 Op cit. Ghanbari Parsa. pp 173-176

18 Falamaki, Dr. M. M. (Professor of Architecture and city planning, University of Tehran): 'Memari-e Iran Az Honar ta Sannat.' (Iranian Architecture from Art to Industry) ;Majalehe Sakhteman (Construction Magazine) No. 8 1989 pp 40-49
Also see Falamaki Dr. M. M.; Hashem Nejad H.Dr. (University lecturer on Architecture); Takmilhomayoon-Dr. N.(sociologist, lecturer), Ansari M.R. (Engineer; prefabrication specialist); Nili-Dr. (University lecturer on Architecture); Salehi M. (Engineer prefabrication specialist from the Ministry of Housing and Development) and Majd A. (Engineer Editor of the Majalehe Sakhteman); 'A discussion about the manner of the need for prefabrication in building (in Iran)' Majalehe Sakhteman (Construction Magazine)No. 9 1989 pp 6-17
It is worth noting that at the end of this discussion A. Majd concludes that: 'The process (of prefabrication in Iran), from the stage of research to end product, must be divided into three phases. The first is research on natural environment, climate, and typology (of the region). This must be done by universities and research institutions in the country. The second stage is the design, which must be done by consultant firms. The third is the execution, which must be done by the contractors'.

19 President Rafsanjani; Message for the opening of the first congress of the Nezam-e Mohandessi (The Architectural/Engineering Order) held in Isfahan on Khordad 1370 (June 1991). Published by the organisation of Nezamhay-e Mohandessi-e Ostan-e Fars (The organisations of Architectural/Engineering in Fars Province) Aban 1370 (Nov. 1991)

20 Ikhlef, Abderrahmane 'Impact of Technology And Industrialisation On Housing In Algeria': MPhil thesis; Institute of Advanced Architectural Studies University of York, 1984

21 Abu-Ghazzeh, Towfiq M., 'Industrialisation of Building Systems in Jordan; The Investigation and Analysis of Housing Problems in Jordan and The Potential Role of Systems in Alleviating the Housing Shortage'. PhD thesis. The Catholic University of America 1985 p 419

22 Kemp Tom, Industrialisation in The Non-Western World. Longmans 1983 p2 'How it was that countries which had developed civilisations many centuries ahead of Europe, were subsequently left behind because they failed to apply knowledge to raising the productivity of labour'

23 Krausz E. and Miller S. Social Research Design ; Longman 1974 p8

24 Barakat S. ; Reviving War - Damaged Settlements: Towards an International Charter for Reconstruction After War' D. Phil dissertation in Architecture; University of York 1993 .

25 Mauch. James E. and Birch Jack W., Guide to The Successful Thesis and Dissertation 1983 p69

26 Johnston J.M., and Pennypacker H.S., Strategies and Tactics of Human Behavioural Research. 1980, pp 412- 413 as quoted by Mauch. James E. and Birch Jack W op cit.

27 Benett John is a renowned reader in construction industry, Professor in the Centre for Strategic Studies in Construction; University of Reading since 1975, and author of a number of publications in the field of construction industry. Among his publications are: Capital and Counties Report: Japanese Construction Industry. (Capital and Counties plc is a property development and investment company in the UK which commissioned this research.) 1987 ; Building Britain 2001 1988 ; 'International construction project management: General theory and practice 1991

28 Bennett, John, 'International construction project management: General theory and practice.' 1991 p45

29 Ibid.

30 Ibid. p45

31 Bennett John, Flangan Roger, Norman George. Capital and Counties Report: Japanese Construction Industry. (Capital and Counties plc is a property development and investment company in the UK which commissioned this research.) 1987;

32Humans are as organs of one body
as was created from the same substance
when a member is in pain
no peace for others, but strain

PAGE NUMBERING AS ORIGINAL

CHAPTER 2

Building traditions, emergence of the 'modern' construction industry, and current conditions.

1. Introduction

> 'The present grows out of the past and is not comprehensible without the knowledge of the past. Past is not static or fixed. It is a living past so long as it is remembered; and even if it is not consciously remembered, it may survive in something that still lives on our minds as an unconscious heritage. It is also a changing past. Because it leaves in our minds, it also changes with them and assumes new forms from age to age.'[1]

In order to understand the particular problems which confront the Iranian construction industry the first step is an acknowledgement that its internal dynamic is the product of many contradictory forces which have arisen at various times during its history. It is true of all societies that changes in the politics and economy of a nation are inevitably reflected in the various branches of that nation's culture. Of course no processes are without their contradictions, and it needs stressing that despite many political changes Iranian industry developed organically and in relative harmony until the 19th Century when foreign imperial powers disrupted, through their control of the Qajar dynasty, the varied but integrated Iranian crafts and/ or non manufacturing industries.

The purpose of the preceding examination of Iranian cultural traditions in the sphere of construction is two fold. Firstly, a brief study of construction in this period is useful particularly to understand the nature and roots of the process, organisation and technology of today's construction industry in Iran. Secondly, it is sometimes necessary for those of us who study the issues related to 'developing countries' to remind ourselves that we are not seeking solutions in a desert. However when there is an ignorance of one's own traditions, the seductive appeal of Western exported technologies can carry with it a kind of cultural inferiority complex. But very few cultures in the developing world are as impoverished culturally as they are sometimes led to believe and in the case of Iran, there is a three thousand years of heritage to draw upon.

In order to discover other alternatives (possibly with fewer faults), a creative retrospective attitude is necessary, though certainly not a fanatical worshipping of the

The study of 'the departure from traditional architecture' includes: The effect and the manner of Western influence, and the role of Modern Schools of Architecture. How far have we gone and what do we think and feel of this departure? These are discussed under 'the continuing influence of traditional architecture', and the views of influential architects and *memars* are presented.

An effort has been made to understand major morphologic elements and factors determining the form and character of traditional domestic architecture. These are examined in the light of the residential architecture of the traditional city of Yazd. After an examination of origins and major morphologic factors and elements such as Ghanat and Bazaar, and the typology of the spaces, the elements of the 'courtyard house' are further studied. To elucidate the deep rooted organisation of the traditional 'building industry' and its 'codes of practice', an attempt has been made to study the traditional principles, geometrical order, and the process of design by *memars*.

Any attempt to re-orient social values and trends, among other things, takes the will, the support, and the efforts of the society. On the other hand economic facts and the realities of life affect people's preference. These socio-economic realities also may influence the attitude of decision makers towards traditional values. The political structure and the way in which the key decisions are made is directly related to the system of decision-making. What kind of structure for the building industry involves the society in the decisions made for the creation and improvement of the built environment? After the two bloody and anti despotic revolutions of the last 90 years the process of decision making must have changed. What are the conditions for change, the historic forces behind the idea of Re-orientation? The final section of this chapter is in answer to the question : what is the state of international relations, and the 'pillars' of the Islamic government, 15 years after the Islamic Revolution ?.

2.Historical background.

The construction 'industry', in Iran or perhaps more appropriately, the construction craft, is one of the oldest in the country and has been responsible for the creation of sophisticated and appropriate physical facilities necessary for the enhancement of life throughout history. For thousands of years, before industrialisation in the West and its influence in different socio-economical aspects of the country, construction methods

evolved gradually and according to the social, cultural and environmental conditions of the country.

Climate, available building materials, and a cultural heritage handed down from the many peoples who have occupied the Iranian plateau since prehistoric times, have all shaped building styles and techniques. Persian *memars* have contributed such techniques as vaulting and the dome to the art of building and have introduced styles such as the *apadana*, the *aivan* and the pointed arch.[2] A brief study of the history of Iranian construction is useful particularly for understanding the nature and cultural roots of the conventional technology in today's construction industry. It is not difficult to see why this historical perspective is vital. Not only does a good deal of traditional know-how still exist, but such knowledge is widespread, as are the many local building materials industries which serve it.

The historical background to construction in Iran starts with the basic problem of 'how to build? 'Environmental conditions and scarcity of wood in Iran led to the early development around 8000 BC of construction techniques.'[3]The complete history of Iranian solutions to this problem would require comprehensive research, but to gain the minimum necessary insight into the roots of the Iranian construction industry, it would be helpful to briefly outline examples of the major construction projects, inventions, innovations and techniques developed in this country. Iranian architecture and building technology developed gradually through stages of trial and error to become thoroughly harmonised with the environment and the people's way of life. It is impossible to over-emphasise the significant role played by construction throughout Iranian history. Iranian *memar*s succeeded in the invention or evolution of the construction of *Ghanat* (special under ground water channel), *AAb-anbar* (closed ground water reservoir with stairs and several taps), *Asiab* (water mill), *Asiay-e baadi* (windmill), *Estakhr* (ponds, open reservoirs), *Sadd* (Dam), *Rah* (road), *Pol* (Bridge), *Karavansara (caravanserai)* , *Sarai*, *Bazaar*, *Timcheh*, *Garmabeh· Hammam* (private or public bath-house), Castle, Palace, Mosque, Madrassa, Tekieh, Mausoleum, and house building over a very large region and influenced the World Architecture.[4] Significant Iranian *memar*s travelled long distances to contribute to the design and construction of important world masterpieces which were miles away from their hometown.[5 &.6]

Iranian architecture displays special features such as proportional design and measurement, proper use of domes, the Ivan, tall column, and the functional incorporation of decoration. Varied geographical and climatic conditions in Iran also lead

to the generation of various `indigenous' residential building types.[7]

In hot arid regions of the country, such as Kashan and Yazd, an amazing system of air conditioning was developed, which not only decreased the temperature by 'bad guir' (wind catcher, a high rectangular tower with openings in each side to actually catch any slight breeze blowing), but also served to increase humidity by passing the breeze through a basement, with usually a pool in the middle. In humid areas like Mazandaran the sunshine was filtered through the use of a wide 'Eyvan'(veranda) in front of the buildings and a roof cantilever on other sides. Tick walls were also specially built here to insulate against heat and cold during summer and winter. In the north, where there is plenty of rain and timber is abundant, pitched roofs with a wooden structure were developed. In other areas wooden posts cut from specially grown trees and mud were used in flat roofs. Domes and vaults were developed in central provinces where there were few trees and horticulture was difficult.

3.Developments in 19th century.

The nineteenth century coincides with the period of Qajar rule. The tale of Iran's social and economic development in the nineteenth century is briefly this: growing contact with European countries; the granting of shameful concessions to foreign companies; the paralysing of the national economy; price inflation; internal and external devaluation of the national currency. The development of European economic power through growing commercial contact and the political influence of European countries over Iran, affected the composition of foreign trade, the balance of payments, the pattern of consumption, and as a result the internal power structure.

According to the traditional view, Qajar Iran (1796-1925) was a clear example of backwardness in comparison with nineteenth - century Europe's socio-economic developments. Although in Iran there were some changes these were by no means necessarily all 'progressive'. With respect to economic welfare, the accumulation of native capital, the invention and absorption of new techniques, the expansion of productive industry, the integration of the productive sectors of the economy, the emergence of a considerable industrial working class, the enactment of necessary social and political reforms, Iran lagged well behind Europe. Qajar despotism, recognised by Iranians as the main reason for corruption and economic backwardness, was ended by *Mashrouteh* (parliamentarism) Revolution.

The cultural stagnation and political corruption of this period had an inevitable effect on the psychology of most Iranians. Seeing their country stagnating, a dislike and dismissal of the past became linked with their hatred for the corrupt regime and prepared the path for greater introduction of 'Western methods'.

However against all odds and evils during the Qajar dynasty, and despite the growing contact with Europe, Iranian architecture continued on its traditional path, and in fact there was no change in architecture and traditional building technology. *Memar*s were fully in charge of building activities with very little change in the nature, procedure and characteristics of the construction industry.

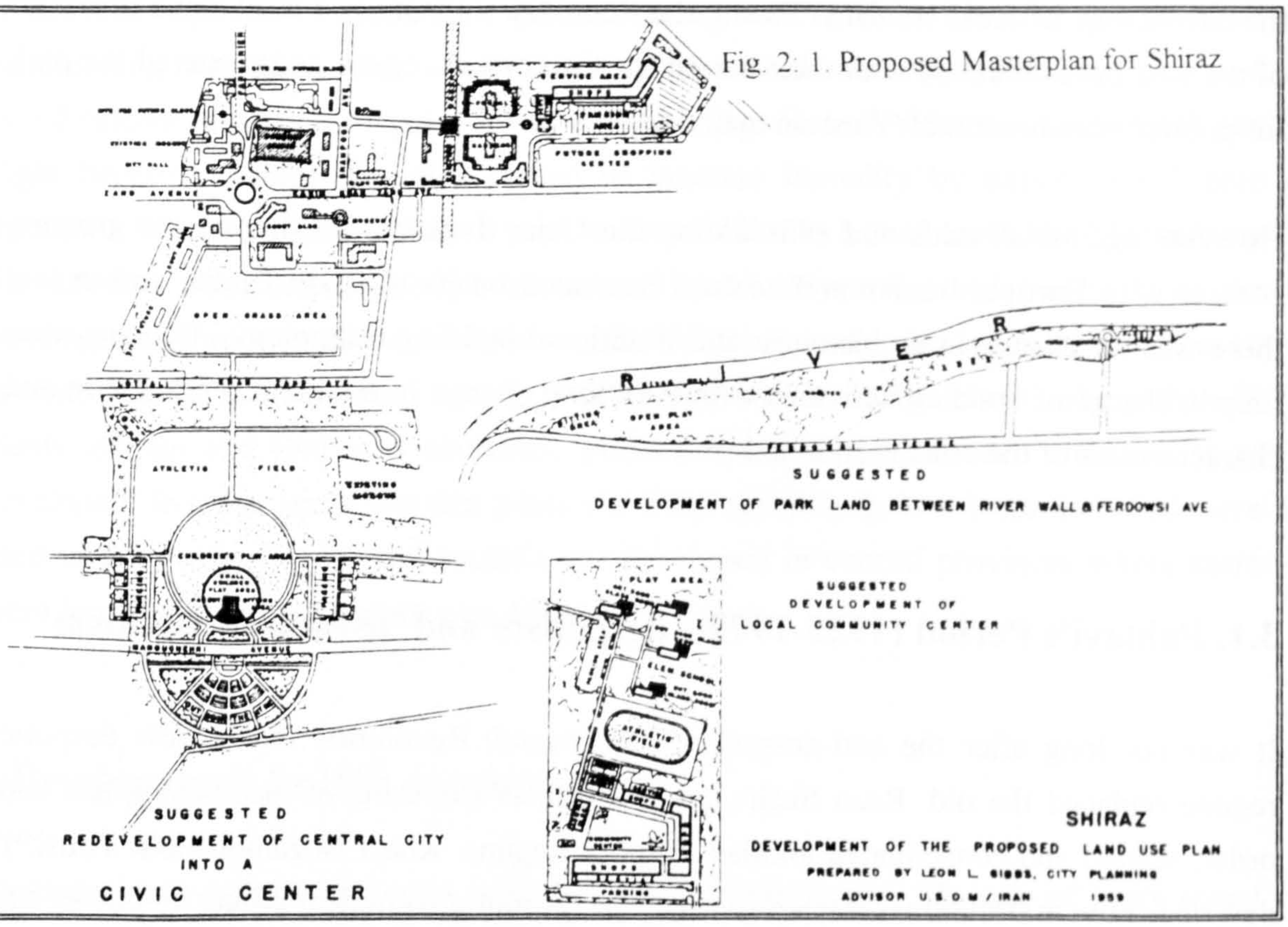
3.1. Pahlavi's Period (1925-1979); despotism and 'pseudo-modernism'

It was not long after the anti-despotism *Mashrouteh* Revolution that a new despotic regime replaced the old. Reza Shah's government, in the name of maintaining law and order, started and consolidated another despotic regime. Khaja Nezamul-Mulk Tousi,[8])' describes how in traditional Iranian society a dictatorial government comes to power but is later overthrown and replaced by another dictatorial government, the turning wheel of dictatorship - uprising and sedition - dictatorship. Katuzian [9] who has analysed this turning wheel during the past 10-15 years on various levels has clarified its roots, foundations and various features states: 'In short, government has been separated from the community in the traditional Iranian society and has been not just at the head rather high above the community. Consequently in the final analysis, the government has never had a solid, continuous base and a point of reliance within the community and for this reason it has never enjoyed political validity among the people and has not lawfully represented them'.

Two major conflicting attitudes developed through and immediately after the Mashruteh revolution towards modern ideas and the methods of the west. The attitudes of the Traditionalists who were opposed to any adaptation and application of modern techniques, values and institutions to Iranian society, were in stark contrast to those of a small but growing group of 'Europeanisers'; superficially exposed to European modernisation but with little understanding of it. Due to different factors within Iranian society and the world geopolitical situation the latter tendency, based on revived despotism, and mainly financed by oil revenue within a largely agricultural economy,

became the dominant force in modern Iranian developments.

Fig. 2: 1. Proposed Masterplan for Shiraz



Another feature of despotism, which is referred to as 'vandalism'[10], played a significant role in the socio-economic structure and relations of the country. A good example of bureaucratic reformism and mindless vandalism was the state expenditure on the modernisation and `beautification' of the capital and other towns and cities.

In Shiraz, Vakil bazaar, (a significant part of the architectural heritage of Shiraz, built in 1799 and still amazingly functioning) was torn down in the middle and divided into two parts for no reason. A marvellous huge 'ab anbar' (special Iranian ground water reservoir built around 1800) was demolished, with many other historical and architectural buildings, merely to establish a `modern' straight street. In principle, such reforms and reconstruction were badly needed; for example the construction of wider streets with pavements properly constructed with sub base, base and asphalt. The reforms, however, tried to fulfil these tasks in the most superficial, arbitrary and in fact disrespectful manner. In a plan for the city of Shiraz presented by the United States mission to Iran[11], it was proposed to demolish all the existing traditional buildings in an area of 750 x 1500 meters of the old portion of the city centre to build a Civic Centre !! Fortunately this

project needed a tremendous amount of money, which was not available in 1959. **What is more interesting is that an individual (Leon L. Gibbs), coming straight from the other side of the world, is empowered to determine the future design of an ancient city like Shiraz, with complete disregard for public opinion or even local authorities and professionals.** Figures 2:1 and 2:1 a.

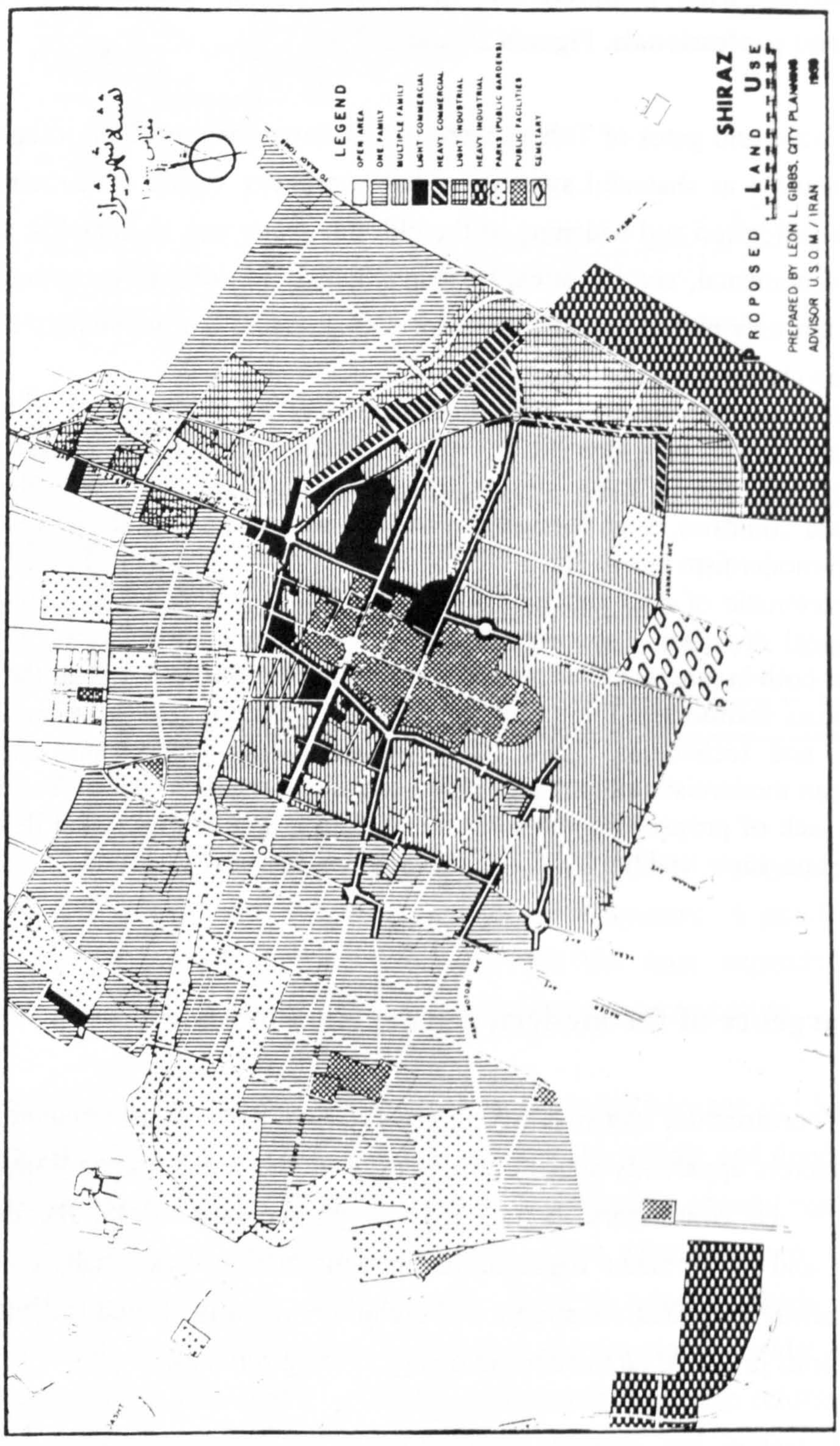
The old city walls and gates of Tehran were pulled down for no reason, other than that they were regarded as shameful symbols of backwardness. In the construction of new streets, or the extension and widening of the old, the policy was to demolish any and all residential, monumental, and historical buildings, merely in order to keep them straight. The vandals not only played havoc with historic architecture but community life as well. As H Katuzian states:

> 'Indeed, many intellectuals and political leaders of the Third World itself are voluntary victims of a superficial version of this European modernism that is, of pseudo-modernism. Pseudo modernism is a product of certain developments in advanced countries, even though it is subject to criticism within its own context. Pseudo-modernism in the Third World, however, is the product of their product: it is characteristic of men and women in those societies that - regardless of formal ideological divisions - are alienated from the culture and history of their own society, both in intellectual ideas and in social aspirations, but, unlike the European modernists themselves, they seldom have a real understanding of European ideas, values, and techniques. Thus, Third World pseudo-modernism combines the European modernist's lack of regard for specific features of Third World Societies with a lack of proper understanding of modern scientific and social development, their scope, limit, and implications, and whence they have emerged.[12]

4. The emergence of the modern construction industry

The modern construction industry in Iran emerged with the Pahlavi regime. The first Iranian contractors apparently appeared from 1927 on the Trans-Iranian Railway project only as minor sub contractors. In the early stages, i.e. until 1948, the demand for construction and government expenditure on construction was small, concentrating largely on railway and road construction. Foreign contractors carried out the main job and foreign firms provided all the consulting engineering services.

Figure 2:1. (a) Proposed Master Plan for Shiraz.



When the government established the Plan Organisation and the first seven year plan (1948-1955)started, opportunities opened up for local contractors and the number of That is how modern technology (which is often confused with modern science) is seen as omnipotent, and capable of performing miracles which would solve any and all socio-economic problems once purchased and installed; why traditional social values and production techniques are regarded as inherent symbols, indeed causes, of backwardness, and sources of national embarrassment, and why industrialisation is viewed not as an objective but as an object, and the installation of a modern steel plant not as a means but as an end in itself[13] .

In reaction to this so called pseudo-modernism an antithesis has been formulated in the tendency towards a rediscovery of Iranian tradition. This growingly accepted antithesis has substantially developed within the past twenty years. It is both understandable and a necessity. But as in the Farsi proverb; **'to avoid falling off the front edge of the roof, the man walked backwards and fell off the back edge'**, it would be equally dangerous to go to the other extreme. **There is nothing intrinsically wrong with the idea of openness and progress both in the intellectual and the material sphere of life if it is not accompanied by an indiscriminate disrespect for the traditions of the past.**

It was Western political domination facilitated by a despotic regime and not European techniques and ideas that played havoc with the social fabric. It was also because of the failure to understand and criticise western ideas and methods within their own context and the subsequent failure to choose and use (not to imitate) those ideas and techniques, which could help reconstruction and development of the country, which caused the damage.

Iranian contractors started to increase slowly. However for various reasons, in particular the low capacity of the industry, government expenditure by the Plan Organisation amounted to only 30% of the planned total of 21 billion rials. It was not until the second seven year plan (1955-1962) that the number of Iranian contractors accelerated significantly and by the end of the second plan the government was obliged to introduce for the first time a system for qualifying and classifying local contractors.

However it was with the political background of the Pahlavis' pseudo-modernist despotism and its later reliance on the false oil economy, that the modern 'organised' Iranian construction industry was born. This organised construction industry is

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recognised as the formal sector of the industry, and the traditional sector is considered as the 'unorganised' or informal sector. This considerable 'unorganised' sector includes *memars* and other urban artisans engaged in housing and commercial buildings with the prospective owner acting as his/her own 'contractor' throughout the country.

In this period there was an exceptional opportunity for the rapid development of construction compared with other industries. As the institutional framework of the construction industry makes it an easy entry/ easy exit industry, the industry soon became overcrowded, particularly during 1970s when in Iran the government provided up to 25% of the contract price as the advance payment for political reasons. This exceptional opportunity lead to rapid growth in the number and capacity of contracting companies.

> 'By early 1972 there were reported to be about 800 Iranian general contractors including 350 individual proprietorships of which 200 were characterised as small, and 450 companies. this number excludes individual artisans engaged in building, some 60 companies doing specialised work such as plumbing and electrical installation, and people active only as subcontractors. Of the 450 companies, 180 belong to the syndicate of Iranian contractors and are said to account for most of the business volume of prime contractors in the organised construction sector.' [14]

But the most dramatic increase in construction activities in Iran came after 1973 during the oil boom. The oil revenue explosion in Iran coincided with the start of the Fifth Economic Plan (1973-78) which was mainly a shopping list of various construction projects. The construction industry rocketed and would have grown even faster had it not been for shortages of skilled workers and, more fundamentally, a shortage owing to inadequate sea ports, of building materials and components.

Although Iranian industry in general grew quickly during the post 1973 period, and in fact contributed 18,7% of GNP in 1977 - 78, the construction fever created by the oil revenue explosion was so intense that between 1974 and 1977 the share of construction in GNP almost outstripped that of manufacturing itself. This rapid growth in the construction industry had serious social implications as its share of labour increased markedly. This led to a large migration of farmers to the cities, causing a paralysis in agriculture and tremendous urban problems.

The rapidly rising labour demand led to a rise in the wages of construction workers from 100 rials a day in 1972 to 500 rials a day in 1973. This rapid increase resulted in turning to equipment based construction technology and a dependency on imported construction

equipment. This was an added factor in drawing manpower away from agriculture to the cities. Materials and equipment were imported, and with them modern technology introduced and employed. The modern Iranian construction industry developed with a total dependence on government development projects, in a linear way and with very weak roots in the national economy and related industries. This will be thoroughly examined in Chapters7 and 8.

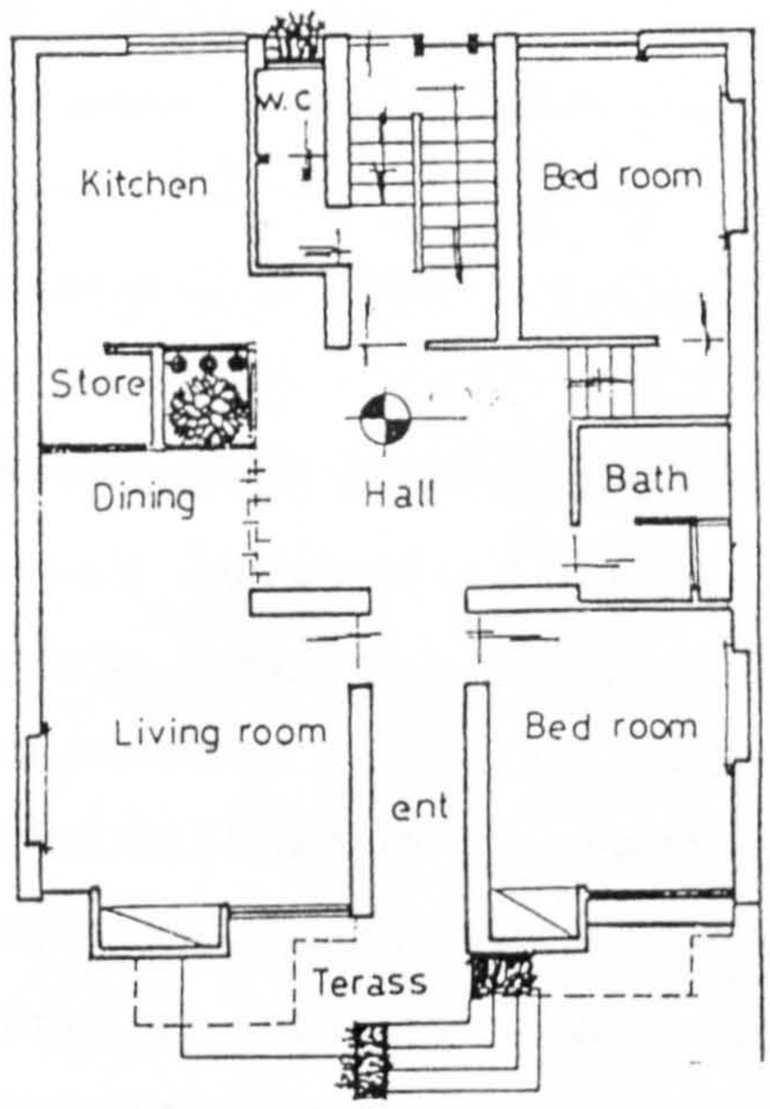
5. The departure from traditional architecture

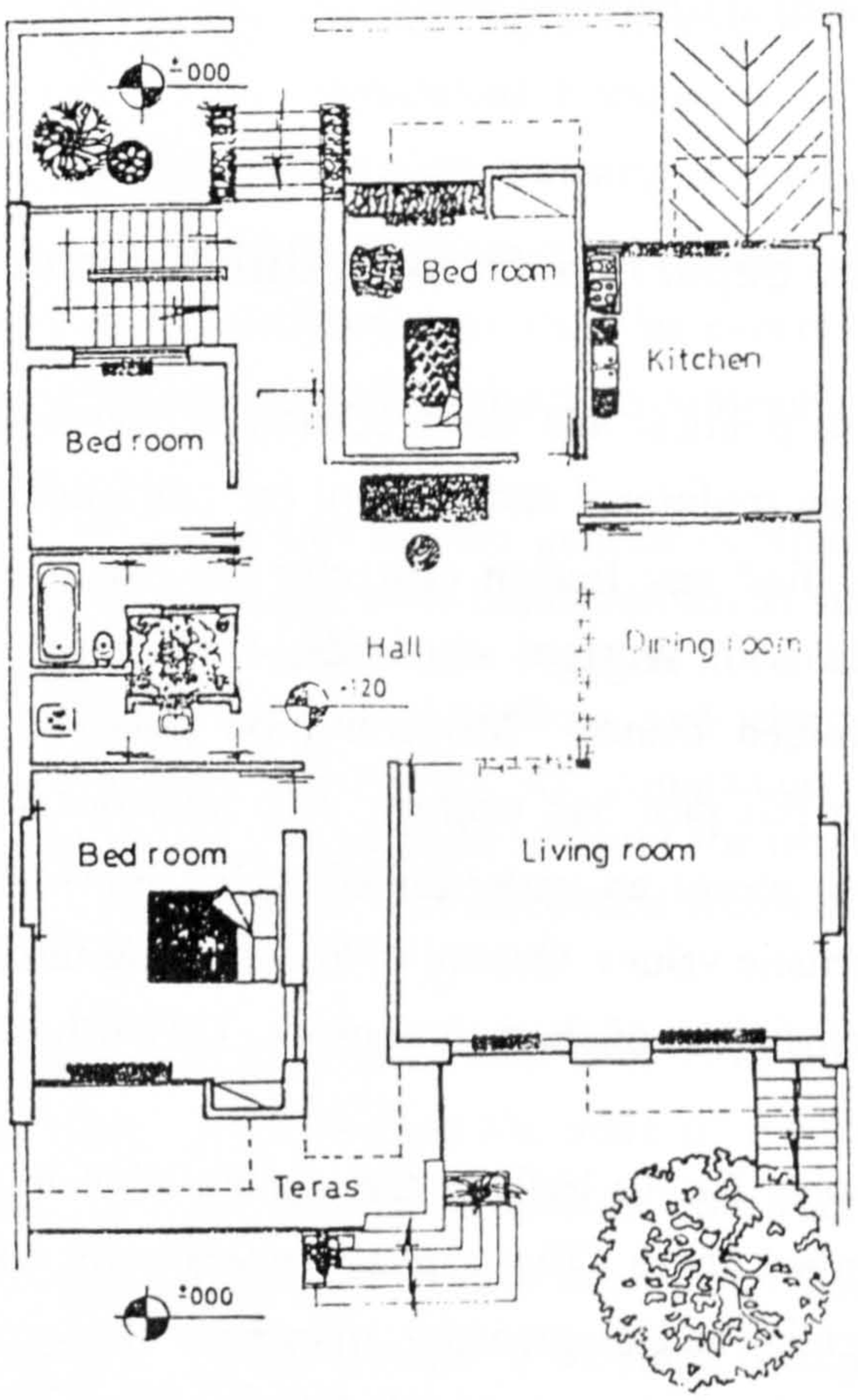
Due to political and socio-economic factors during the last 50 years the crucial link between traditional and modern (or conventional) architecture has weakened. You can hardly find any Iranian character in what is built today either by architects who are trained with Western standards, or *memar*s who actually imitate the architects in a blindfolded manner. Modernisation policies, and dominance of practical necessities during this past half century, with improvements in health leading to rapid population growth meant an understandable, but nonetheless regrettable, departure from cultural and artistic values. Quality of life and long term benefits have been dominated by a spirit of philistinism, of short term profit. This is the character of the built environment today.

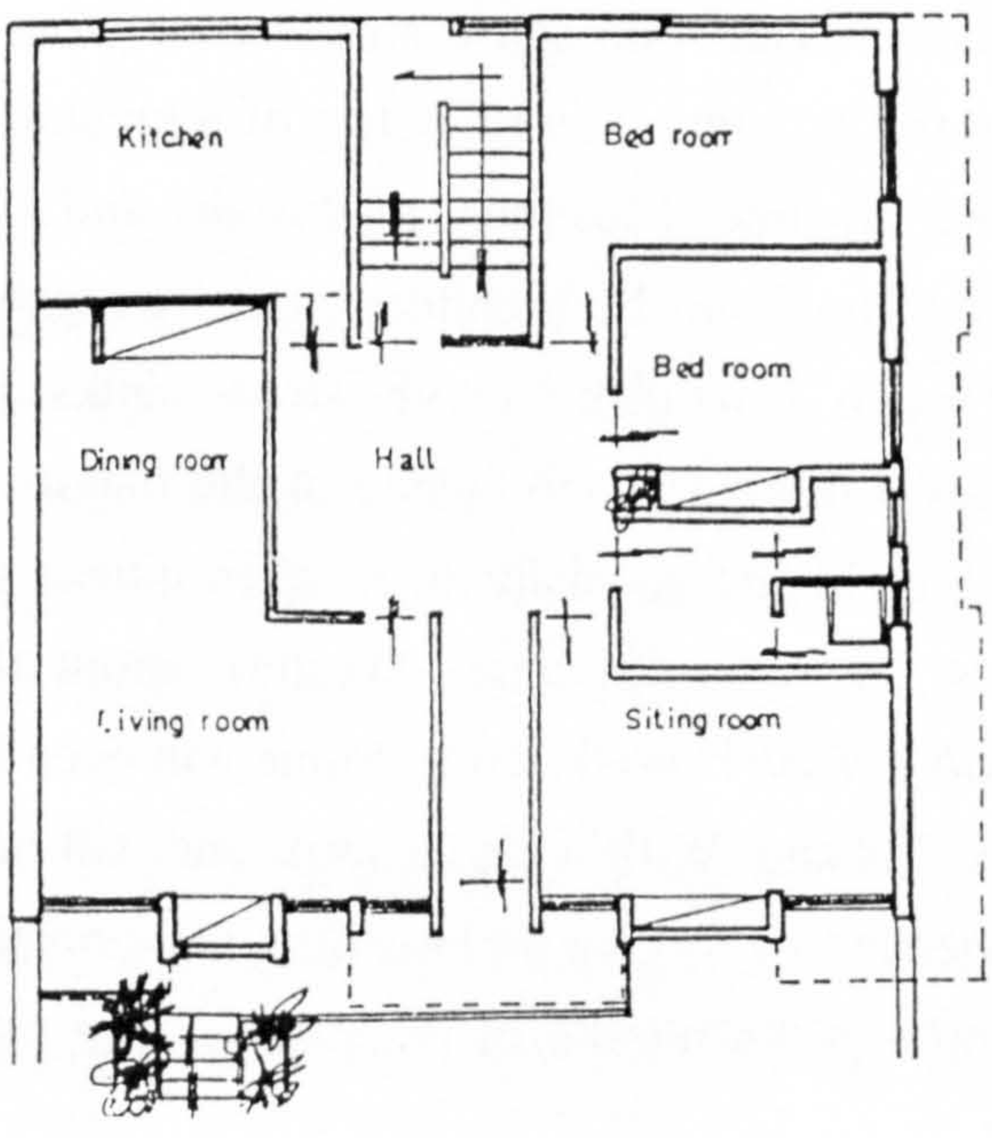
One only has to look at the modern Iranian city to sense the cultural contradictions embodied there. The capital Teheran, for example, with its huge developments of residential and commercial apartment blocks, acts as a model for the development of other cities. It appears noisily Western to an outsider who arrives at Teheran (Mehrabad) Airport. However by looking closer the observer can soon sense a difference from the average Western city. This difference is due to the continuing influence of a much older and deeper rooted architecture and building practice. Mosques, madrasahs and other religious buildings are still being designed and built not by architects, but by reputable and culturally aware *memars* such as Hosein Lorzadeh[15], with strong links with traditional architecture and building practices. Looking at the facade of the majority of owner built one or two storey residential buildings specially in smaller cities, soon reminds the passenger of where he/ she is. There is not much Western about these buildings with their *Ivan* and detailed *'Ab Sab Tarash'*[16] brick work. Some will even have traditional glazed tile work, such as Faience Mosaic. With a closer look one will notice that even the plan of the house, though influenced by foreign architecture, still contains a traditional character. A large hall for example in the middle of the plan is, and indeed

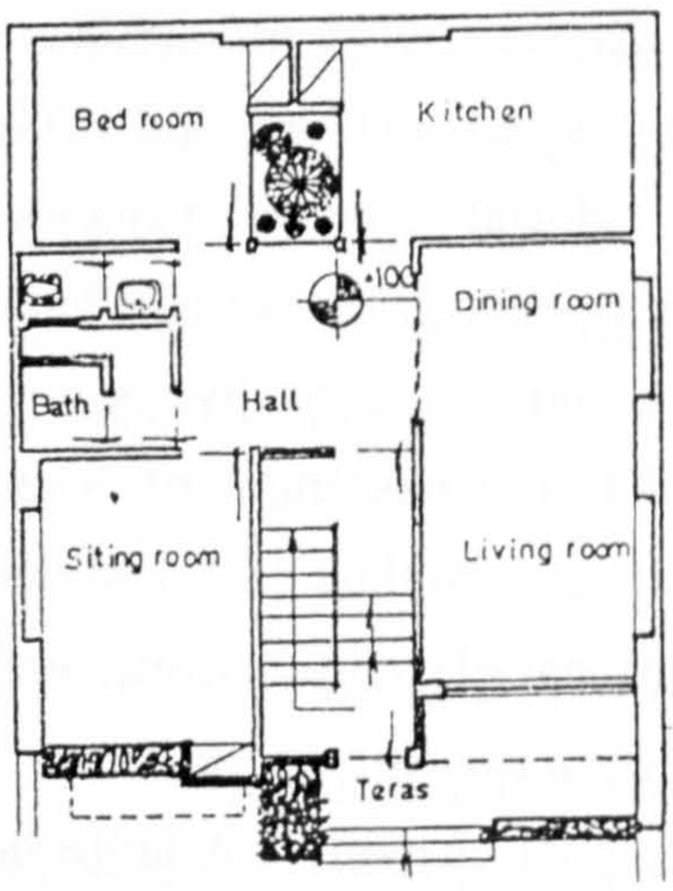
functions as, the courtyard.(see fig. 2:2.) It is worth noting here that the majority of these houses are designed by junior *memar*s in close consultation with the owners.

Fig. 2:2. Typical plans of modern urban houses.









5.1. Western influence.

The influence of Western architecture in this country has been an indirect one. The country does not have any colonial history and was never under direct colonial rule. The implications of the 'pseudo-modernist' policies have already been discussed. The direct role of expatriate architects designing projects was negligible and has been limited to a very few buildings in early major civil engineering works, such as railway stations. Apart from the obvious influences on ordinary people through different media, for instance magazines and cinema, the main Western influence on Iranian architecture has proliferated through modern professionals. Western educated architects and modern professional bodies have been conduits for Western influence. Perhaps the most influentiál bodies, however, have been modern schools of architecture.

5.2 Modern Schools of Architecture

The transformation from the traditional mode of architectural training to modern architectural education has always been associated with losses all over the world, but in this country the dimensions of loss and destruction have been tremendous. The establishment of the first formal school of architecture coincided with the period of transition from Qajar to Pahlavi, when there was no 'self-reliant' position in the sphere of culture and politics in the country. In the West,. although the responsibility of architectural education was transferred to the Universities, the professional community also re-organised and remained the source and the site for experience and experimentation. In other words the crucial link between Industry and University was never broken.

During the pseudo-modernist rule, when everything from the past was considered backward and undesirable, the first school of architecture was established without any participation by or appreciation of the traditional *memar*s. It was in this political and social climate that Iranian architects witnessed a Western archaeologist as the head of the first school of architecture in the country, namely the Tehran School of Architecture in Tehran University. André Godard[17], a French archaeologist[18], although highly respected for his archaeological work, was not an appropriate person to head the school of architecture in Iran[19]. He certainly was interested in the products of Iranian Architecture, but not the process. For this reason the modern school of architecture was born without any link with the professional body and its head i.e. the *memars*. This modern school was

without any appreciation and perhaps awareness of the important practical potentials of the traditional building industry. One could argue that many Iranians didn't understand either, which is true. There were however many who did understand, but who had no voice in the despotic regime, and were not in charge and thus responsible.

Saifian Mohammad Kazem[20], present head of Tehran University School of Architecture, pointing to the long history of architecture in the country, states that in all those years there has of course been a method of architectural education. However, the first school of architecture established by André Godard and other expatriates copied, word for word, Baux-Art, (the French School of Architecture). During those years a wave of modernism was sweeping over all aspects of life, and schools of architecture were no exception. In my opinion this onslaught was so wide and intense, it did not give any opportunity for anyone to think. Like the computer fever to-day; perhaps in a few years time some of its aspects will be condemned.

Dr. Ghaffari, the head of Tehran Shahid Beheshti School of Architecture[21] believes that one of the characteristics of the Revolution has been a return to the cultural values. It would be appropriate that architecture too is being revolutionised with the knowledge and understanding of cultural issues and environmental factors.

On the issue of links with the professional community, Ghaffari states that, there are several ways for the exchange of information between the two. The academic community needs to learn more about the practical aspects. It would be perhaps possible to commission universities to undertake research projects as well as design works in the same way as is common in other parts of the world. On the other side we are able to undertake the continuing education of the government personnel and provide those who have been out of the academic environment with the necessary education. It is also possible to choose a percent of the students from among the bursaries of government offices.

Hamid Noohi[22], the director of the Department of Architecture and Planning, Tehran University of Science and Industry, in his evaluation and future perspective of architectural education, does not mention the necessity of the link between professional community and university. Nevertheless he points out that in fundamental orientation of education towards indigenous culture, and the return to its historical status, sufficient attention has been paid by the Headquarters of Cultural Revolution in order to compensate educational shortcomings of the past (regime). He goes on to argue that one

should not expect a quick reflection of their efforts and plans on the society and the built environment. Achieving this goal needs time and cultural transformation that will in turn reflect on the academic movement.

Hamid Nadimi[23] believes that: 'Architectural schooling in the country, has been dominated by Western values, relationships and patterns, it has failed to be an integral part of the building industry'. He argues that in a wide perspective, architectural education in the country proves to have been suffering from the following problems or shortcomings:

- An inability to understand the connection between the real needs of society and the role of the education / profession.
- An irrelevance to conventional construction professions
- A general ignorance of the past architectural values of the country.
- A lack of relationship between the given knowledge (briefing) and designed projects.

Right from the beginning, the prevailing attitude of the modern schools of architecture toward traditional architects was one of negligence, and in practical terms rejection. It is not at all accidental that when the head of the Shahid Beheshti School of Architecture is asked about the link between the university and the profession his concern is only for the government officers who are obviously architects, engineers or technicians. Over a long period of time the author has discussed the question of relationship between *memar* and *mohandess* (architect, engineer), with *memars* from Shiraz and Mashhad. They usually have expressed their feeling of rejection and betrayal. In a recent interview one of the Shirazi *memar*s pointing out his lack of knowledge about concrete technology mentioned that: 'This produces a loss of confidence and sense of inferiority'[24]..

It is hardly surprising that some contemporary academics are highly critical of this negligent attitude on the part of the main teaching institutions. Here is what Falamaki has to say: 'Our schools of architecture in their life of more than 40, 30, and 20 years have not attempted to produce scientific documented written materials (on traditional architecture), except translation of a few books to Farsi'[25] Today there is a great failure by the practitioners of modern architecture to understand traditional architecture, its methods and practices. To be fair their job is not made any easier by the poor linkage between the two sectors.

5.3 Modern architects

There is a growing lobby of enlightened architects who appreciate the values of traditional (national) architecture, deplore the break in continuity and who are seeking ways of re-linking traditional, conventional and modern (international) architecture and their corresponding building methods and techniques. Falamaki[26] believes that there have been at least two decades of disputes concerning the rather confused and vague perceptions of modern and traditional architecture in Iran. While acknowledging the necessity of further in-depth study of the matter, he attempts to draw together the points apparently agreed by the majority of architects in the country, or as he says 'to repeat what we all know'.

> The conventional or modern architecture which is produced in our cities and rural areas, is a damaging phenomenon, and generates products which are tend towards the destruction of cultural and artistic values. There is no chance unless the direction can be changed. It must also be said that Iranian traditional architecture, whatever it was and however it is explained, belongs to another time, has the 'colour and taste' of 'yesterday'; it is our cultural bullion (heritage) but not a 'capital' which could be used directly.[27]

He goes on to argue that the difficulty is the definition of the problem and the method of analysing it. It is not simply the dilemma of choosing between traditional and modern architecture. He points out;

> If conventional architecture was successful and capable of meeting our 'value judgement' (cultural) and even practical needs we wouldn't gaze so intensely at our traditional architecture and we would not try to add on some of its elements to what we build to day in such a blind-folded and desperate manner.[28]

In other words, if the imposition of modern (Western) architecture is bad, then the sentimental re-introduction of old forms and methods simply for their own sake, is no better. Our wistful attitude towards the past is a sign of the inadequacies today and the result of being cut off from the cultural roots - this in a country which holds one of the most valuable treasures of world architecture. Falamaki, after mentioning the general and accepted concern of many architects ('what we already know') poses an important question: can we actually use our traditional architectural 'bullion', reflecting as it does the cultural variations of the different regions as well as their different climates and physical conditions, and if so how?

Lorzadeh[29], one of the last *memars* of the traditional kind, has focused on the products of modern architecture under the Western influence.

> 'The 'assault'[30] of Western architecture on Iran, and the wrong perception and use of it, has resulted in the disaster of the matchbox like[31] buildings of today, which are not compatible with Iranian conditions.'

In another part of his interview with *Majalehe Sakhteman* (Construction Journal) he states:

> 'The influence of Western art and architecture on the country in general and faculties of architecture in particular, has been the cause of public's negligence, and also the reason for the lack of knowledge on the side of modern architects, of traditional and national architecture of Iran.[32]'

These criticisms have dominated all the discussions and publications, particularly since the 1979 Revolution, and indicate a growing desire to rediscover the more traditional architecture as a cultural expression of the every day life of the people. B. Boostan[33] in an article paying tribute to Ostad *memar* Aliakbar Mas-oudi [34]quotes him as follows:

> Architecture is influencing every moment of our life, and for this reason we cannot play with it cursorily' What we are losing in today's architecture of this country is the years of experience and practice of our fathers.

5.4. Evidences of continuity of traditional architecture on modern process and product

Certain aspects of the traditional architecture, although neglected to a great extent, have never been totally abandoned. Its major continuing influence is in how we build. This influence is reflected both in the process and the product. The significant role of the *memar* on the building site, and in the training for the building trades should not be neglected. One can legitimately question the relevance of traditional practices in a situation where an already acute building shortage is continuing to grow. These practices are traditionally more painstaking and therefore slower. How might they be used for the efficient and swift provision of housing for low-income people in the rapidly growing cities? But the counter-question is equally legitimate. Are the housing requirements of the urban poor best satisfied by culturally anomalous, industrialised solutions, even if

they are possible or economically feasible.

By asking questions we can convince politicians, economists, and those who work in the formal planning institutions that to ignore the skilled workers in the traditional building crafts is a waste of a valuable national resource. The tradition of the *memars* and their craftsmen is part of our cultural heritage and for a rich culturally heterogeneous architecture to survive the whole structure of this traditional sector must be nourished. There is a great potential in this sector in terms of its practical basis as well. The *memars* system, will be more sensitive to those traditions, people's needs and expectations, and social and economical realities than the formal sector companies.

Despite the government's ignorance of this sector and its adoption of a Western structure in the formal sector, the *memar*s live on with their traditional organisation of production and their role in site management and training in the building trades. The *memar*s' role as managers on site has not been replaced by school trained technicians, and they continue to provide almost 100% training of skilled labour for the building industry as a whole. *Memars* seem to build more efficiently and more cheaply, as the traditional sector still provides almost 80 percent of housing and almost hundred percent of training for the different trades needed in the building industry. What is the reason behind this continuity? To answer this question, a search for the values of traditional practices through a more detailed examination of the factors determining their form and character, and also details of traditional building process would be helpful.

6. Factors determining the form of traditional architecture

J.M Fitch and D.P. Branch[35] argue that the two major factors determining the form of architecture of traditional people are 'climate and available building materials'. They give as an example the Arctic Eskimos who use snow blocks to build dome shaped ice igloos. Any cracks due to ill fitting blocks are overcome when the interior wall slightly melts and re-freezes again plugging any holes.

From the tents and *Yurts* of travelling nomads to the sophisticated houses in Yazd the typography of rural architecture in different regions is an excellent example of the influence of climate and availability of materials. On occasions two different types of architecture have emerged very close to each other. In the north for example, the Alborz

mountains are parallel to the coast of the Caspian sea with high rainfall and abundant timber, the buildings have pitched roofs with a wooden structure. On the south side of the mountains however, the extreme height prevents the penetration of humidity from the Caspian sea. With this different climate, and less available timber, the buildings are built of thick, stone or adobe, walls and a flat roofs with wooden posts and mud. In *Kavir* (desert) architecture in central provinces, where water is scarce and even cultivated aspen wood is difficult to grow, the whole structure including the roof is made out of mud bricks.

There is a feature common to houses in most regions: a highly functional outdoor space, the courtyard. The centrally located courtyard is perhaps the most recognisable feature of the traditional Iranian house. Is this feature a purely cultural manifestation or the result of climate, available materials and other factors?

6.1. The example of the courtyard house..

Religion is considered one of the most important influences on house-form in the Islamic countries. The courtyard house is widely known as an Islamic or Arab solution to residential architecture. How significant is the role and influence of Islam as a religion on the courtyard house and why have they been abandoned in almost all urban areas and are even diminishing in some rural areas in Islamic countries?

The growing concern about the values of traditional architecture in Islamic countries is reflected by A.D.C. Hyland[36]

> 'The traditional house forms and settlement structures of the Arab world, which have evolved naturally over thousands of years in response to local and climatic and topographic conditions, and the social and religious traditions of the Arab peoples, are increasingly at risk. The pressures of modern development and the superficial attractions of the materialistic culture and life style of the West, set little store by traditional values, reduce privacy and weaken social and family cohesion.'

He also mentions 'the threat to the integrity of the Arab culture' which is identified by Hasan Fathy, and illustrated by the disintegration of the traditional built environment and the atrophy of traditional building techniques.

Dr. M. Makiya[37] mentions a situation in Iraq resulting from just one bye-law in the housing legislation. This bye-law imposed a four metre set back of the building line from the plot boundary on all sides. This means that actual dimensions necessary for the provision of an internal courtyard cannot be fulfilled. The courtyard is consequently being abandoned.

The introduction of the automobile coincided with the pseudo modernist era (1925-1979) already mentioned. This resulted in the demolition of the traditional urban fabric and the adoption of Western style city planning. Access to home by car became an aspiration for every citizen. One can argue however, that people didn't consciously choose to abandon the courtyard house. This abandonment was, rather, the result of landlords' greed and their influence on the Government. Plots of land were designed with the minimum possible width and maximum length, so requiring fewer access roads and consequently less 'wasted' land. The average plot is 10 metre wide and 25 metres deep. It is, however, impossible to design a courtyard house in a rectangle of these proportions. In addition there are often bye-laws which limit the building line to somewhere less than 60 percent of the original plot length and which require the buildings not to exceed the neighbour's facade line. As a result, the traditional courtyard has been virtually eliminated from modern houses. As a result of cultural necessity, and considerations of life style, the courtyard is being replaced by a large internal hall. The least adverse effect of this transition is, the increased area of construction.

Dr. Subhi Al-Azzawi[38] points out six factors as 'the influential factors to the courtyard'; Religious Demands and Social Customs, Micro-Climate, Availability of Land, Economics, Structure, and Security. Of these the first, privacy, may be considered a religious or Islamic factor. Privacy and security, however, which are not necessarily religious in content, can be distinguished from segregation of men and women which is considered an explicitly Islamic demand. Security, for instance has always been a major concern.

> 'Throughout history people in the Middle East have experienced tribal conflicts and invasion by other cultures leading to violence and attack against property. The construction of walls along the perimeter of property was thus adopted to increase security and provide for adequate defence.[39]

But the primary importance of a courtyard is its function in relation to privacy. In winter, when outdoor living drastically declines, the courtyard loses some of its importance. In fact in colder regions almost no activity can take place in the courtyard in winter.

However, for proper segregation in summer one courtyard is not enough, and two courtyards are needed for perfect hejab, one for family/ women's activities and another for males. This type of two courtyard house is not very common in Iran. Only some of the larger houses have two courtyards. But in Arabic countries, Sudan for instance, the multiple courtyard is common. In Sudanese dwellings for example there are at least two courtyards.[40]

There is evidence that there are similarities in form between traditional or vernacular structures and monumental buildings. For instance Rapoport studying the Safavid architecture in Isfahan has reported that 'the monumental architecture of Isfahan is based on vernacular forms, systems, and practices of house building.'[41] Both Sarvistan Palace and Firuzabad Palace 224 AD are clearly identical courtyard houses. This may be taken as evidence that the courtyard house is deeply rooted in this region.

7. 'Codification' of customers needs in the traditional house.

Codification of customers needs by tradition, the study of the traditional building 'industry' and its most important role in house-building would be easier in the light of the last living examples of traditional cities -- The city of Yazd. *Memar*s either intuitively understood their clients needs, because they were similar to theirs, or these needs were codified by tradition and the *memar* had only to follow the custom.

7.1 The History

According to a wealth of evidence, the city of Yazd has a long history. It has been a place of pilgrimage for Parsis (Persians) of India, and a holy city to Zoroastrians, much in the same way as the Holy City of Mecca is to Moslems.[42] As Ahmad bin Hossain bin Ali-e-Kateb[43] states '... because he (Yazdgerd the First) was building the city in the name of yazdan (god) he named it as yazdan gerd (the work of god, or done in the name of God). His own name, which had been Shapur, became famous as Yazdgerd (399 AD Sassanid Dynasty). Before this date the City had several different names; Isais, Farafidzh, and Kasseh.[44] One of the most prosperous epochs of the city was from the Daylamid to Safavid dynasties (1316-1694).

7.2. Description of the natural environment.

The city of Yazd is located in the central region to the East of Isfahan at longitude 54;24, and latitude 31;25 degrees. The plain is surrounded by chains of mountains with some rainfall beyond the mountains, but very little within the plain. The minimum altitude in the plains is 600 meters and in the mountainous areas the maximum altitude is 2500 meters above sea level. The average annual rainfall is 16.7 mm minimum and 98 mm maximum.

7.3. Islam

The traditional city in Islamic countries is one of the manifestations of Islam as a law for religious and social life. From this point of view Islam provides the social environment for the integration of the people with one another. The mosque as the symbol and the central feature of the Islamic way of life is the pre-eminent feature of the traditional Islamic city.

7.4. Major morphologic elements

Abr-o bad-o mah-o khorshid-o falak dar karand
Ta to Nani be kaf ari-o be ghaflat nakhori.
(Saadi Shirazi 12th century)

Cloud - and, **wind** - and **moon** - and **sun**, together with the wheel of destiny are at work;
For you to 'work and gain' bread and eat not with neglect.

Water, vegetation, sunshine, and wind, are each utilised in their own way by traditional technology to create a harmonious aggregate for the built environment for the enhancement of life. Traditional technology with respectful use of the natural environment, develops peculiar elements which strongly contribute to the morphology of the city. These elements are:

7.4.a. *Ghanat.*[45]

Water has been always the most important element of the traditional city. In the absence of a natural source of water, the existence of thousands of wells which form the strings of *Ghanats*, a kind of under-ground canal system originated in the North Western Iran in the times of Medes (pre Acamedian) and later proliferated to the rest of the world[46]. (see figure 3). Under-ground channels bring water to the city, or in many cases individual houses, from the water table beyond the mountains. *Ghanat* converts the hostile *Kavir* (desert) to a habitable and pleasant environment, and is the most peculiar feature of Yazd. *Ghanat* also acts as the energy source for tens of *asiabs* **water mills.** Water, in either hidden and/or open has the most important role in the formation of the traditional city fabric. From the upper to the lowest level of its flow, the water helps in creating different spaces with different names such as *payab* [47], *Gowdal* [48], and *baghcheh* (the garden in the courtyard).

7.4.b. *Bazaar*

In fact, after the water the second determinant of the traditional city of Yazd is the *Bazaar*[49]. 'A *Bazaar*, which is itself an urban phenomenon, is at the same time a factor in the forming of a city or town as its responsibility is to serve the principal fabric. In the majority of Iranian towns, the *Bazaar* takes the form of a central area in the traditional fabric and acts as the heart of the city'.[50] In order to establish an equilibrium between the material and spiritual life near the *Bazaar* there is the *tekieh*[51], mosque, *madrassa* (traditional religious school), *garmabeh* (public bath), *karavansara*, *serai*[52], *timcheh*[53], *ab anbars*[54], *zurkhaneh*[55] *ghahva khana* (coffee or tea houses) etc. This complex is woven within the network of residential areas and develops the special fabric of an Islamic city.

8. Traditional house.

The centrally located courtyard is perhaps the most recognisable feature of the traditional Iranian house. Is this feature a purely cultural manifestation or the result of climate,

available materials and other factors? The answer lies in the long history of the architecture. The traditional urban house is an indigenous phenomenon. Its continuation and evolution can be traced from pre-historic times in this region, and right to the start of modernisation.[56]

In parallel with the evolution of the traditional house, a set of principles developed as some kinds of 'Codes of Practice' which assisted in enabling the traditional *memars*[57] to achieve their objectives in design and building. These principles were not only guide-lines to assure quality but they also made their job easier. Learning about these principles helps us towards a better understanding of the traditional house, and its deep rooted origins.

8.1. Traditional design 'codes of practice'.

M. K. Pirnia[58], himself from Yazd, an accomplished *memar*/ architect, points out six main principles for architectural design and two main principles for city planning. Understanding each of these principles, for the traditional *memar*, took years of experience, as well as the teaching and guidance of *memar bashi* (senior *memar*). A brief definition of each of these principles will be given.

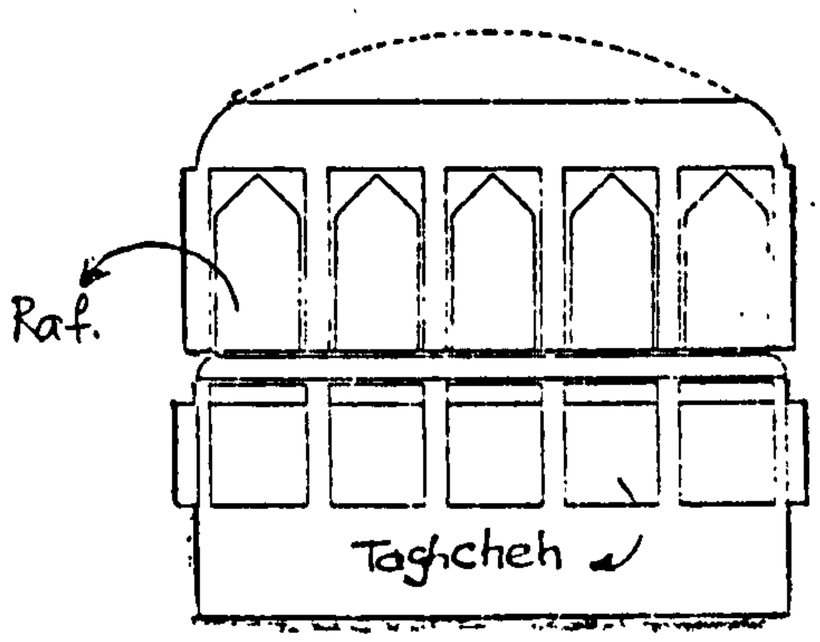
1) ***Mardomvari.*** *Mardom* means folk or people and the suffix *vari* is equivalent to 'ly' like in the word kingly. So, Mardomvari means 'peoplely'. The consideration of human scale and function in every element of design, irrespective of the social status or wealth of the customer or the size of the house. What determined the size of the house was the number of rooms proportional to the number of people who lived there. For instance *Memars* in the past used to build a privately located *se dari*[59] with a width of three *gaz* and depth of three, four or five *gaz*, which was usually used as a bedroom, with *taghcheh (rack)* and *raf* (upper level rack) to accommodate objects used daily and less frequently respectively. As an annex to a *se dari* there was usually a *Pastoo* (small storage space like a walk-in closet) to store bedding, cloth etc. Regardless of how rich or poor the owner, or how big or small the house *se dari* was the *mardomvar* bed room. This 'standard' room can be found in every single house in Yazd.

2) ***Khod basandegi***. This means self sufficiency. In practice it meant the maximum use of existing facilities from *boom-avard* (grown in, or brought out of the local habitat) components, that is locally produced from local materials (highest 'material productivity')

Provision must be made from sources as close as possible to the project. For example the provision of the soil needed for construction by the excavation on the site for needed *basement, payab* and *gowdal.*

3) ***Ganj-o-banar*** (Avoiding the unnecessary). There has traditionally been a great emphasis on avoiding unnecessary elements because there was a belief that unnecessary work not only wastes capital and labour but also spoils aesthetic and artistic value. For instance, room walls were decorated with *taghcheh* and *raf* which was useful for the storage of objects and also an element of decoration to avoid the monotony of walls (fig. 2:3.). At the same time these voids allowed for economy in the use of bricks. In the same way glazed tiles, with their decorative value, were basically used as protection against weathering and mainly employed outside.

Fig. 2:3. Taghcheh and raf.



4) ***Niaresh*** is an idiom in Persian architecture which refers to all works and activities carried out to ensure stability and strength of the building. In other words *niaresh* is a complex of statistics and structural calculations, with the addition of material science, used to work out dimensions and dictate the choice of appropriate methods and materials. Practicality studies were also involved in the design of more complicated buildings such as mosques and *bazaars.*

5) ***Peymoon***. 'Application of peymoon - with some differences - is like the application of module in Western architecture'[60] It refers to the application of a series of rules to determine the dimensions and proportions of different spaces, elements, and components. *Niaresh* and *peymoon* work together and sometimes overlap each other, so it is referred to as *niaresh-o-peymoon* . For instance, the thickness of an external mud brick wall is determined by peymoon rules as 2/5 of the dimension of the span, in the case of an isolated room.

6) ***Daroongaraie*** (introversion): *Memars* like Iranian philosophers and Gnostics were taught to pay more attention to the inside than the outside. The climate of the country, privacy, and 'the issue of *'hejab*', preventing the inside being viewed from the outside, was also an important consideration before Islam.'[61] Pirnia also shows that *'Arsan*[62]*-e-khaneh* (composite house) which might include *'andaroon*i'(inner courtyard), *'biroon*i' (outer courtyard), *'barband'* (delivery yard), *'naranjestan*' (orange courtyard), and *'padiav*[63] (patio) shows the importance of the concept of *hejab* in all parts of the country.

8.2. Traditional Planning Principles

The two main planning principles were *'Panaam*' and *'Rown*'. Although they were basically principles of city planning, they were also applied in architectural designs. *'Panaam*' is the means and ways of stopping the harmful effects of the environment, especially climate, and *'Rown*' covers orientation considerations.

8.3. 'Code of practice' for the process of design

For the traditional *memar*s, who were usually responsible both for the design and execution of the job, there were five different stages of design before they could start construction. 1*)* ***'Gaz kardan'***: site measurement and investigation. In addition to site survey necessary information about water level, orientation, wind direction and other environmental conditions were obtained at this stage. 2) ***'Goftegoo'*** (discussion) Determination of the number, and the type of each room *(Talar-o-badguir, Sedari, Panjdari, Urusi...)* and other necessary spaces discussed with the *Karfarma* (work-orderer, client)[64] 3) ***'Barzeh'*** [65] In this stage the *memar* prepares the arrangement of different rooms and spaces with the contours of rooms made of gypsum planks on the *barzeh*. 4) ***'Kast-afzood'*** (deduction-addition). Having demonstrated the design to the *Karfarma* discussions and decisions are carried out concerning the addition and subtraction of spaces or even extensive changes to the design. Rearrangement is demonstrated again until the design is finalised. 5) ***'Arayesh'*** (decoration) In this stage the whole design is comprehensively discussed including determining the type and quality of materials used for external facade such as brick work or different styles and kinds of

8.4. 'Code' for static and aesthetic: Geometrical order [66]

The Crystal pattern of the room arrangement around the courtyard is achieved by a special 'process' of co-ordination of measurements called *(Gaz-o-Peymoon)* on a geometrical basis. The main geometric principle which is used to determine the proportion of the horizontal and the vertical plane of each room is based on the rectangle surrounded by an equilateral hexagon.

M. Reza Ghezelbash Farhad Abuzia[67] state that: 'The ratio of the sides of this rectangle is 5/3=1.66'. In fact, having checked the calculations the ratio is actually equal to square root of 3, approximately 1.732. If we take one side as 3 units the other side would be 5.196 units. It is notable that if we draw the diameter of this rectangle the famous 30-60 triangle is the result, the set square on the drawing boards of today's architects. (Fig. 2:4.)

However it is conceivable that *memars* have taken the proportion as 3:5 for the purpose of their `modular' approach and the ease of application. With 90 degree rotation of this rectangle, different room proportions were obtained. (fig 4) Thus the ratio of the sides of each of these quadrangles is either 5:3, 3:5, and 3:3 which is equal to 5:5=1 (square). A whole set of different room sizes and figures can be generated. Persian carpets also use the similar 5:3 ratio which is the desirable rectangle in Persian architecture. See Fig 2.5.

Fig. 2:4.

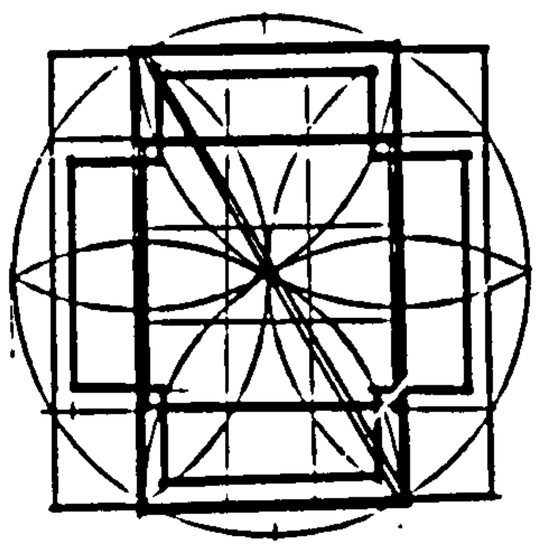
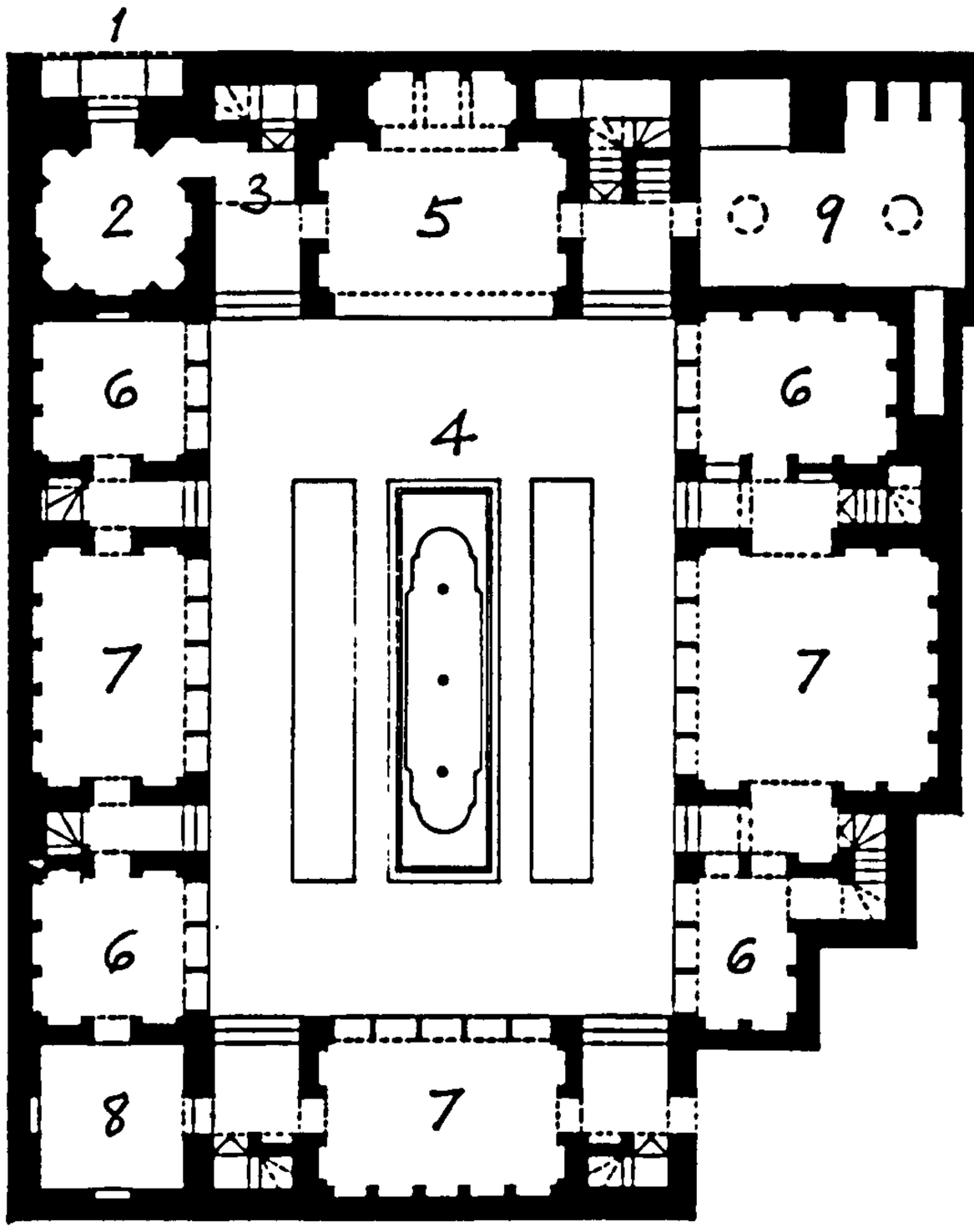
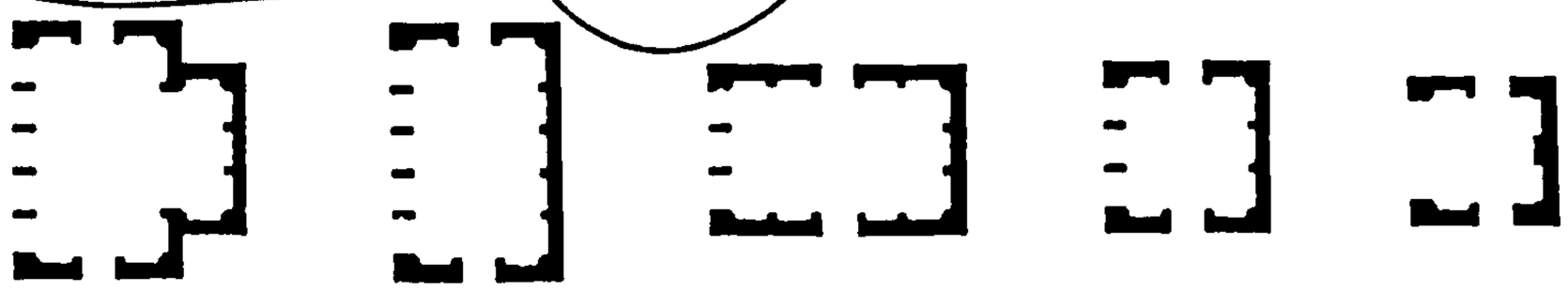


Fig. 2:5. Typology of spaces



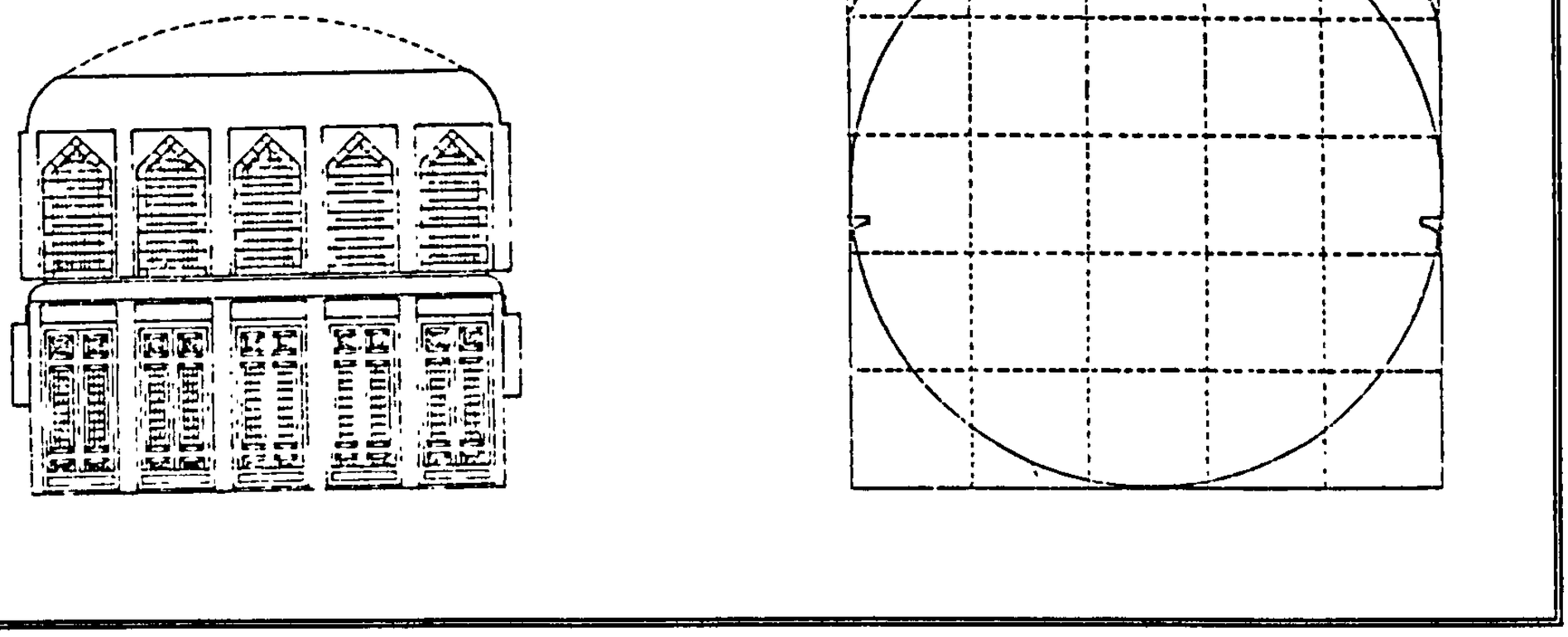
1- *Sar Dar -e Voroodi*
2- *Hashti*
3- *Dalan* (corridor)
4- *Hayat* (courtyard)
5- *Talar-o-Badgir*
6- *Se dari*
7- *Panj dari*
8- *Pastoo* (storage)
9- *Ashpaz-khaneh* (kitchen)

For more definition of the spaces see pp 96 - 97



In the vertical scale there are two types of rooms: high ceiling (double height) and low ceiling. The height of high ceiling rooms from finished floor to the peak of the vault is 5 module (5 gaz = 5.33 metre). This dimension is equal to the room length, but there is always a false ceiling at the height of 4,1/3 gaz. The height of low ceiling rooms are always 2.25 gaz, approximately equal to 2.4 metre. See Fig 2.6.

Fig. 2:6. Vertical Scale



8.5. Typology of the rooms and other spaces

Typology of a room concerns the description of its floor, walls, and ceiling.

The floor is always raised as the surface of the room is considered as a superior place and shoes must be taken off, not only as a matter of hygiene but as a matter of respect. Another reason is to avoid rising damp in the summer as a result of daily water sprinkling for cooling and to add to the moisture. The room floor is covered by square bricks with the dimensions of 3x3 *gereh* approximately equal to 20x20 centimetre

Plain decoration of the walls by *taghcheh* (niche), *ghatar bandi* (horizontal framing), and *raf* (rack) is based on obvious household needs and aesthetic considerations. *Taghcheh* starts at the height of 14 gereh = 94 centimetre and is used to place objects which are used daily. *Above Ghatar bandi* (at a height of 1.25 gaz or 240 centimetre*), is raf* or upper *taghcheh*. This is a place to store objects of less frequent use. All the walls are plastered by gypsum except in the basement, some parts of kitchen and the bathroom where tiles are used. The main roof is covered by *'kelil'* (broken headed arch), or *tagh gahvareie* (barrel vault) but inside there is a flat false ceiling.

Ursi is originally a distinctive type of window (or facade) usually consisting of 3 or 5 bays divided by two sash sections with an elaborate lattice work and different coloured glass which slides open vertically. Rooms with this type of window are called *ursi* rooms.

Penetration of sunlight to the heart of the room in winter, and diffusion of the rays by the lattice work and coloured glass in the summer, gives special characteristics to the room. These features enable the room to be positioned at any side of the courtyard, but its usual location is facing south-east or south-west. *The Ursi* facade can be applied to almost all main types of rooms including *Talar-o-Baadgir.*

Se-dari and ***panj-dari.*** The names of these rooms are taken from the number of *dars* (door/windows)[68] or `modules' facing the courtyard. The size of *se-dari* is either 3x3 *gaz* or 3x5 *gaz* but a *panj-dari* is always 3x5 *gaz*. If they have *ursi* they are called *se-dari ursi* or *panj-dari ursi*

Bala-khana All rooms located on the top floor are called *bala-khana*. They are always of low height *se-dari* with the depth of 3*gaz.*

'Gooshvar' is a low-height *se-dari* room with *Ursi* window. It is located on the top floor over *kafshkan* or *takhtgah*.

'Kafshkan' means a place where shoes are taken off. It acts as the entrance hall and is a low height eivan type space with one side open to the courtyard. *'Kafshkan'* is usually located between two rooms to serve both, or located in the corner of courtyard, to serve only one.

'Hashti' is a roofed space in the shape of a room located behind the main entrance. The plan is usually in the shape of a square, hexagon, or octagon and it can have either low or high ceiling. *Hashti* is usually dome roofed with a hole for light.

'Talar-o-badgir' is a combined space consisting of a *badgir* (wind tower) and a *talar* (a large living space). Badgir is designed to divert cool breezes from the north-east to *talar*. The proportion is usually is 5/3 and its facade is either a) open to the courtyard (without any doors or windows), b) vertical and horizontal *aftab shekan* (sun breaking) walls, or c) *ursi*. *'talar-o-badgir* is a tabestan-neshin (summer living room) and is usually located facing north east.

Ashpaz-khaneh (kitchen) usually consists of *abanbar* (water reservoir), *anbar* (store), and *chah-khaneh* (well house). Around the main cooking room there is a continuous platform with the approximate height of 12gereh= 80centimetre and storage places underneath. The location of ashpaz-khanah is in the second layer and is connected to

hashti, and close to the *zemestan-neshin* (winter quarters). The *memar* tries to locate it near the water stream or *payab*. The *ashpaz-khaneh* is always a double height space covered with a dome with a light hole in the middle.

Garmabeh or *hammam* (Bath house) is located below the basement level for a number of reasons such as access to water and to minimise the heat loss. The units comprising a domestic bath house are the same as in a public bath house only on a smaller scale. The two main sections are *sar-e-bineh* and *garmkhaneh*. The sequence of different spaces of a *garmabeh* is: 1) *sar-e-bineh* 2) middle space 3) *garmkhaneh*. 4)*khazineh ab-e-garm* (warm water reservoir/ pool) and 5) related services like toilet and *noureh-khaneh* (a separate space for the removal of the body hair) and finally *toon* or *golkhan* (firing place). All these spaces have simple geometric shapes, the walls being tile covered and having a domed roof with a light hole in the middle.

Sar Dar-e-Voroodi (Main entrance). In the plan it is 1/2 or 1/4 of a square or octagon. Its elevation is two storeys high with a vault or *neem-gonbad* (half/part dome). There are two platform on each side of the door for putting shopping bags etc. or for elderly and tired passers-by to rest.

9. Peoples' response to traditional architecture.

What are the actual aspirations of today's inhabitants? What are their preferences? What is their response to traditional architecture.? M. M. Zandi[69] has researched this area. Zandi's principle question was, 'What is the role of tradition in establishing preference toward 'house form?' He defines the term 'house-form' as the physical appearance and the spatial relationships of the different elements of a residential dwelling as well as the relative significance of these elements.

The questions were addressed to a sample of the population living in suburban Tehran. The overwhelming majority of people were in need of housing, and defined as 'individuals of low income status undergoing changes of life style from a traditional-rural activity to low socio-economic urban status'. The huge number of rural- urban migrants during the last 30 years and the continuation of this trend, means that today many city dwellers have a rural background from the last one or two generations. As a result, Zandi's findings can be seen as relevant not only with regard to recent migrants but also to a large number of citizens who still have a memory of living in a traditional house.

Zandi discovered a degree of preference for the traditional house form. He states that:

> 'Studies have shown that in developing countries, there is little difference between the migrants and the city-born population in their attitude toward a place of residence. There is a notable although not striking preference toward traditional house form among the rural migrants living in Teheran. Urban family tradition in Iran places high emphasis in making the house presentable to others and thus help maintaining the honour of the family. The condition and appearance of the house is thought to manifest one's level of social achievement and prosperity. On the basis of this study, the rural migrants in Teheran are no exception to this norm.'[70]

In summary, the main findings of Zandi's questionnaire in relation to house-form and tradition are:

- Over 95 percent of the respondents prefer a house with a private courtyard (walled enclosure) to living in an apartment building

- In a follow up question, the respondents were given a choice between having a 2-room house with a small courtyard and a 3-room apartment. Over 75 percent chose to have one less room in order to have a small courtyard (walled enclosure).

This must be a significant sacrifice since the majority of the respondents (73 percent) complained of a lack of adequate living space in their present (3-room) residence.

One of Zandi's findings which is indeed closely related to this research is in relation to *memar*s role when he states: 'in case of Iran it was not the Westerner who brought about, alien and inappropriate design concepts. Apart from the educated architects even the *memar* who is usually a member of the traditional community was responsible'[71].

The memars, whose designs reflected the preferences of the community and who symbolised local traditions, made similar mistakes to modern architects. The reason may lie in the pressures of modernisation in general and the construction industry in particular. As a result of dominance of 'pseudo-modernism' buildings constructed by the government or high status 'Europeanised' individuals there became ideal models. The design process became self- conscious in its manipulation of new models, materials and concepts of use, but still retains the close client -designer relationship. This remains close in memars system whilst in the modern sector, particularly mass housing, the paying client and the actual users are different so the relationship is lost and various problems

result.

9. 1 Experts and the users; 'mass housing'.

John F. C. Turner[72] also learnt his, now universal, formulas for housing in relation to - and from economically deprived people. The central issue of what John Turner absorbed in Peru, is believed to be the role of housing in the economic affairs of the dwellers, is also applicable and valid in this case. John Turner's three Laws of Housing can be summarised, as the psychological, social and economic bases of his findings:

'1. **When dwellers control the major decisions and are free to make their own contribution to the design, construction or management of their housing, both the process and the environment produced stimulate individual and social well-being.** When people have no control over, nor responsibility for, key decisions in the housing process dwelling environments may instead become a barrier to personal fulfilment and a burden on the economy.

2. The important thing about housing is not what it is, but what it *does* in people's lives; dweller satisfaction is not necessarily related to the imposition of material building standards.

3. Deficiencies and imperfections in *your* housing are infinitely more tolerable if they are *your* responsibility than if they are somebody else's.'[73]

With the unfortunate pressure from decision makers to shift from private owner built housing to 'mass housing', the element of owner control and satisfaction only gets worse. Not only the owners satisfaction, but also the livelihood of the traditional/ conventional building industry which goes with it. The statement by the Minister of Housing and Urban Development of 'the ministry's future strategy'[74] is very important as it is an indication of the general consensus of the professionals' opinion on the issues related to the housing problems and the building industry. What follows is the whole strategy statement which will be returned to in future chapters, in order to examine its different components.

> 'On the Ministry's future strategy: Ninety-two percent of houses in Iran is built individually and only 8% in the form of mass construction. This has caused

housing to be both expensive and of short useful life. A disagreeable point in housing planning is the existence of a 'demolition rate'. The demolition rate is 1.5% in the cities and 2.2% in the villages. These figures indicate that some 1.5% of the residential units in the cities are naturally demolished irrespective of the population expansion. When buildings are not constructed on a mass scale -and - without the involvement of the engineering profession, together with a number of other factors, the result is a significant decrease in the useful life of those buildings. If we take the number of houses in the Urban community at around 6 million something like 90,000 of them wither away every year. And if we take the number of rural residential units at 4.5 million it can be concluded that something like 180 thousand units crumble down every year. With these figures how much of the natural wealth is wasted away in just a brief period? That's why we are after raising the useful life of buildings, and the best solution is promoting sound engineering systems and housing construction on a mass scale.'[75]

It is admirable of the Housing Minister to publish the basis of the Ministry's future strategy so that it could be debated. This is one of the results of the downfall of the former despotic regime, and a credit to, the Islamic Republic.

It appears that much debate is needed on this strategy statement. Should this be by the professionals? An attempt is made to answer this question later in the dissertation. Coming back to the statement itself; first of all the number of demolition's are not as a result of an owner built system, and there is strong evidence to the contrary. A high proportion of demolition in urban areas can be attributed to the laws banning the sale of land. Construction firms, developers, and various individuals, unable to buy land on the private market, had no choice but to buy a house, demolish it and build a high rise apartment or commercial block in its place. Devastating earthquakes are another factor Some of the traditional buildings withstand the earthquake better than 'engineered' ones. The shortage of cement is another factor, and so on. However there are other ways for 'raising the useful life of buildings' or 'promoting sound engineering solutions'.

This situation here as the 'justification' does not immediately proceed the statement resembles 1960s Britain, when 'in the heyday of industrialised building, enormous tower blocks were being built to re-house people from areas of unit Victorian housing . . convoluted costing were done to justify the cost of factory production including such things as getting rent income earlier.'[76]

The statement seems to indicate a division or misunderstanding between the main goals and ideas of the Islamic Republic. On the one hand to support culture and tradition, on the other the environment in which government executives compile their ideas and on

which they bases their decisions:

Even in the West, despite their efforts on the evaluation and feedback methods of POE (Post Occupancy Evaluation), the tremendous scale of problems with the modern housing estates has led the authorities to think twice.

> Since the industrial revolution various types of buildings have been designed and built for a client other than the user. No matter how much designers negotiated with paying clients it was difficult to plan for the needs of the user clients who were neither well known nor readily available to plan with.....Significant disagreement between experts and users have indeed been demonstrated in several studies of residential environments[77].

Alice Coleman's[78] detailed study of houses and blocks of flats covering 100,000 dwellings presents the evidence to establish links between social malaise - from litter and vandalism to children in care - and the design and the layout of modern estates. This is an example of the outcome of a total divide between the users and designers, when the un-examined methods are preferred to traditional, tested, procedure.

The *memar* intuitively understood his clients needs because they were similar to his own and were codified by tradition and so he had only to follow the custom.

As housing is one of the major demands on the construction industry in developing countries, it is important that the industry develops in such a way to be able to accommodate the psychological, social, environmental and economical aspects of housing. This cannot be fulfilled by the modern sector. The modern sector needs medium to big scale projects, the economy of scale. Mass housing is the domain of the formal sector which is perhaps why it is highly advocated by government officials. Mass housing will deprive the people of their control and satisfaction. Mass housing may cause unknown troubles and large scale problems!

10. The effects of the Iran-Iraq war and the Islamic revolution: present conditions.

Drastic changes were studied in the period between 1925 and 1979 which were made possible due to different factors within the Iranian society and the 'world international relations'. It was explained how 'Europeanisers' created an atmosphere of 'pseudo-

modernism' as a 'philosophy' behind the regime's destructive, anti-cultural policies. 'Royal Despotism', 'Pseudo-Modernism', and 'Oil Economy' were identified as the main pillars of the Shah's Regime.

The Islamic Revolution put an end to 'Royal Despotism' and the 'Pseudo-Modernism' era. The place of oil revenue in the economy had to change due to drastic changes in the world oil market, and the siege of the American Embassy on Nov. 4th 1979 marked an era of new international relations. The Iran-Iraq War was another factor in social and economic change. Literature on the Islamic Revolution and the events which changed the face of the society is numerous. Individual writers and different organisations have analysed these remarkable events from a variety of standpoints. For years to come an enquiring reader would find enough literature for further analysis and the drawing of conclusions. The analysis of 15 years of drastic events in the social and economic sphere of the society is obviously outside the scope and aim of this dissertation. As mentioned earlier there is a need to make careful assumptions in answering the important questions which directly affect the final assessment on the future development of the Iranian construction industry.

What are the conditions for change, the situation, the basis of international relations and the 'pillars' of the Islamic government 15 years after the Revolution when religion, history, and culture were re-instated as issues for discussion? 'The Islamic Revolution also transferred culture, civilisation and religion from academically taboo to ones admissible into the analysis of tissues and theories of international relations'[79] Prior to a discussion of the basis of international relations the influential factors within the society will be examined.

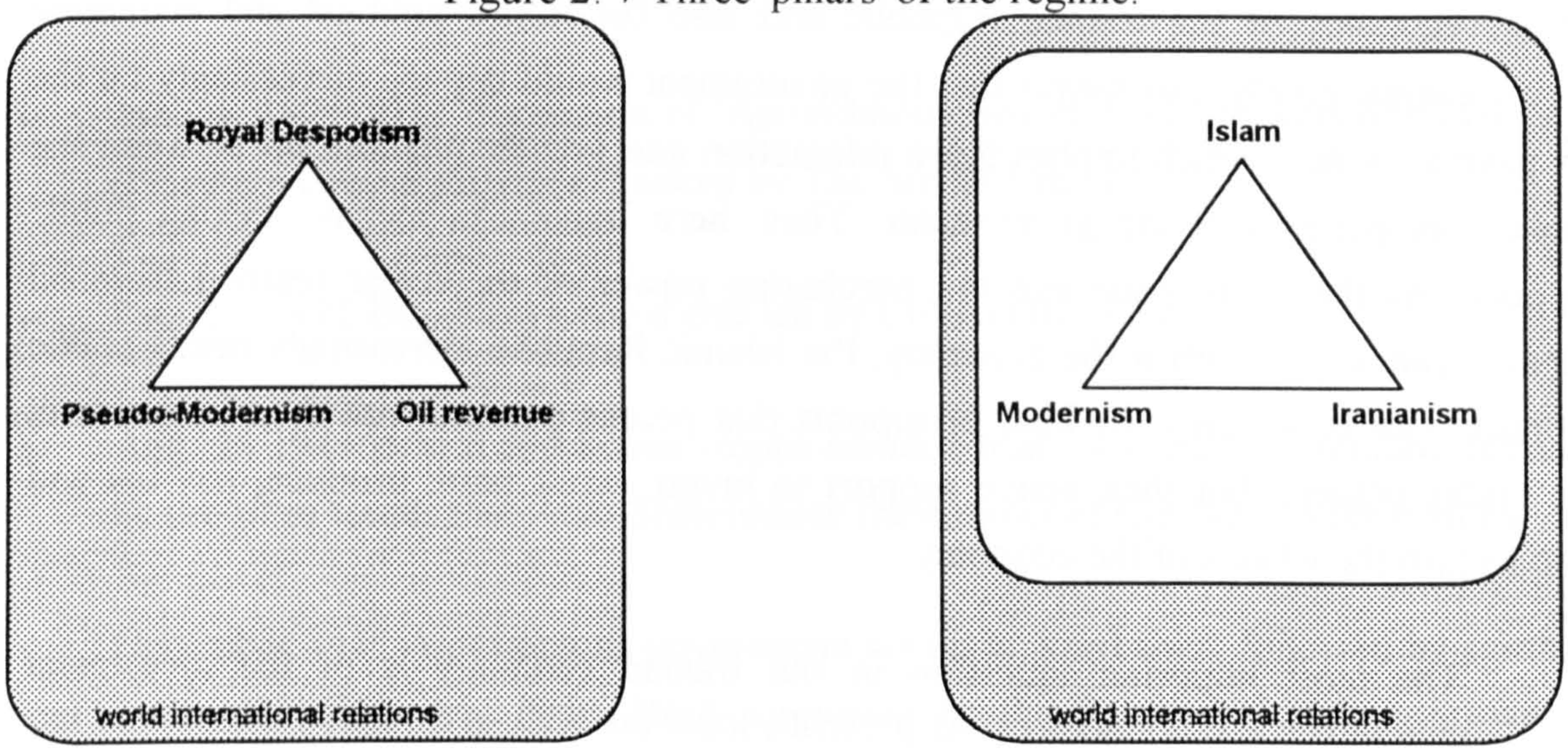
10.1. The socio-economic conditions.

Sepahsalar Qaem Maqam and Amir Kabir are believed to be the most popular figures in the Iranian history. Their works and services to the society leads one to the assessment that their personality was based on three 'pillars': Iranianism, Islam, and modernism. Pointing out the fact that popular personalities like Fereydoon Adamiat and Mr. Hashemi Rafsenjani have written books about Amir Kabir further leads us to the reasons for their popularity within the society. In other words the people were agree with their principles which was similar to those of Amir Kabir, they had attractive personalities, and held popular support.

> 'Amir Kabir was extremely patriotic, devout and Muslim and very much interested in sciences. He set up a polytechnic institute in Tehran 20 years before the Japanese established theirs. Dr. Mosaddeq too was a Muslim and a modernist. During the Pahlavi era the total disregard of one of these pillars, Islam, led to imbalance in society with the Islamic Revolution being its natural and rational final reaction.'[80]

The 'modernism' mentioned here is obviously quite different from the 'pseudo-modernism' of Shah which were discussed earlier. It is believed that the cultural element of Islam would control the process of modernism and makes it sensitive to the indigenous culture. However, 'Mr. Rafsanjani, when he had just been elected president, said he was like Amir Kabir and would focus all his attention on those three main pillars.'[81] In order to remind ourselves of the so called three pillars of the Shah's regime, and to draw comparisons with those of the Islamic regime, the following diagram (Fig. 2: 7.)can be used.

Figure 2: 7 Three 'pillars' of the regime.



Replacement of the royal despotism by the Islamic republic giving a more rational attitude towards the modernisation process is clearly demonstrated in the diagram, and is indeed well acknowledged.

Since the industrial exploitation of oil in 1909, the Oil revenue has been a major factor in the economy and the whole political and social structure of the country. During the Shah's regime oil revenue provided a plentiful source for government expenditure. More important it was not tax payers money, so the public had no say in its spending. 'Petro-dollars' were used to buy popularity for the Shah. Katuzian[82] in an analysis of the cycle of

dictatorship and democracy in Iran states:

> 'In such a traditional regime of dictatorship if the government is successful in its works, i.e., in the words of Nizamul-Mulk, be a just government, it undertakes two things: one, creation of order and stability in the society and, two development, that is, building of roads, irrigation networks inns, even building of towns. These two undertakings are not only to please the nation. Rather these are necessary for preservation of government and to enhance its power. However people too, benefit by its various fruits. But as a nation enjoys no rights or responsibilities, it, as a rule, does not view this with gratitude. Rather, at best it regards it as insignificant and at worst, considers it as another trick to expand despotism, corruption or to deceive the people.'[83]

Oil revenue is not considered as one of the pillars of the Islamic regime for a number of reasons. One is the drastic change in the structure of the oil market. It is a well known fact that **'Iran's oil earnings are roughly half what they were in 1979, yet the population had risen by two thirds'**[84] This drastic change has a number of implications for the economy of the Islamic Republic and also for future political and economic developments. Firstly, this means that the government would depend increasingly on the tax payers' money, which implies more interaction and greater relationship between the public (tax payer) and the government. Thus, here Iranianism means 'seeking public support'. As the oil revenue and the purchasing power of the dollar (earned from oil sales) declines, and with it the economy, the Islamic Republic increasingly needs public support. This is not only the kind of support that people express with their presence in the Friday prayers, but their active support to invest, work hard, produce, pay tax and help to turn the wheels of the economy.

> 'The most important question in the Iranian economy is of the investment guarantees and boundaries. At present , local (as well as foreign) investment has no sufficient guarantee for its own stability. The absence of and overall strategy, the waywardness of establishments, the lack of co-ordination among organisations and departments, the discrete management and the still persisting confusion, which can render management unsteady, have forced 'capital' to flee our country or ever set foot in Iran. So, not only the foreign capital will not come here, but the native capital won't get started.'[85]

The relationship of the former regime with the West , particularly its close ties with the USA surrounded the whole structure and economic affairs of the country. The Islamic government, since the siege of the American Embassy, have been always cautious about western interference in its foreign policy. Imam Khomeini's metaphorical phrase, that 'our relationship with the West has been the relationship between sheep and wolf', has been a

common opinion in the country. Thus, after 15 years of revolution the future and the boundaries of this relationship are still unknown.

10. 2. Western interference.

Western intervention, or interference, in the political affairs of the country has had a great effect in our life and the course of history in the last 90 years. Below are major events with the (known) influence of the Western governments:

- Qajar dynasty. period marked by rivalry between the UK and Russia. A period of granting shameful concessions such as in 1872 Baron de Reuter were granted a 70-year monopoly over communications, irrigation works, telegraph, almost all minerals and customs duties. This had to be cancelled one year later as a result of public uprising.

- June 4, 1920-1921 Formation of 'Autonomous Soviet Socialist Republic of Gilan' (Northern coastal province) backed by The Soviet Union.

- Feb. 20, 1921 Bloodless coup d etat led by Colonel Reza Khan.

- Aug. 25 1941 British and Soviet troops invaded Iran, as a result of refused demand by the allies forces that Reza Shah reduce the number of Germans in the country.

- December 1945 Autonomous government set up in Azarbaijan, followed by another in Kurdistan in early 1946. Both supported by the Soviet Union overthrown in December 1946

- August 1953 Dr. Mosaddeq overthrown in an operation masterminded, supported, and aided by the CIA.

Of the six major events which happened prior to eight years of supporting Saddam in a destructive war against Iran, three of them had already happened in the lifetime of the author. The basis of these interventions will be discussed. That is the only 'valid' basis for the dominant Western Capitalism, the economic relations.

10. 2 1. Economic relations

The globe is fast becoming a single marketplace. Goods are being made wherever they can be made the cheapest, regardless of national boundaries. One would think that with the industrial processes so geographically widespread, its resulting benefit would be spread similarly wide. But this is not the case.

> Every year $40-50 billion flows south to north in debt repayment and profit reparation. Despite all the talk about more preferential trade deals with the South, the flow of wealth is as gratefully out of kilter as it was at the height of colonial period, when the rich industrialised European nations were unapologetically sucking wealth out of the Third World'.[85]

While this development of truly international economic relations was going on, ironically cultural relations have actually grown apart; racial and religious antagonisms and the deliberate division of cultures have been boosted. With this growing economic inter relatedness there has been a proliferation of wars, which themselves will further exaggerate cultural differences. '. . . the most consequential and the bloodiest of all wars and conflicts will take place between the boundaries of culture which separate countries from one another. . . . it is because various civilisations have varying ideas about their relations to God and human being, nationality and government, parents and children, freedom and authority, equality and class difference.'[86] Although most wars in history had some element of ideology behind them but many analysts look for the economic reasons of the conflict. In relation to most wars happening in the oil rich region of the Middle East one needs to answer the question: Who were the ultimate beneficiaries of those wars?

11. Summary and conclusions

The study of building traditions started with a brief overview of the historical background. This followed by a detailed examination of residential building traditions which continued up to the 19th century when the 'modern' construction industry emerged. Drastic changes in building traditions were studied with an effort to understand the dynamics of change in the period 1925-79. Islamic Revolution was a start of a new era. An era of recognition of traditional values and moves towards re-orientation towards those values. The departure from traditional architecture included the study of Western influence; the influence of modern Schools of Architecture and modern architects.

An effort was made to understand the influence of traditional architecture in today's perception and current practices. This involved the study of evidences of continuity of traditional architecture on modern process and product, the people's response to traditional architecture. The study of evidences of continuity of traditional architecture involved examining factors determining the form of traditional architecture which was studied with the example of the courtyard house in Yazd. In this example its form in relation to its major morphologic elements were discussed. The examination of the traditional process included the study of various customs or 'codes of practice' in design and construction: 'codification' of customers needs in the traditional house; 'code of practice' for the process of design; and 'code' for static and aesthetic. Traditional building process was also compared with modern process and the relationship between the 'experts' and the users and the effects of ' mass housing'. The effects of the Iran-Iraq war and the Islamic revolution, and a study of present conditions examines possible tendencies towards traditional building.

The conclusive section is comprising four main headings: The Background, Departure; Recognition; and Re-Orientation. Before reaching a conclusion statement, a summary and conclusion of each of these quasi sections is provided.

A: The Background

1. The thousands of years of Iranian construction constitutes a history of innovation and creativity. Iranian architecture and building technology developed gradually through stages of trial and error to become thoroughly harmonised with the environment and

the people's way of life. It is impossible to over-emphasise the significant role played by construction throughout Iranian history. *Memars* have contributed to and enhanced the art of building through developing various techniques and succeeded in the invention and further development of various constructions such as *Ghanat*, water-mills windmills, reservoirs, roads bridges dams *caravanserai* and so on. Their work was a reflection of the people's philosophical beliefs and thus was in harmony with nature and contemporary social beliefs.

2. Iranian architecture according to certain scholars, was based on folkloric or popular principles; self sufficiency, standard measurements and modules and internal orientation. Iranian architecture displays special features such as proportional design and measurement, and functional incorporation of decoration. Varied geographical and climatic conditions in Iran also led to the generation of various 'indigenous' residential buildings types.

3. In the Qajar period, despite growing contact with Europe, the *Memars* 'system' continued on its traditional path, and in fact there was no significant change in architecture and traditional building technology before the Pahlavis. Nevertheless the Qajar period created an atmosphere of resentment towards cultural traditions. The cultural stagnation and political corruption of this period had an inevitable effect on the psychology of most Iranians. Seeing their country stagnating, a dislike and dismissal of the past became linked with their hatred for the corrupt regime, and prepared the path for greater introduction of 'Western methods'.

4. In a pseudo-modernist atmosphere a small but growing group of 'Europeanisers', with little understanding of European developments, begun to prosper and grow in numbers. Based on revived despotism, and mainly financed by oil revenue, they became the dominant force in modern Iranian developments. Pseudo-modernism in the Third World is characteristic of men and women who are alienated from the culture and history of their own society, both in intellectual ideas and in social aspirations.

5. When surveying the difficulties of the last seven decades, the relative harmony of pre 19th century development in Iran seems a long way off. The degrading capitulation of the Qajar dynasty before foreign Imperialism foreshadowed a later, less obvious, capitulation of the Pahlavi's. Despite the potential benefits of huge oil revenues, the Pahlavis also failed to develop national autonomy and despite its bureaucratic

largesse, in effect relinquished control of industrial development to the vagaries of the world oil market. To attempt to industrialise by decree, to implant technology, can only lead to an alienation of industry from the culture and environment which ought be nourishing them.

6. In reaction to this so called pseudo-modernism an antithesis has been formulated in the tendency towards a rediscovery of Iranian tradition. This increasingly accepted antithesis has substantially developed within the past twenty years. It is both understandable and a necessity. However, as in the Farsi proverb; 'to avoid falling off the front edge of the roof, the man walked backwards and fell off the back edge', it would be equally dangerous to go to the other extreme. There is nothing in itself wrong with the idea of openness and progress both in the intellectual and the material sphere of life if it is not accompanied by an indiscriminate disrespect for the traditions of the past.

B) The departure

1. Due to political and socio-economic factors during the last 50 years the crucial link between traditional and modern (or conventional) architecture has substantially weakened.

2. The influence of Western architecture in the country has been an indirect one. Apart from the obvious influences of the mass media on ordinary people the main Western influence on the architecture has been through modern Iranian professionals. Architectural schooling has been dominated by Western values, relationships and patterns, it has failed to be an integral part of the building industry. Today there is a great failure by the practitioners of modern architecture to understand traditional architecture, its methods and practices.

3. There is a growing lobby of enlightened architects who appreciate the values of traditional (national) architecture, deplore the break in continuity and who are seeking ways of re-linking traditional, conventional and modern (international) architecture and their corresponding building methods and techniques. If the imposition of modern (Western) architecture is bad, then the sentimental re-introduction of old forms and methods simply for their own sake, is no better. Our wistful attitude towards the past is a sign of our inadequacies today and a result of

being cut off from the cultural roots

4. Certain aspects of the traditional architecture, although neglected to a great extent, have never been totally abandoned. This influence is both in the process and the product. The significant role of the *memar* on the job site, and in training for the building trades is a precious heritage and evidence of this. Despite the ignorance of this sector by the government and the adoption of a Western structure for the development of the building industry, the *memar*s live on with their traditional organisation of production.

c) Recognition

1. The centrally located courtyard is perhaps the most recognisable feature of the traditional Iranian house. Its feature is the result of climate, available materials and a cultural manifestation. The introduction of the automobile coincided with the pseudo modernist era (1925-1979), and resulted in the demolition of the traditional urban fabric and the adoption of Western style city planning, which in turn affected the traditional residential architecture.

2. There are five main principles for architectural design and two main principles for city planning. Understanding each of these principles for the traditional *memar* took years of experience as well as the teaching and guidance of *memar bashi* (senior *memar*). One of these principles were *khod basandegi*. This means self sufficiency. In practice it meant the maximum use of existing facilities from *Boom-avard* (grown in, or bringing out of the local habitat) components, that is locally produced from local materials with highest productivity.

3. The *memar* intuitively understood his clients needs, because they were similar to his own, moreover these needs were codified by tradition and he had only to follow custom. For the traditional *memar*s, who were usually responsible both for the design and execution of the job, there were five different stages of design before they could start construction. 'Code of practice' for static and aesthetics was the geometrical order. For instance, the crystal pattern of room arrangement around the courtyard is achieved by a special 'process' of co-ordination of measurements called *gaz-o-peymoon* on a geometrical basis. Typology of the rooms were also 'codified' comprising the description of its floor, walls, and ceiling.

4. In a questionnaire survey it was found that over 95 percent of the 'respondents' preferred a house with a private courtyard (walled enclosure) to living in an apartment building. When the residents were given a choice between having a private roof-top or a private balcony (in an apartment) almost 80 percent chose the roof top. The roof top is still, quite commonly, used as a place to sleep at night during hot summer months.

5. Significant disagreement between experts and users have indeed been demonstrated in several studies of residential environments. A study of 'mass housing' apartment block projects of the post-war in the UK suggests that there is evidence to establish links between social malaise - from litter and vandalism to children in care - and the design and the layout of modern estates.

6. John Turner's important finding says: When dwellers control the major decisions and are free to make their own contribution to the design, construction or management of their housing, both the process and the environment produced stimulate individual and social well-being'. while this is in agreement and adaptable with the memars system, it is in contradiction with the mass housing policies declared by the government authorities.

D) Re-orientation, and present conditions

1. Drastic changes in the period between 1925 and 1979 were made possible due to different factors within the Iranian society and the world international relations. It was explained how 'Europeanisers' created an atmosphere of 'pseudo-modernism' as a 'philosophy' behind regime's destructive anti-cultural policies. 'Royal Despotism', Pseudo-Modernism', and Oil Economy' were identified as main pillars of the Shah's Regime.

2. The Islamic Revolution put an end to the Royal Despotism and the 'Pseudo-Modernism' era. The place of oil revenue in the economy had to change due to drastic changes in the world oil market, and the siege of the American Embassy on Nov. 4th 1979 marked an era of new international relationships. The Iran-Iraq War was another factor of social and economic change. Iran's oil earnings are roughly half what they were in 1979, yet the population has risen by two thirds. This means that government would be dependant on the tax payers money. This implies more

interaction and relationship between the public (tax payer) and the government. Thus, Iranianism (in the Islamic regime) replacing oil revenue (in the context of the former regime) could be interpreted as 'seeking public support'. If the Islamic government is based on the sound bases of Islam, Iranianism, and modernism, then history, religion, and culture would be the key issues in the future developments.

3. If the Islamic republic can provide a balanced, social, economical, and cultural environment to get the best of all worlds as, to some extent, Japanese did, then it needs, not only the kind of support that people express with their presence in the Friday prayers, but their active support to invest, work hard, produce, pay tax and help to turn the wheels of the economy. The most important question in the Iranian economy remains the investment guarantees and boundaries, which are uncertain at the present time. Present confusion has forced out the so much needed 'local capital', let alone foreign investment.

4. Imam Khomeini's comment, that our relationship with the West has been the relationship between sheep and wolf, have been a common opinion. This is probably why after 15 years of revolution the future and the boundaries of this relationship is still unknown. Western intervention or rather to be called Western 'interference' in the political affairs of the country has had a great effect on our life and the course of history in the last 90 years. The mass media is constantly sedated and confused by the 'capitalist' controlled media. No nation can persuade to survive and develop in isolation. We must invest our hope for a sound and just relationship in the people of the West, and not their governments. After all we are in the same 'boat in crisis' with regard to the natural environment.

Western technology, needed for economic development, brought with it Western products, and to some extent, Western culture. The seductive appeal of Western technology can carry with it a kind of cultural inferiority complex. As a result society's value judgements are affected. In a state of confusion of identity unbelievable historical mistakes are made, for instance the abandonment of traditional architecture. Intellectuals from the ex-colonies blame the influence of the colonial period for the demise of traditional architecture. Without intending to exonerate colonial powers in any way, it is important to note that this phenomenon has happened in many other non-colonial countries. Iran for instance had started to adopt Western house forms and urban development plans ever since the end of Qajar period (1925), which started an obsession for modernisation.

There are many groups of conscious intellectuals in non-western countries who believe that the adoption of Western architecture has resulted in the development of a built environment inappropriate to cultural and environmental conditions. Careful study and active publicity of the merits and values of vernacular architecture, are the first steps in building up confidence and in breaking the circle. This must not result in a nostalgia and the un-pragmatic attitude of trying to impose **indigenous** architecture, but rather an effort to **enable** 'a traditional construction industry' to grow again from within -the word is **endogenous**. To this end the author believes that the study of traditional architecture must include not only the **product** but also the **process**. In the same way, it is important to preserve the traditional/ conventional building industry in order to enhance the traditional values in the sphere of the built environment.

The era of 'departure' has changed as a result of the Islamic revolution, in which the circumstances and the conditions of despotism, and pseudo-modernism were abolished. 'Recognition' of traditional values is the general tendency in the post revolutionary Iran. This could be considered as a historical thrust for the realisation of the ideas towards 're-orientation'.

In the same way as the Islamic Revolution helped the period of recognition, the re-orientation phase is dependant on a successful process of understanding and the recognition of the historical, cultural, and practical merits of traditional values. In this chapter the aim has been to elucidate some of these merits in the sphere of traditional architecture and building process in the light of present 'internal' conditions. An understanding of the new 'external' circumstances and conditions is equally important. The state of the world economic relationship does not seem to change for the benefit of the third world. This is why self reliance is so important. Despite the prevailing economic problems, there remains a lot to be optimistic about. The abolition of despotism can be considered as a firm base for a period of national responsibility, hard work and achievement. In this process the cultural and historical strengths would certainly help as they did in the past, to overcome those problems.

3:10. End notes.

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[1]Baker Ernest. As quoted from Traditions of civility. Cambridge 1948 p21

[2] See Wullf Hans E.: The Traditional Craft of Persia; 1966 . Also:
K.A.C. Creswell, A Short Account of Early Muslim Architecture pp 245.321;
A. U. Pope and P Ackerman; A Survey Of Persian Art. p318 ;
Braiwood. Howe, and Reed; 'The Iranian prehistoric project.' SCIENCE: 23 June 1961 .

[3]Op. cit. Braiwood et al.

[4] Here we present a brief account of their achievements in a chronological list. The list is extracted by the author from *Tarikhe Mohandessi-e Iran* (The history of Iranian Architecture and Engineering) by Dr. M Farshad. Tehran 1983

A): Pre-Islamic period

Oldest remains of houses in Iran. ..... 8000 BC
The oldest human settlement in Sialak (Kashan)..... 5000 BC
Mud houses with clay walls become popular. ..... 5000 BC
Mud bricks are made and used in Sialak (Kashan). ..... 4000 BC
Invention of brick burning kiln and use of burnt bricks. ..... 4000 BC
Corbel arch is built in Ur..... 3000 BC
Masonry domes are built in Ur. ..... 3000 BC
Roof truss invented in Shush. ..... 3000 BC
Ceramic made and used. ..... 3000 BC
First use of gypsum in Iran. 3000 BC
Remaining evidence of a brick arch in Shush. ..... 1300 BC
Ziggurat Choga Zanbil built in Shush. ..... 1250 BC
Water treatment system built in Shush. ..... 1250 BC
Ekbatan appears as a city. ..... 800 BC
For the first time metal pulleys are made of bronze. ..... 700 BC
Rock architecture and related masonry techniques developed. ..... 700 BC
Dam and Canal is constructed in Khusistan. ..... Achamenian
Sasanian and Islamic period'
Dams are built on Tigris and Euphrates by Iranians. ..... Achamenian
Sasanian and Islamic period'
'Apadana' style become common. ..... Achamenian
The construction of Pasargad started. ..... 550 BC
Road construction on a large scale dJadeh Shahi (Kingdom road). ..... 500 BC
The construction of Shush castles started. ..... 521 BC
The construction of Takhte Djamshid (Persepolis) started. ..... 518 BC
Iron and lead used to connect and assemble stone components. 'Achamenian '
Suez canal between Nile & Red sea by the command of King Daryoosh and the advice of Iranian scientists and Engineers. ..... 523-520 BC
According to Herodotus. this canal was started by Pharaoh Setti the first in 1318-1293 BC. and continued by Pharaoh Ramsis II 1289-1232 but stopped because of the belief that the level of the Nile is lower than the Red sea. This was proved by an Iranian scientist to be false.
Irrigation with 'kanat' or ghanat widely used. ..... 500 BC
Herodotus reports of oil wells and the use of tar in Iran. ..... 500 BC
Athos canal (2200 meters long, 90 meters wide and 2-8 meters deep)
was dug by Buberanda and Arthakle. Iranian engineers. by khashayar Shah's -
command. ..... 480 BC
The bridge on Helspont by Khashayar Shah. ..... 480 BC
Silk road constructed..... 200 BC

Cities of Teifon. Hatra. Darabgard and Gowr constructed. ..... 50 B.C-200 AD.
Kangavar Temple Built for (Anahita). ..... 50 B.C-200 AD.
Innovation of the lateral arch. ..... 100 AD.
Innovation of corner Arches in order to adapt a circular dome on
a rectangular plan..... 100 AD.
Circular concept of city planning is employed..... 100 AD.
Glazing techniques transfer from Iran to China. ..... 200 AD.
Chahar Tagi (construction of a dome on four lateral Arches) style introduced..... Sasanid
period.226-641 AD.
Firoozabad city renovated and revitalised by Borazeh. Iranian architect and engineer. 224 AD.
Firoozabad castle constructed. ..... 224 AD.
Shushtar dam-bridge constructed..... 230 AD.
Ghir dam on Karun river constructed. ..... Sasanid period
224-642 AD.
Ahvaz dam constructed. ..... 'Sasanid period'
Karkha Eivan constructed..... 'Sasanid period'
Arched dam constructed in Izad Khast Fars Province. ..... 'Sasanid period'
City and castle of Bishapour constructed..... 260 AD.
Kasra Castle constructed..... 300 AD.
the main hall roofed by a brick arch with a 25 meter span .(without the use of formwork)
Construction of Sarvistan castle..... 500 AD.
Metal Structures inside water for port construction. ..... 531-578 AD.

B): Islamic Period

Kufa and Basra constructed by Roozbeh Iranian Ostad
(architect engineer. scientist)..... 'Khalif Omar'
Construction of Baghdad designed and started by Nowbakht (Iranian Ostad)..... 762 AD.
Papers from Abu Reihan Birooni about materials science. topography.
surveying and geology. ..... 1000 AD.
Surveying and topography instruments such as level altitude meter and angle meter invented by karaji
..... 1100 AD.
Construction of Djame mosque of Isfahan started. ..... 1137 AD.
Invention of two-layered dome employed in Eljaitoo dome. ..... 1218-1344 AD.
Construction of Soltaniah dome finished. ..... 1209 AD.
Kashi haft rang 'Seven colour tiles' style and technique becomes popular..... 1501-1736 AD.
Construction of Kahrood arched dam near Kashan. ..... 1510 AD.
Construction of Chehel Sotoon building in Isfahan. ..... 1590 AD.
Construction of Allah Verdi Khan Bridge in Isfahan. ..... 1600 AD.
Construction of Sheikh Lotfollah Mosque in Isfahan. ..... 1612 AD.
Construction of Khajoo bridge in Isfahan..... 1642-66 AD.
Karim Khan build the Shiraz mosque. bazar bath house and other buildings
in Shiraz..... 1750-97 A.

In the Qajar period (1786-1925) the same styles and technologies were continued and evolved further.

[5]For instance: the Taj-Mahal in India was designed and built under the supervision of Ostad Ahmad and his brother Ostad Hamid from Shiraz: Dabbagh Khanah Mosque in Ankara Turkey (13th century AD) by Abdul Ghader Isfahani from Isfahan. Shafaieh hospital (12th century AD.) In Gezel Gezlar Torbasi :Sivas Turkey. by Ahmad bin Abibakr Marandi from Marand: Khaja Ahmad Yasvi Mosque in Turkistan (13th century AD.) by *Memar* Hossein Shirazi: *Gur-e-Teymur* (Timur mausoleum) in Samarkand (13th century AD) by Muhammad bin Mahmood Al Isfahani from Isfahan: Or the works of Ajam Ali or Asir Ali (Ajam means farsi or Persian and Asir means captive. Sultan Salim the first took Ajam Ali with himself to Istanbul (Ottoman empire's Capital) and soon he became the chief of *Memar*s of The empire he built numerous buildings. Baab-Al-Salam. Top Kapi serai. Sultan Salim Mosque .Jazaari Mosque. Ali Pasha Mosque. Pir Mohammad Pasha Mosque all in Istanbul. also he built Suleymanieh Mosque in

Chorlu. Ayaz Pasha Mosque in Takir Dagh. Saif-Addin Qazi Mosque in Sufia. Sultan Mosque in Manisa Chupan Mustafa Mosque in Gabzah. Dar-Al-Baidha by the order of Khosrow Pasha. Khatunieh Mosque in Tarabuzan Salim Mosque in Ghounieh. Ghasem Pasha Mosque in Burpook (15the century): and many more.

[6] Mohammad Yousof Kiani. *Memari-e Iran - Dowrehe Eslami* (Iranian Architecture - Islamic Period): Yahya Zokaa: '*Memaran va Ostadkaran-e Dowrehe Islami* '('Architects and Builders in the Islamic Period') p435
For a number of reasons. the author have been able to list the names of only 234 *memars* of the Islamic period. only a small fraction of what might be expected. Firstly they did not put their names on their buildings. Secondly. the building or part of the building with the name of the builder. was ruined or removed during restoration or repair. The third and probably the most important reason is that history is usually the story of rulers and kings. rather than artisans and ordinary people.

[7] Kiani M. Y.. 1987

8 Khaja Nezamul-Mulk Tousi. Iranian (prime) minister to Alb-Arsalan and Malek-Shah in Seljuc period. According to Godard (Iranian Art Paris 1962). 'he was one of the wisest ministers the 'East' has known'. He was a precious asset to Iranians in his period of service to the people and the country. After 55 years faithful and precious service to the two kings. he was dismissed and later killed by a court conspiracy. His book *Siasatnama*' or 'Sariul-Moluke was a significant guide and its'advice to kings has been quoted by many scholars in the East and West since it was written.

9 Katuzian M.A.H. Professor., 'Democracy, Dictatorship and Nation's Responsibility' Kayhan International (Iranian weekly paper) August 5 1993. p7
10 After H. Katuzian: The Political Economy of Modern Iran p285

[11] Gibbs Leon L.. Plan of Shiraz; The office of the area development : Shiraz 1960

[12] Op.cit. Katuzian

[13] Op.cit. Katuzian

[14] Dewilde John. C. et al. A Framework for The Development of Construction Industries In The Developing Countries 1972 World Bank: Report of a Special IBRD Mission 1972. Volume III. Appendix 2 p2

15 Hosein Lorzadeh. born in 1900. is one of the last memars of the traditional kind with a full functionary role from design to the building and tiling-decoration of many mosques. He is also a calligrapher painter and poet. One of his famous works is the mausoleum of Ferdowsi. an Iranian epical poet in Mashad. When the design by Andere Godard was rejected by M.A. Foroughi (member of senate and an influential elite) Lorzadeh was appointed in charge. He designed and built the mausoleum.

16 *Ab Sab Tarash* is a technique of cutting and grinding bricks. to make them accurate in dimension and fare face. The brick used is ordinary hand made burnt brick made in an open brick kiln. For more information see: Wulff Hans E. The Traditional Crafts of Persia. The M.I.T. Press. 1975 pp 117-125.

[17] Godard André. The Art of Iran , Translated from the French by Michael Heron edited by Michael Rogers. London 1965

18 Godard Andrea. French archaeologist and architect who was invited by Iranian government in 1928 for restoration and evaluation of Archeologic sites. He lived in Iran for more than 30 years of his life and returned to France in 1960. Godard gained his reputation in his archaeological works and his

publications on the Iranian art and architecture is much appreciated. His name is also associated with the establishment of the first modern school of architecture and a number of architectural designs such as the museum of *Iran-e bastan* and the tomb of Saadi in Shiraz. the latter have been subjected to strong criticism particularly after the Islamic Revolution in 1979.

19 Falamaki M.M., '*Gosastegiha va doshvarihay-e memari sonnatin va memari-e emruzi-e Iran*' (rapture of linkage. and the problems of our traditional and modern architecture) .*majalehe Sakhteman* (The Construction Journal) vol 5 Tehran 1988. p48. Dr. M Falamaki is a lecturer in the Faculty of Architecture. Teheran University. Recently he has made an effort to articulate his views on traditional and conventional architecture and their relationship.

20 Saifian Mohammad Kazem. Director of the Faculty of Fine Arts. University of Tehran. '*Sargozasht-e AAmuzesh-e Memari dar Iran*' (The story of Architectural Education in Iran): *Abadi* magazine. quarterly publication of the Centre for Architectural and City Planning Studies Ministry of Housing and Development. *Paeez 1370* (Autumn 1991) pp2-4

21 Ghaffari Dr.'*Sargozasht-e AAmuzesh-e Memari dar Iran*' (The story of Architectural Education in Iran): *Abadi* magazine. quarterly publication of the Centre for Architectural and City Planning Studies Ministry of Housing and Development. *Paeez 1370* (Autumn 1991) pp 5-6

22 Noohi Hamid . '*Sargozasht-e AAmuzesh-e Memari dar Iran*' (The story of Architectural Education in Iran): *Abadi* magazine. quarterly publication of the Centre for Architectural and City Planning Studies Ministry of Housing and Development. *Paeez 1370* (Autumn 1991) pp 6-7

23 Nadimi Hamid. former lecturer in the School of Architecture in Shahid Beheshti University Tehran. and a member of Planning Council for Art and Architectural Schools. Nadimi is currently involved in a PhD research on 'Towards a consistent model for architectural education in Iran' at the IoAAS University of York.

24 Nassrollah Asemani. is a conventional *memar* and a member of the Union of Memars and Technicians of Shiraz: Interview with the author in 25th March 1989

25 Op. cit. Falamaki p47

26 Op cit. Falamaki

27 Op cit. Falamaki

28 Op cit. Falamaki

29 Lorzadeh Hosain. '*Pay-e Sokhan-e Lorzadeh Memar-e kohansal va sonnatgaray-e Irani*' (As an audience to Lorzadeh. old Iranian traditionalist memar): *Majalehe Sakhteman* (The Construction Journal) vol 2 Tehran. 1987 P32

30 The term 'cultural assault' or 'cultural onslaughts' refers to the propagation of Western culture and life style by Western mass media as: 'Minister of Culture and Islamic Guidance Mostafa Mirsalim Tuesday said thaat the introduction of the Islamic Revolution to the world and countering cultural onslaughts of the enemies of the Islamic Revolution is the utmost importance to this ministry. quoted from 'Countering Cultural Assault Top priority. Says Mirsalim': Kayhan International 24th Feb. 1994 p1

31 OP cit. Lorzadeh

32 Op cit. Lorzadeh

33 Boostan Bahman. '*Ostad Aliakbar Mas-oudi va aasarash*' (Ostad Aliakbar Mas-oudi and his works). *Majalehe Sakhteman* (The Construction Journal) vol 5 Oct. 1988 p65)

34 Ostad Aliakbar Mas-oudi (1916 - 1988), was one of the most outstanding memars of recent years. In addition to the construction and restoration of mosques. holy shrines and other traditional buildings he was involved in the construction of a number of private houses in Tehran.

35 Scientific American, 203 Dec. 1960 p 136-138

36 Hyland A.D.C., and Al Shahi. Ahmad., The Arab House Proceedings of the Colloquium held in the University of Newcastle Upon Tyne 1986

37 Op cit. Makiya, The Arab House 1986 p7

38 Op. cit. Hyland A.D.C. et al pp 56-57

39 Zandi M.M.: 'Preference for House Form in a Low Income District of Teheran. Iran'. PhD dissertation. University of Pittsburgh 1985

40 El Tayeb Ehlang. Adamad Adam.'Culture Architecture and the Urban Form: with special reference to privacy' PhD dissertation: IoAAs University of York 1990

41quoted as M.M Zandi 1985 p20)

42 Ghezelbash Mohammad. Reza, and Abuzia Farhad.. *Aleſbay-e kalbod-e Khaneh-e Sonnaty-e Yazd* (The Alpahbet of the Yazd Traditional house form). 1364 (1985) p10

43 Ahmad bin Hossain bin Ali-e-Kateb. *Tarikh-E Djadid-E Yazd* by the efforts of Iraj Afshar. Published by: *Inisharat-e Amir Kabir*; Tehran 1357 (1978)

44 Op cit.Ghezelbash. et al., p10

45 *Ghanat*, or *Kanat* from the persian infinitive *kandan* (to dig).

46 Moghtader Mohammad Reza. 'AAb va Ghanat dar Iran' (Water and Ghanat in Iran) *Majalehe Sakhteman* (The Construction Journal) Vol Tehran *Esfand 1361* (1983) pp73-78. Moghtader wrote his 100 pages account of his resarch on Ghanat and Water in Iran. comissioned and published by UNESO in Dec.1982

47 *Payab* is a sub-basement room providing access to underlying ghanat

48 *Gowdal-baghcheh* is a low level garden usuall dug in the middle of the coutryard which makes irrigation by gravity possible.

49 Building of roads. administrative and military changes during Achamenian Darius the Great brought about a growth in trade between various centres of the empire such as Babilonia. Hekmatane. Shush and Thakhte Jamshid (persepolis). The first unit of currency in Iran was made of gold and called Darik (the root word of Dirham. and Drachma). These conditions heightened by the right of passage upon commercial roads. As a result Iranian Bazaars due to their special characteristics. formed along the major commercial routes and the word became known in all languages.(Biglari 1977)

50 Biglary Esfandiar. Bazaars Of Iran Tehran 1356 (1977) P10

51 *Tekieh.*, Shi-ite centres used for special ceremonies during the year. especially in the month of *Moharram.*

52 *Serai*. Essentially storage areas comprising of a large courtyard in the middle and a number of storage room around it.

53 *Timcheh*, small enclosed market places with a courtyard in the middle and chambers surrounding it.

54 *Ab anbar*, Endowed places for Water comprising of a large closed ground water reservoir with stairs leading to one or several taps.

55 *Zurkhaneh*, (house of strength) or traditional gymnasiums with a unique architecture.

56 See Arthur Upham Pope; Introducing Persian Architecture; Asia Institute Books. 1969 pp 1-9

57 *memar*. traditional architect/ master builder. The word is Arabic and its Arabic pronunciation is Me-Amar or Mimar

58 Mohammad Karim Pirnia was born in Yazd where finished his primary and secondary education, later he moved to Tehran to be one of the first graduates of school of architecture in Tehran. As he mentions he was aquatinted with many traditional memars and was taught by a few Ostads like Ostad memar Ardakani, one of the famous traditional memars of Yazd. : *Abadi* Magazine No.1 first year Tehran 1991 p5

59 *Se Dari*, is a room with three door/window `module' facing courtyard. Depth of the room can be either 3 or 5 modules.

60 Pirnia Mohammad Karim '*Dar Bareh-e Shahrsazi Va Memari-e Iran*' (In regard to City Planning and Architecture in Iran). *Abadi* Magazine No. 1 first year Tehran 1991 p15

61 Op cit. Pirnia, p7. He then points out that the Persepolis remains and the residence of Khashayar Shah are evidence of this. It can be noted that evidence supporting this point are numerous and date back to the 3-4 millennium BC. these include the Susa seal. a courtyard house with a symmetrical plan. of the 3rd mill. BC (see Arthur Upham Pope; Introducing Persian Architecture 1976 p2). And the Firoozabad Castle. Sassanid period just before the introduction of Islam.

62 '*Arsan*'. means compound or composite.

63 Patio. is taken after ***Padiav*** which is the small courtyard (not necessarily central).

64 *Karfarma*, does not simply mean client (there is the word *Moshtari* to mean client) but can be translated as a client with authority. In fact the whole process of design is carried out with close consultancy and collaboration with the owner.

65 The name of this stage is taken from *Borzeh* which is a portable folding surface consisting of two hinged planes used to erect a table on site.

66 Op cit. Ghezelbash et al.. The issues under this title (Geometrical Order) were based on findings of a research carried out by Mohammad Reza Ghezelbash and Farhad Abuzia of the study of three different *mahalas* (quarters) of early Qajar period (1786-1925) in Yazd. The research was commisioned and published by the ministry of the Plan and Budget.

67 Op cit. Ghezelbash et al p43

68 '*Dar*' (door window), is like a French window which opens from *astaneh*(raised threshold). and usually consists of two bays opening outwards.

69 Op. cit . Zandi M.. M.

[70] Ibid. p21

[71] Ibid

72Turner John F.C.. Housing By People; Towards autonomy in Building Environments, 1976

73 Op cit. Turner

74Akhundi Abbas, 'Housing Problem Can Be Solved By Planning, Foresight.' Kayhan International Feb. 24 1994 p9

75Op. cit. Akhundi

76 Kelly B.T.. Chairman Campriband Ltd. in response to the authors questionnaire concerning 'Factor Affecting Productivity in the British Building Industry' See Appendix 3

77 Behloul Magda, 'Post Occupancy Evaluation: An Important Stage In The Design Process' PhD dissertation, Department of Architectural Studies, The university of Sheffield, 1991 p2

78 Coleman Allice, (Reader in Geography at King's College London, where she is also Director of the Land Use Research Unit) Utopia on Trial: Vision and Reality in Planned Housing, 1985

79Op. cit Mowlana. H., p4 See also Huntington ;Op cit.

80 Naraghi Ihsan, an Iranian advisor to the UNESCO director-general 'Interview With Author of 'From Shah's Palace to Evin Prison' Kayhan International Feb. 24 1994 p4

81 Op. Cit. Naraghi.

82 For more on the nature of despotism in the Iranian history consult the works of H. Katuzian. His most recent paper: Katuzian M.A.H. Professor. 'Democracy, Dictatorship and Nation's Responsibility' Kayhan International (Iranian weekly paper) August 5 1993. p7.

[83] Ibid

84 Simpson John., 'Veil of fears' on the occasion of 15th anniversary of the Islamic Republic. The Guardian, 1st Feb. 1994

85 Op. cit. Naraghi Ihsan, p4

86Porritt Jonathan, (special adviser to Friends of the Earth and a founder member of The Other Economic Summit) (TOES).The Guardian 16 July 1991

87Op. cit. Mowlana

CHAPTER 3
Characteristics of the construction industry and the effects of socio-economic environment

1. Introduction

There are a number of basic questions which firstly need to be defined in general terms and then in relation to the Iranian context. These start with the basic question of what is the construction industry and follow with: what are it's characteristic features as compared to the manufacturing industry; how does this industry relate to the national economy; or what are the characteristics of the structure of the industry?

The construction industry is characterised by several features which differentiate it from the majority of other industries. Among them are fluctuation in demand, temporary nature of sites, instability of employment, and the effects of weather conditions. These features not only make the industry a unique one but also affect its efficiency and productivity.[1] Another important characteristic feature of the construction industry is that it is an industry with no 'factory', it operates on the client's property. 'It is a rent and rate free industry'[2]. 'It is an industry on paper'[3]. For this reason it is considered as an easy entry, easy exit industry. 'Building combines a wider range of technologies than the products of any other industry. Today's building industry (in the UK and some other Western countries) uses computer-based technologies and robots on one hand, whilst on the other it needs bespoke craftsmanship and manual labour . . . managing such an industry is difficult and demanding . It requires steady co-ordinated actions from all sectors of the industry and from society in general'[4].

The structure of the industry is shaped by a number of factors such as nature of the work to be done which in turn, is a function of factors of scale, geographic dispersion; the choice of technology. The choice of technology in turn depends on the industry's state of technological development, the relative abundance or scarcity of labour, material, and capital. The structure of the industry is also affected by the social and economic environment, which is conditioned by the general structure and state of the economy, political organisation[5], and the traditions affecting the manner in which business is carried out.[6] In the last 15 years in Iran the two major events of war and revolution has affected both the economic and business environment, but the most influential effect was the drastic decline of oil revenue in the economy in general and in

the construction industry in particular.

2. Definition of the construction industry

Definitions of the construction industry (CI) seem to be as numerous and varied as the countries; even in the context of the relatively harmonious countries of Western Europe. As John Bennett[7] states: 'Europe's building industry is shaped by the diverse and historic cultures it serves. As a consequence, there is not one European building industry but a multiplicity of separate national and regional industries. Each comprises a distinctive pattern of roles and relationships.'

UNCHS Habitat defines the construction industry as:

> 'The construction industry is composed of contractor organisations and individuals who use their skills, labour, finance, tools, and equipment to procure, combine, and assemble a variety of materials and components to produce buildings (houses, offices, etc.), plant and process facilities (factories etc.) for various industries and infrastructure systems from transportation, communication and water to power supply 8

Jill Wells, pointing out difficulties in framing a definition, states: 'The fragmentation of the construction industry, leads to difficulties in the definition of its boundaries. The boundaries of construction are in fact frequently drawn very narrowly, to include only the main contractor'. She then concludes:

> 'The construction industry will therefore be defined to include not just activities generally carried out by main contractors but rather the whole construction process, including the production of building materials and the process of planning and design, in both public and private, formal and informal sectors.9

Building materials industry which is involved with the production of basic materials such as lime, cement, reinforcing steel, etc., - as well as those who produce more composite components such as block, brick, tile, and glass - are not included and usually considered separate industries. These are included either in building materials or the building components industry. There are also others such as building merchants, building plant manufacturers, as well as suppliers and transport agents who are excluded.

> 'It is often said that construction is a diverse industry - one that contains a large number of organisations working purely for the interests of the membership of each. But there is a common aim, however loosely expressed, and that is the success of the industry as a whole.'[10]

In the West, the UK. for example, there are numerous number of organisations, such as trade federations, professional institutions, government testing agencies, or employers' organisations. All who serve the industry provide information, help and assistance, not only to their own members but, to the other members of the construction industry as a whole. In a directory of organisations serving the industry in the UK provided by the Contract Journal[11], the name, address and the type of services they provide are listed. The point worth noting here is that most of these, nearly 50, organisations[12] and institutions are involved in research in their area of interest. However, the construction industry in different countries can be categorised in relation to the number and degree of development of related professional institutions.

Many academics and authors evade a general definition of the construction industry. Many who try, experience difficulties from the beginning. For example the definition that: 'The construction industry supplies services to three distinct types of client',[13] does not apply in this case. The modern Iranian construction industry supplies only one client, that is the government. The traditional sector deals exclusively with the private sector residential building. That makes a lot difference in its organisation, operation and, most importantly, its development.

3. Divisions in the construction industry

'The structure and organisation of the construction industry varies considerably among countries. The differences within the industry are determined by the relative importance of a few specific conditioning factors and special characteristics of the industry as well as by the degree of development of a country's economy.'[14] The economic structure of the country is also a determinant factor. For example, the construction industry in the oil rich countries of the Middle East has developed in a different way compared to some other poor developing countries. Mitchell and Bevan[15], relate profound changes in the house building process of the developing countries to 'moves towards an urban cash economy'. Not only the 'degree' of the economic development, or the economic structure but also building and economic traditions are influential factors which affect

the shape of the industry.

According to The World Bank [16], the structure of the industry is shaped by three main factors:

1. **Nature of the work to be done,** which in turn, is a function of factors of scale, geographic dispersion, function, and specialisation, such as building or civil engineering.[17], or 'the size of the country, its climatic and geographical features, the dispersion and density of its population'[18].

2. **The choice of technology,** which depends on the industry's state of technological development, the relative abundance or scarcity of labour, material, and capital (and prices for them[19]), climatic and physical conditions, government policies , and the overall development level of the economy. This, of course, does not imply that the choice of technology is always logical or appropriate. There are some 'external' factors influencing government policies which override climatic, physical, and other practical conditions which must be addressed.

3. **Social and economic environment,** which is conditioned by the general structure and state of the economy, political organisation[20] and the traditions affecting the manner in which business is carried out'.

Raftery[21] argues that 'there are usually four sets of production units, informal sector individuals, self help or communal organisations, state owned and private sector enterprises. 'There are very few 'informal sector individuals', of the kind who produce squatter buildings as in Latin America, but there is the unique *memars'* organisation which is often referred to as the 'informal' or un-organised sector.

As Chardin [22] described when he travelled to Iran in 1642: 'there were no government taxes or duties on the building or its sale. Instead the *memar bashi* or the chief of *memars* was entitled to two percent of the price on each transaction'. He continues, 'he was also entitled to five percent for all buildings built by the Government. If the building was built under his direct supervision the *memar* was entitled to 20 percent of the total cost'. What Chardin describes gives a picture of an industry with a competent professional organisation operating according to certain codes of practice and regulations in the 17th century.

Self help with a degree of communal organisation exists only in rural areas and state enterprise does not play a major role, except for the construction crusade in the period of the war with Iraq.

The construction industry in the majority of developing countries can be divided into four categories: 1) the international modern, 2) the national modern, 3) the national conventional, and 4) the traditional.[23] In this country the international modern sector, dealing primarily with specialised civil engineering works such as off-shore construction, is negligible both in terms of the number of companies involved and in its actual share of building works. The purely traditional sector only exists in rural areas and it is rapidly changing. In the cities it is mixed with the dominant national conventional sector. This study suggests that there is a two tier building industry in Iran: 1) **The traditional/ conventional ; 2) The modern sector.**

The traditional/ conventional sector is exclusively dealing with residential and commercial buildings and hereafter it is referred to as the traditional/ conventional building industry or simply as the T/C sector. The modern sector which deals with development planning projects includes both building and civil engineering works and is referred to as the modern construction industry or as the CI. A detailed examination of these two sectors will be given in Chapters 7 and 8.

There are three other types of 'division' which apply particularly in the modern sector organisation: 1) Design and building : 2) architectural and structural design; 3) public client and private contractor. These will be discussed in the analysis of the modern CI in Chapter 8.

4. Special Features of the Building Industry.

After the Second World War, concerns about productivity and a search for ways of improving it in Europe attracted the attention of national and international bodies such as the ILO[24] of the United Nations. Looking to the organisation of the industry and comparing it with agriculture and the manufacturing industry suggested some ideas and helped better understanding of the special features of the building industry. These features differentiate the construction industry from the majority of other industries. Among these are fluctuation in the demand. the temporary nature of sites, the variety in the end products. temporary duration of jobs - and - instability of employment, the

effects of weather conditions, lack of co-ordination between successive operations, and weak co-ordination between the different parties involved, such as client, consultant, contractor and so on.[25]

> 'In the light of the particular features of the construction industry. . . some of the practical difficulties confronting attempts to increase productivity, and particularly the productivity of labour may be appreciated. The need for improvement is, however, acute, for on the speed and efficiency with which the industry can meet the world-wide demand for its products may depend the future of social progress and world peace.'[26]

These special features will be studied in detail in the theoretical discussion in Chapter 4 in relation to the factors affecting productivity in the construction industry.

5. The economic environment

The construction industry, while is a major contributor to the economic growth, is in turn significantly affected by the economic conditions. The construction industry and its role in the development process is well documented in relation to both developed and developing countries (Turin[27], Moavenzadeh[28], Jill Wells[29]).

> There is little doubt that the construction industry is of crucial importance to economic development. Previous studies have disclosed that new construction usually accounts for between 45 and 60 percent of fixed capital investment. Our findings in the countries we visited have confirmed this. In Korea, Iran and Ethiopia the proportion in each case averaged about 60 per cent during the last five years for which estimates were available. Any developing country thus has an important stake in ensuring that construction is carried out at the lowest possible cost, and therefore in improving the efficiency of the construction industry as far as possible.[30]

Ghanbari [31] provides a through account of the role construction industry plays in the development process, contribution to national economy, national income, capital formation, as well as employment generation. But his account on the way economic environment affects construction industry is limited to pointing out a number of sources of construction demand. However there is a need to understand the nature of the economic environment and the sources of finance for the generation of workload for the construction industry. Construction industry as any other industry is relied upon a steady flow of demand to sustain its achievements and develop further.

> 'Building needs a stable economic environment to bolster general business confidence. . . overcoming them (the problems of fluctuations in demand), and rising to the challenges and opportunities which lie ahead will be greatly helped by a continuation of policies aimed at stability and growth. . . . Therefore the report makes no plea to Government to give building special help or assistance. Instead it prefers to rely on industry knowing its own business best and creating its own future'[32]

Social organisations are considered as organic beings. Attention is paid to all aspects of social and economic environment in which the construction industry operates (lives on) and develops (grows). The social and political environment as well as some economic aspects in relation to the period of emergence and development of the modern sector have been discussed. Here, the focus will be on the economic environment in relation to construction demand. A deep understanding of the nature and manner of the source of finance for development projects which provide jobs for construction industry seems crucial. A detailed quantitative description of the economic environment of the CI would neither be possible nor resonant with the aims of this dissertation. There is a lack of reliable statistical sources and rapid changes would render such a description rapidly out of date. An overall long-term view would be more appropriate to the aims of this study.

The fluctuating oil revenue has drastically affected the workload in the context of the CI (the modern sector of the industry) in a way it did not affect the T/C sector. Fluctuations in demand in the traditional/ conventional sector, which is mainly based on private sector housing, is less extreme and much smoother to tolerate and adjust.

In the Middle Eastern oil exporting region as a whole the modern CI is, in some general aspects, similar to that of the rest of the third world. However, it also has similarities to the CI of developed countries. Indeed, the CI in this region is constituted in a quite different way to other third world countries with regard to the availability of hard currency. As in industrialised countries, reliance on capital equipment is the natural and logical result both of high wages and a relative shortage of labour caused by the allocation of tremendous amounts of money to development projects. At the same time, because of routine problems shared by most developing countries, very little construction equipment is manufactured inside the country, resulting the industry's disastrous dependence on foreign exchange. This has a crippling effect in times of shortage. The effects of this shortage in the post War period will be examine later in

this Chapter.

Since the discovery of oil in Iran in 1891, oil revenue has become a key factor in the economy of the country. As a result the country became of increasing interest to multinational oil companies, as well as western governments, provoking their systematic intervention in the domestic affairs of the country. Although there has usually been a general understanding in the country that most important political events have an oil dimension, the public have been deprived of the exact underlying realities about oil. As a result judgements have been based on myths and distortions, or old and invalid impressions.

The share of oil revenue in overall government income has been significant. Table 3: 1 shows the decrease in the government revenue from oil and gas and the changing pattern of the structure of the government budget. Between 1982 and 1986 the share of tax revenue in the total budget rose from 17.7 to 28.3 percent, meanwhile the share of oil and gas revenue declined from 44,9 to 32.5 percent and since then is continuing to decline.

Table No. 3: 1 Government revenue 1982-1986 (million rials)

Year	1982/83	1983/84	1984/85	1985/86
Tax revenue	614,561	797,524	900,123	1,035,547
Percent	17.7%	20%	25.4%	28.3%
Oil and Gas revenue	1,563,477	1,585,267	1,282,173	1,188,658
Percent	44.9%	40%	36%	32.5%
Others *	1,301,269	780,570	1,359,989	1,428,810
Total	3,479,307	3,960,885	3,542,285	3,653,015

Source. Iranian Statistics centre, Plan Organisation, Iran Dar Ainehe Amar (Iran in the statistics mirror) issue No. 6 pp 240-243

It must be noted that the figures being in Iranian 'rial', do not take into account the extraordinary and drastic inflation rate, and could be misleading. In the last 15 years, the rate of exchange and the value of the rial has dropped about 35 fold from 1 dollar 70 rials to 2500 rials per dollar.[33] If the value of the dollar assumed as being constant, it could be roughly concluded that the inflation of the last 15 years, in relation to the purchasing power of rials abroad, accounts for approximately 230 percent a year! For an accurate evaluation of those figures the inflation rate must be taken into account.

The development of the world oil industry and changes in the pattern of energy and the oil market have caused alterations in the political economy and industry, and this has been reflected in technological development and other qualitative and quantitative

changes in the life of the people. In the 1970's during a period of relatively high oil revenues, the country spent 30 - 40% of these 'petrodollars' on its CI. One could almost call it a 'Construction-Economy'. During the 1980's, in the context of a protracted imposed war and a drastic decline in oil revenue, construction had all but stopped. What revenues there were went towards the war effort. During the 25 years practice in the CI, the author has been a close witness to drastic changes in its capacity, structure and technology, caused by fluctuation in the oil revenue. These fluctuations have had disastrous consequences for the modern CI.

Despite the increase in world energy consumption, 'OPEC share of the world oil demand has been reduced to 40% from 70% in the 1970's because of introduction of non-OPEC oil to world market'[34]. In fact even OPEC's export has declined from 36.5 million barrels in 1973, to 24.5 million barrels per day 20 years later in Feb. 1994.[35] The price of oil declined from $ 40 per barrel in 1981 to just over $ 15 per barrel in 1986 and later on some occasions to nearly $ 12. It is currently around $13 (Feb. 1994). Changes such as these mean that any valid assessment of the current and future situation in Iran must take into account the changing structure of the world crude oil market.

It is not the intention, nor indeed would it be possible here to give an instant and comprehensive treatise on the structure of the world oil market. However by concentrating on the most significant structural developments over recent decades and by looking at the history and growth of the oil industry, it is possible to get an insight into the future of the modern sector of the CI if it continues to depend on oil revenue as its sole workload generator and in fact its lifeblood.

5.1. Oil revenue and the world energy market: a long term view.

Perhaps it would be well to take on a historical view and to remind ourselves that oil is only part of a long and complicated development. The development of new energy forms to supersede old ones is continuous and oil will find itself no exception. Although we are still in an era where oil is dominant, it is clear that new forms are jostling to take over this leading position and that nuclear, solar, wind energy or indeed a combination of these will soon be dominant. The question is not if this will happen, but when. This is a long term view , but even considering short term prospects, recent trends in the last decade suggest that not only is the boom in oil revenue of the 1970s unlikely to recur,

but that the price of oil and the purchasing power of petrodollars will continue to decline[36]. This matter is clear from Table 3:3.

Table 3:2. World Energy Market: a long term view

Bygone>>>>>>>>>>>>>>>>>>>>>>>>>>>>				**Industrial Revolution**	**2nd World War>>**	**1970s>>**	**>>>>>>>>>Future**
Human	Animal	Wind	Hydro	Coal	Oil	Oil? Nuclear	**Cold Fusion? Nuclear?**
	Human	Animal	Wind	Hydro	Coal	Gas Solar	**Solar?**
		Human	Animal	Wind	Hydro	Coal	Oil **Gas?**
			Human	Animal	Wind	Hydro	Coal
				Human	Animal	Wind	**Hydro?**
					Human	Animal	**Wind?**
						Human	Animal
							Human

I would contend that the major oil companies foresaw the demise of oil and prepared for it in a number of ways. Firstly they have undertaken expensive research and development into new energy resources and systems. More interesting though is the very subtle way they have increased the price of oil during the 1970s as a way of preparing the market for other energy forms and financing the new Western oil fields. They have done this initially through OPEC, which the western companies not only tolerated but supported. Then when non-OPEC production increased and supply overtook demand, through the encouragement of various economically de-stabilising conflicts, notably the Israeli-Arab war and the imposed war and more recently the occupation of Kuwait and subsequent Persian Gulf crisis. The myth of oil scarcity also had a role to play. It was not until the early 1970s that the so called shortage of oil was mentioned and the myth was bolstered to such an extent that the price of $ 1.6 per barrel in 1970 was soon left far behind.

Table 3:3 Decline in OPEC oil exports (in $ billion)

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Exports	305	283	223	185	181	163	103	125	126	138

Source: Derived from OECD Volume 43; June 1989; table 64 p152

Conventional wisdom in the West is that the huge rise in the price of oil was engineered by the oil rich Arab countries. What, after all, did the western countries stand to gain by having their fuel costs increased? I will examine the question of how, if at all, the Arab economies benefited later. But why should the western governments want higher oil prices? The Seven Sisters companies had been involved in expensive oil exploration for

some time and although this exploratory work had born fruit, in Alaska and the North Sea for example, the reserves they had discovered were very expensive to extract. Middle East oil is largely onshore oil and much cheaper to extract.

The price at which Middle East oil could be sold was prohibitively low as far as the new, more difficult fields were concerned. Higher prices were obviously more attractive to the Western Oil Companies as these would enable them to sell their oil at a profit. Indeed, profits from non-OPEC oil have soared, with the high prices. When prices began to fall again it was the viability of these new fields which was jeopardised, not of the Gulf oil fields. The necessity for higher prices and bigger profits is clear when the huge sums which the companies were spending on research and development into new energy forms are taken to account.

The preparation of those energy forms had to be financed by oil itself. Indeed the consolidation of a higher bench mark for oil would make nuclear energy, for example, more financially viable, neutralising one of the arguments used by some of the oil companies and domestic opponents in the anti-nuclear movement.

The Gulf States certainly earned very large sums of 'petrodollars' from selling their commodity. However, in the absence of any significant industrial base, these dollars had to be re-cycled to the West in order to buy manufactured goods. The Gulf States spent most of what they earned on goods and services, keeping vast sums of petrodollars flowing round the West's economic system, and more recently even greater amounts have flooded back to the west in weapons' payments. In this latter respect, as far as the western economies are concerned, the war was heaven sent. Later when Western political considerations necessitated an end to that war, the Iraqi attack on Kuwait and the so called allied response to restore the 'world order', was timely and 'heaven sent', and served to rescue the falling oil prices and boost arms sales.

A proportion of the oil revenues were of course spent within the country. Most of this money, as mentioned earlier, was spent on the CI and caused the serious economic and social imbalances already outlined. This policy also produced, in the absence of native heavy industry to supply the CI, an essentially imported CI.

It can be seen from this that the Gulf countries have not been able to control either their own oil or indeed the limited financial benefits derived from that oil. It is known from history that what happened when Iran attempted to wrest control of the oil industry

away from the Western companies. Musaddiq had massive popular support for his nationalisation programme, and yet the CIA was able to replace him with someone more pliable. Today essentially the same relationship exist between exploiting Western companies and the exploited Gulf States, only the methods have become more subtle.

In the 19th Century when 'slaves', West Africa's energy resource, were no longer required the area was left economically dependent and socially disrupted. In order to avoid a similar experience it is necessary to remove dependence on oil as a trading commodity and to develop it as the basis of an integrated, industrial network. The illusion that we own a golden goose that will lay eggs for ever must be destroyed. The oil market is changing and the goose may soon be extinct. Before it dies its remaining usefulness must be employed to restructure the economy. The oil must be looked at, not as a trading commodity, but as a source of energy, a tool in building the industrial base. This will obviously include a construction industry which is serviced by a native industrial infrastructure.

5.2. Oil income in the context of the CI.

It is perhaps time to relate the developments in the world oil market to those in Iranian industry. Fluctuation in oil prices have always had a determining and profound effect on the CI. An example of this is when: 'oil revenues quintupled from 1963/64 to 1970/71 and made it possible for the Plan Organisation to finance most development projects under conditions which protected domestic contractors from foreign competition'. [37] This was the start of an era when a rapid decline in the share of foreign companies ended with self sufficiency in the CI. With the exception of a few areas of highly specialised construction such as off shore construction related to the Oil industry.

The periods of extreme rise and decline had a profound effect on the CI. What was happening in CI, for example, during the oil boom? What is the situation now with the previously outlined decline? These need to be studied in relation to development planning projects.

6. Development Planning Projects and the construction industry; Nature of Works.

Since 1949, the country has experienced nearly five decades of government effort towards economic development. These construction efforts were depended upon the

seven Development Plans (DPs), five of them during the former regime, and two since the Islamic republic. A brief account of development expenditure in relation to oil income and increase in population during the first four plans is presented in Table 3:4

Table 3: 4 Government expenditure on Development Planning Projects (1 to 4) at current Market Prices.

DPs	Period	Oil (and gas *) income billion rials	Total projected expenditure	Total real expenditure billion rials	approx. exchange rate	population at the end of period
1st. DP	1949-1955	7.8	21.0	4.18	32.5	20 million
2nd. DP	1955-1962	115.22 **(1)**	70	75.22	32.5 - 75.75	22. million
3rd. DP	1962-1967	276.3 **(2)**	190.2	204.6	75.75	25 million
4th. DP	1968-1972	593.65 **(3)**	554.5	506.8	75.75	30 million

Derived by the author from various tables and text by Mofid[38]

* Income from Gas started during Forth DP. **(1)** The figure given by Mofid is $2,129 million[39], and not in rial. In this period, 'the official exchange rate of the rial was changed from 32.50 to 75.75 rials to a US dollar'[40] and for this reason there was no way to convert this figure accurately. However, it is assumed the rate as an average of those figures (32.50 to 75.75 rials to a US dollar), i.e. exchange rate of 54.12, thus the income figure in rial calculated 115,221 million rial. **(2)** Calculated by the author based on figure $ 3,644 million given by Mofid (p55). **(3)** Calculated by the author based on the figure $7,837 million by Mofid (p80)

It would have been more helpful if a column was included to show the percentage of expenditure on construction. This was not possible because the construction industry still does not have a place in statistical conventions of the country. This leads to another conclusion. Not only the governments never had a comprehensive plan for the sustainable development of the construction industry but also have been consistently reluctant to allocate a place for it among other industries and in their statistical convention.

Figures on construction must be interpreted as a part of capital investment. During the first plan. in which planning methods were less sophisticated, expenditure on development projects in different sectors of the economy were cited as in the Table below. But later in fifth DP to get a picture of development expenditure as a whole numerous tables and pages of text must be studied. Katuzian's assessment of development planning in the pre-revolution period as 'mainly a shopping list of various construction projects' makes the assessment easier.

1) Transport and communications 37.1 Percent

2) Industries and mines	28.2	Percent
3) Agriculture	24.1	Percent
4) Social welfare	5.2	Percent
5) Oil industry development	5.0	Percent

However a thorough study of these development plans, although helping understanding of both the pace and the way in which the construction industry has aided the implementation of these plans, and on the other hand the pace and the path of its own development, is itself a subject for research and outside the scope of this work. Here attention is paid to some more important aspects of the first four DPs and then focus in more detail on the Fifth DP.

With regard to the nature of works:
The **First DP** mainly comprised road, and the construction of a number of factories. In the **Second DP** the modern sector took a more prominent role in the economy as a whole, apart from the construction of 4,503 kilometre roads (the target being 10,700 km). The railroad from Tehran to Mashhad was built and the network extended to Tabriz. In the **Third DP** the construction of roads continued and speeded up and absorbed a large share of the investment. Other major projects were the construction of the first steel mill in Iran, built in Isfahan and a number of other factories, and the completion of three major dams of Sefid Rud, Aras Rud, and Zayandeh Rud. It was during the **Fourth DP** that a special Mission of Consultants commissioned by the World Bank prepared a report on construction industries in developing countries[41]Their assessment of the modern sector of the CI in this period is the sole one, and precious. In this report the Iranian and Korean construction industry have been praised for their achievement. 'There is little doubt that Korean and Iranian contractors have become increasingly competitive with foreign firms. On the achievements of the modern sector the authors argue:.

> In Iran, too, the indigenous construction industry has become largely self sufficient. The share of foreign contractors in the construction market has significantly diminished. Foreign contractors are for the most part employed only for major dam and port works. During the third and fourth plans all road contracts, including those financed by IBRD, were awarded after competitive bidding to Iranian firms with only one exception: and that exception was due to the fact that foreign firms were allowed, in contrast to Iranian contractors, to bid on more than one 'road lot' and to offer a discount if they were awarded more than one 'lot'. Of the two major irrigation and road contracts awarded in the Khusestan area under IBRD financing the firsts was awarded to an Italian contractor largely because no Iranian firms were qualified for bidding, but the second was awarded

> to an Iranian contractor who won out over five foreign competitors and submitted unit prices 20% below those in the first contract.[42]

In a comparison between foreign contractors on one hand, and the Korean and Iranian contractors on the other, there are areas indicating that the latter still do not equate with the former: 'We found, for instance, that the quality and the finish of the work carried out by Korean and Iranian contractors was, in many cases, not to international standards.'[43] Nevertheless it must be considered a great achievement in itself compared to other countries under study. It is very embarrassing for Iranian contractors to see their former equals are winning international contracts all over the world, including this country. This will come back to discussion later in the chapter. In the 1970s the construction industry already possessed a considerable capacity and degree of sophistication which developed further during the Fifth DP.

The oil revenue explosion coincided with the start of the Fifth Economic plan (1973-78). 'However this was mainly a shopping list of various construction projects and under a regime of economic despotism, such a plan could be at best only an empty propaganda ploy and at worst a terrible waste of resources'[44] The economic background to the 1973 price explosion had been fairly sedate. Growth in GNP between 1962 and 1973 of 5% to 6% was steady. In manufacturing, construction and non-oil mining (including revenue from the sale of gas to the Soviet Union) annual growth of around 10% -11% was achieved. Service industries increased by 8%-9%, agriculture by 2% and oil revenue by 20% per year.

The growth in GNP after 1973, although very large, is less interesting than the differing rates of growth in the non-oil sectors. The CI rocketed and would have grown even faster had it not been for the shortage of skilled workers such as plumbers, bricklayers and even managers and more fundamental shortage of building materials such as cement, steel, bricks etc. due to inadequate sea ports. The CI had a permanently large share of the massively increased oil revenues. These revenues, which had been 40 billion Rials in 1963, rose to 133.3 billion Rials in 1973. GNP showed a similar massive increase from $4.3 billion in 1963 to $ 49.4 billion in 1973. In addition to housing, roads and urban infrastructure, money was earmarked for other areas such as agriculture, but even here it was spent on construction projects such as huge dams. Most of these projects tended to be prestigious schemes of dubious value and were heavily dependent on foreign resources.

Although Iranian industry in general grew quickly during the post 1973 period, and in fact contributed 18.7% of GNP in 1977-78, the construction fever created by the oil revenue explosion was so intense that between 1974 and 1977 the share of construction in GNP almost outstripped that of manufacturing itself. This rapid growth in the CI had serious social implications. The share of labour taken up by the CI increased markedly leading to the migration of farmers to the cities causing paralysis in agriculture and tremendous urban problems. The rapidly rising labour demand led to an increase in the wages of construction workers from 100 rials a day in 1972 to 500 a day in 1973. This rapid increase resulted in turn to equipment-based construction technology and thus a greater dependency on imported construction equipment. This was an added factor in drawing manpower away from agriculture to the cities. Materials and equipment were imported and with them modern technology was introduced and employed. The development of the CI was rushed and developed in a linear way with very weak roots in the national economy and related industries.

After a brief study of four Development Planning Projects and their role as the exclusive workload of the modern CI, a more detailed examination of the Fifth Plan would elucidate the crucial role of the construction industry in development planning. The Fifth Development plan had a profound effect not only on the construction industry but also on the social, economic and political environment of the country. The Fifth Development plan was also a test of the capacity and ability of the industry to expand.

6.1. The effects of the Fifth Development Plan. 1973-1977

The announcement of the world oil prices' increase by OPEC at the Tehran conference on 23d of December 1973 meant that the country's financial resources were going to quadruple in just over two months. In fact the governments revenue per barrel of oil jumped from $1.85 to $7.0 in 1973. and to $10.21 by the end of 1974. For the nation it was good news but for the modern sector of CI as a whole, it meant an unprecedented expansion of an already too high workload. lower competition for individual companies and assured profits for all.

This drastic increase in the oil price. immediately made the Shah feel over-confident, and he made a flurry of promises. which in turn led to a high and rising level of expectations. Moreover the Shah's over confidence and in his own eyes at least, his increased status on the political scene as a result of his apparent confrontation of the

West on the oil price issue, led him to a more despotic approach in his decision-making. As K Mofid states:

> 'The confidence factor also led to more centralisation of power and decision-making, arguably the opposite of what should have taken place. In the face of an increasingly complex economy, and in what was to follow, efficiency requirements would have been best achieved by increasing delegation of authority at all levels. The confidence factor in effect was to reduce such delegation, as the Shah relied increasingly on his own decision-making powers, a tragic mistake that came to haunt him only two years after the (period of) oil boom.'[45]

The Shah promised 'the great civilisation' that was to bring about a national state of well being through industrialisation. This was to be achieved within the lifetime of one generation and would lead to the full regeneration of Iran's ancient glory. **This was all to be implemented through the strategy of a 'big-push' in development planning financed by oil revenues.** The original Development Plan which had already started in March 1973 was abandoned in favour of a totally revised Plan. The original Fifth Plan was in itself ambitious, but the revised one was totally unrealistic and damaging.

The sheer dictatorial appetite of the Shah accompanied by the state of euphoric expectation in the country which he created, meant that the Shah could easily dismiss the warnings of the Planning Division of Plan and Budget Organisation (PBO) concerning the dangers of adopting a 'big push' strategy for development. Development theories and the problems of this strategy are not going to be discussed here. The interest is in relation to the CI, its ability to implement the plan and the way it was finally affected by the 'big push' strategy.[46]

PBO identified shortages of manpower as one of the most serious practical problems for the implementation of such a strategy adopted in the revised Fifth Plan. The following Table is a summary of the shortages of 721,200 skilled, semi-skilled and unskilled labour. For the CI the shortage of 3800 architects and civil engineers was not the central problem, given the availability of money and the management capacity of the Iranian contractors and consultants to hire foreign expatriates. Similarly, the shortage of unskilled workers was not a problem as it first appeared because of the influx of workers from Afghanistan. These workers, with similar language and culture, could easily fit in on any construction site and their salary did not differ from their Iranian counterparts.

The shortage of 270,000 skilled workers appears more significant. Skilled workers were

not available in sufficient numbers in neighbouring countries and for those that were available there was the problem of language. In the case of skilled labour language difference is more important as are the technical problems of incompatibility in terms of technology.[47] This shortage was not overcome in the plan period and affected both the industry and the client. Poor quality of work, low productivity, problem of management and long delays were amongst the most important effects.

3:5 Projected Demand and Supply of Manpower by Occupations during the Fifth Plan, 1973-77 (1000's persons.)

Category	Demand	Supply	Shortage
Architects, town planners, civil engineers	**7.8**	**4.0**	**3.8**
Electrical and electronic engineers	5 5	2.8	2.7
Mechanical engineers	6.9	4.2	2.7
Chemical, mining and metallurgical engineers	2.0	1.0	1.0
Other engineers	14.2	8.3	5.9
Senior medical personnel	8.5	7.2	1.3
Other medical personnel	35.6	14.3	21.3
Educational personnel	287.4	230.0	57.4
Higher Educational personnel	22.5	21.0	1 5
Technicians	116.6	75 0	41.6
Other technical & vocational personnel	8.0	4.0	4.0
Managerial administrative and sales personnel	185.0	185.0	–
Mining drilling and extracting workers	23.0	15.0	8.0
Transport workers	41.0	41.0	–
Skilled and semi-skilled industrial workers	520.0	230.0	290.0
Skilled construction workers	**290.0**	**20.0**	**270.0**
Unskilled workers.	**538.0**	**528.0**	**10.0**

Source: Plan and Budget Organisation of Iran (PBO) [48]

The major gain of the construction industry in this period was in relation to experience in a variety of fields. In a list of contractors qualified by OCA published in *Bahman 1364* (1986)[49], seven years after the revolution and while the war was still going on, 3171 companies were introduced in nineteen specialised fields including: building; heavy concrete structures; heavy steel structures; oil industry construction, storage tanks, and warehouse; civil engineering works, and urban infrastructure; concrete injection; piling and special foundations; port and dock building.

6.1.1. Material shortage in Fifth Plan

Material shortage has always affected the CI in different periods but in different ways. In this study the issues have been examined in three different respects: 1) Material shortage in periods of high workload and abundant foreign exchange (the present

discussion); 2) Material shortage in periods of scarcity of foreign exchange (examined as one of 'the problems of the industry' in chapter 8) The effects of shortage of material on building productivity (in Chapter 6)

The importance of cement and steel as the key construction materials for the modern sector have been recognised. It has considerably affected the industry's capacity to carry out development projects. The Table below shows the figures of production and imports of cement, steel, and aluminium during the years 1970 to 1978

Table 3:6 Iran's use (production and import) of cement. (Thousand tons)

	1970	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**
Cement production	2575	2850	3392	3451	4628	5421	5955	6323	6228
Cement import	55	80	58	303	738	1230	1376	2963	1690
Total use	**2630**	**2930**	**3450**	**3754**	**5466**	**6651**	**7331**	**9286**	**7918**

The sharp increase of both production and import of cement starts in 1972. In fact between 1972 and 1977 cement production increased by 86.4 per cent, and imports in the same period increased by almost three fold, with the exception of 1977 which shows an almost six fold increase. In all, the use of cement in the industry increased from 2,630 tons, in 1970 to the peak of 9,286 tons in 1977, an increase of 3.5 fold (an annual average increase of 50 per cent) . This also indicates the degree of expansion of the CI.

Table 3:7 Iran's use (production and import) of steel 1970 -1978. (Thousand tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Steel production	-	-	-	200	567	551	550	550	780
Steel import	218	306	288	254	208	504	272	584	986
Total use	218	306	288	454	775	1055	822	1134	1766

Steel production started in 1973, initially with 200 thousand tons, and increased to 567 thousand tons in one year (183.5 per cent). On average the annual increase was 45.1 per cent. Considering the fact that almost all the produced and imported steel was used by the CI, the use of steel in the industry increased from 218 to 1766 thousand tons in that period (an annual average increase of about 100 per cent).

> 'Ministries, their deputies and the officials within the Supervision and Co-ordination Division of the PBO, all acted as if money was the binding constraint on Iran's development, when in fact human capital and infra-structural resources should have guided the allocation of investment funds'.

One of the certain reasons for the failure of the Fifth Plan was the shortage of materials and components. During the 'boom' times consumption increased rapidly and the share of domestically produced items in total consumption kept falling. This meant that domestic production of materials did not increase fast enough which leading to an increase in the cost of 'industrialisation', the plan's objective. In summing up his account of the Fifth Plan Mofid states:

> 'To sum it all up, during the Fifth Plan period as a result of constraints in the efficient absorption of new capital, the cost of industrialisation soared significantly. In all, the constraint on absorptive capacity was due to impediments which resulted from inadequate infrastructure and shortages of complementary inputs, planning and implementation inadequacies, socio-cultural and institutional restrictions'.[50]

The authors assessment is that during the Fifth Plan, CI's constraints in the efficient execution of development projects was one of the major reasons for the increased cost of industrialisation and the subsequent failure of the objectives of the Plan. This can be attributed to a shortage of technicians and middle management personnel as well as of skilled labour. But the author's view is that the CI was rapidly overloaded beyond its capacity to expand efficiently. The CI did manage to expand in terms of undertaking projects and in its 'absorption' of a significant share of government's development expenditure. In the situation of an overloaded industry without the need for competition, high levels of profitability were guaranteed. What really happened as a result was that **high levels of profitability led to a sacrifice of efficiency and productivity**. This situation will be analysed in more detail under 'Methods of Awarding Contracts: Competition and Conspiracy' later in Chapter 7.

7. The impact of the Iran-Iraq war and changes due to the Islamic Revolution.

Disruptions of war and subsequent changes in the economy, social and administrative affairs of the country were so intense that in a retrospective view it seems difficult to separate the effects of war and the changes due to Revolution.

> 'During and immediately after wars. . . . normal economic activities are severely disrupted, due to one or more of the following effects: (1) direct destruction of factories, shops and offices; (2) destruction of infrastructure and communications;

(3) people leaving their jobs and occupations in trade for survival and security for themselves and their families; (4) reduction in man-power due to mortality, disability (both physical and mental) and migration; (5) lack of security would drive local businesses and banks, etc. to operate outside the war zone, or even outside the country, thus causing a loss of investment; (6) loss of corps and deterioration of agricultural land, in rural areas; (7) lack of goods in the local markets causing inflation and a black market, making it very difficult for families to get hold of food etc. . . . . '[51]

In common with other incidents of war elsewhere most of these effects had been influential to the economic disruption - and - destruction in Iran. Destruction of Abadan refinery as well as serious damage to a number of regional refineries such as Isfahan and Shiraz, for example, created a serious shortage of fuel and other refinery products such as engine lubricant oil or tar as the flat roof tanking material. Although the government was quick to introduce a system of ration for the public as well as economic institutions including construction companies, long queues and the limited ration affected the performance of most contractors.

Distraction of infrastructure and communications was more serious in the war zone areas of Khusistan and Western border cities and villages. The threat to the security of citizens and families affected not only people in the war zone but all over the country. This resulted from bombardments of civilian targets across the country and lead not only to migration between the cities but also abroad. Loss of entrepreneurs and company managers lead to the closure and malfunction of many businesses and industries. This affected the remaining large companies which survived the revolution.[52].

- There was no shortage of man-power, particularly unskilled labour which was maintained principally by 1.5 million refugees from Afghanistan.
- A combination of factors lead to a general shortage of building materials which had a drastic effect on the building process and productivity.
- The lasting effect was the on economy (this will be discussed under 'recent developments in the economy')

The immediate impact of war was the destruction of a number of cities, particularly in the South West, which could have increased the demand for buildings and infrastructure and created work for the construction industry. However, immediate effect was a shift from development expenditure to war expenditure. As the war continued its devastating effect on the national economy increased to the point where after eight years of war, the

Islamic Government had to concede to the UN's peace proposal.

The shift from development to war economy had the greatest initial impact on the CI in the form of decline in demand. As the war progressed its impact on the economic conditions was disastrous resulting in further decline of development projects and thus demand for construction.

Disruption from the bitter war with Iraq was tremendous. Amirahmady[53] estimates War damage at 600 billion dollars; a figure does not include damage to the population and the military. Difficulties in relationship with the World Market resulted from an economic blockade and oil export quota. 'At the end of the last financial year (March 21/1991 Iran admitted to oil revenues of $15.8 million and imports of nearly $25 million. In fact, imports were probably $2 bn.- $3 bn. higher than stated. Even allowing for non-oil exports of $ 2 bn., this would still have left the country with a trade deficit of more than $10 bn.'[54].

Damage to the factors and process of production in the war period includes: The effect on emergent industrial entrepreneurial class; Uncertainty for long term industrial investment by the private sector; capital drain; increase in labour cost; changes in labour relations; intensive control of government on resources and problems of utilisation; the controversy between clergy and technocrats related to the former regime; problems of the new born Islamic Banking; difficulties with importing machinery, spare parts, and primary resources for a highly dependant manufacturing industry.

Iran was drawn into a dependent relationship with Western capitalism, not least as a result of dependent nature of import substitution policy in the former regime. Transportation problems, massive corruption, mismanagement, and demographic pressures have kept economic growth at depressed levels. Oil accounts for over 90% of export revenues. A combination of war damage and low oil prices brought a 2% drop in GNP in 1988. GNP probably rose slightly in 1989, considerably short of the 3.2% population growth rate in 1989. [55]

The effects of the Islamic revolution on the basics of social, political and economic policies have been discussed in the previous chapter. Since the 1979 revolution, the banks, petroleum industry, transportation, utilities, and mining have been nationalised. The introduction of the new five-year plan, the first since the revolution-passed in January 1990 called for the transfer of many government-controlled enterprises to the

private sector. Since the Revolution those policies, laws, rules and regulations have been constantly changing. Numerous books have been written on those policies which affected all aspects of life in the country from different perspectives. Most of them have been published in the West. Herem basic changes in the political economy, with their implications on decision making, have been discussed in Chapter 2. The effects of Revolution on the construction industry is reflected in all aspects of this research. For example changes in the structure and organisation of individual construction firms due to the new rules and regulations is discussed in Chapter 8. Recent developments affecting the level of workload in the CI as well as changes in the business environment will be studied in the following sections.

7.1. Recent developments and the situation in 1994.

On the 9th of Feb. 1994 two days before the anniversary of the Revolution, as a result of a 20 percent cut in the oil revenue, the government had to announce austerity measures with the aim of reducing the current year's budget. President Rafsanjani's view of the situation was announced with optimism as he said: 'Our country cannot be hit even if oil prices plummet to 10 dollars a barrel or less'[56] Parliament agreed that any improvement in the forecast should go towards foreign loan repayments. Meanwhile, to compensate for the drop in oil income, the parliament suggested an increase in taxes, partly through tariffs on luxury goods.[57]

Figure 3: F1 is arranged to show the relationship between the government's major sources of revenue, public spending on development projects and other major sectors of the economy. As the oil revenue is decreasing other government revenues, taxation in particular, will increase as much as possible. Of course there is always a limit to tax increased and government efforts to reduce expense is another option . It is impossible or inappropriate to reduce most elements of current expenditure. For instance in the 1994 Budget Bill 'the Majlis cut the current expenditure by 6.3 percent for realistic considerations'.[58] But reduction in oil revenue can be as drastic as 40 percent, and similarly drastic reductions on development projects seems inevitable. The effects of these sudden and often unpredictably large reductions are disastrous for the modern sector of the CI.

The following quotations throw light on the proportion of development expenditure as well as the general economic situation as it is in 1994.

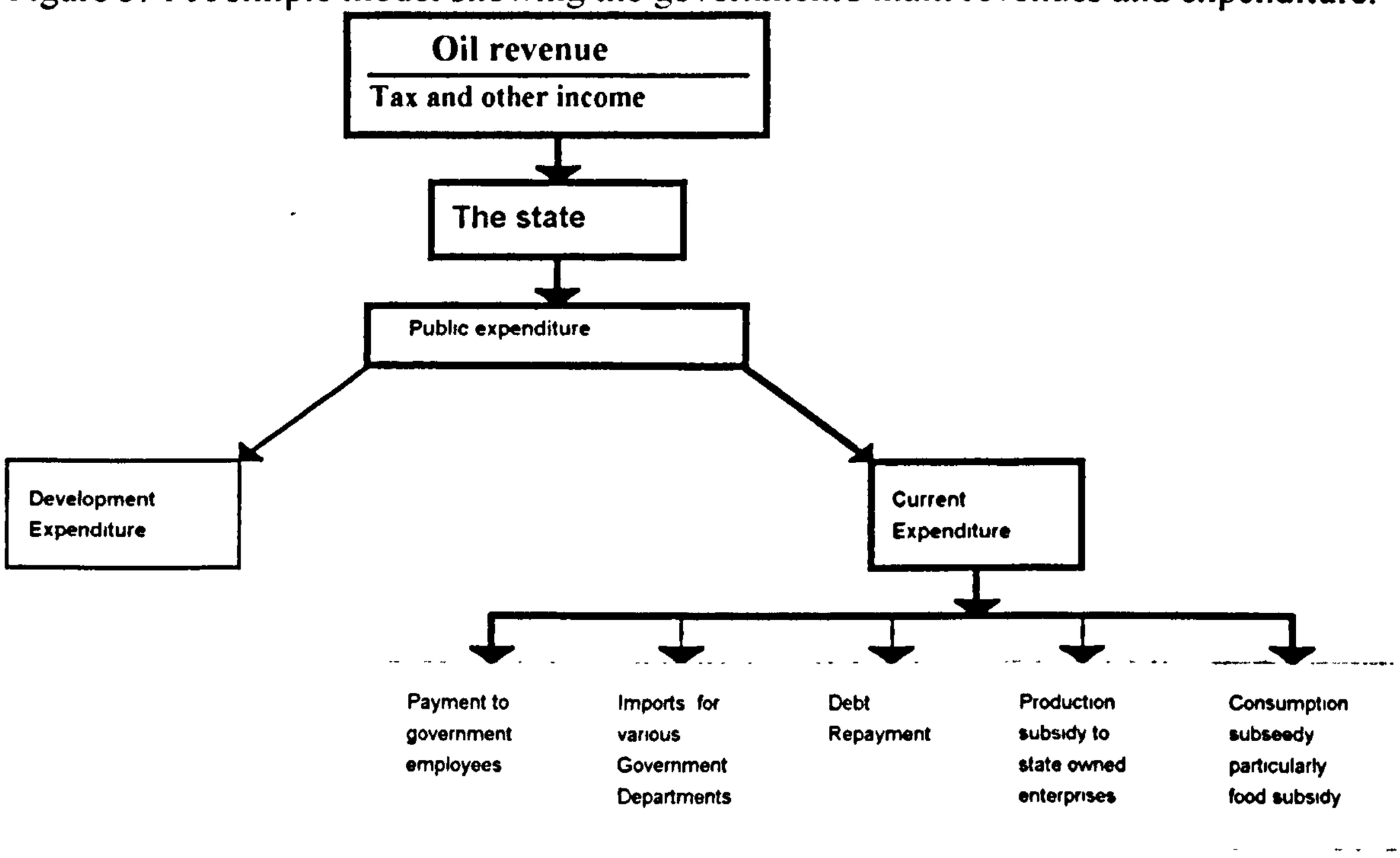
- 'The total revenues envisaged by the 1373 budget bill was Rls 69,770 billion of which Rls. 32, 300 was the government's general budget including 19820 billion for current expenditure and Rls 12840 billion for development expenditure.'[59]

- 'Foreign debt accounts for more than 30 billion dollars (Rls 75,000 billion with current free market exchange rate). Of this about 20 billion dollars are current debt and more than 10 billion dollars overdue debts. During the year 1373 the government would repay 1.6 billion dollars (Rls 4000 billion about 6% of the total budget, or over 5% of the total debt).' [60]

- 'According to Note 40 of the 1373 (1994-95), budget bill approved by Majlis, agreements on education and training of manpower, being signed by some ministries and state organisations and companies, with other countries are valid only if the training in question would not be possible at the universities and educational and research institutes inside the country'.[61]

- 'Still more than 80% of Iran's foreign revenue comes from oil, thus the economy remains vulnerable to the world oil market fluctuations. This year was the worst year for the oil market in five years . The price fell by more than 25%, and left its mark on the economy. The country failed this year to attain the oil revenue target of 16.8 billion dollars . . . Since the first plan projections for oil revenues did not materialise, the economic officials and planners moved with more caution and are considering a figure of a little over 10 billion dollars for oil earnings in the 1994-95 budget.' [62]

Figure 3: 1 A simple model showing the government's main revenues and expenditure.



Source author

Five years earlier (Dec. 1989), the Oil Minister had a very optimistic, and, in a way, totally different view:

> 'In the opinion of Oil Minister Gholamreza Aghazadeh, OPEC is 'at the outset of a long-term strategy' which he says will be 'in the interest of its members and oil consumers. . . He described the latest OPEC meeting as ' a beginning of a new stage in which OPEC will play a more important role in the oil world. . . He also said 'the rise in the OPEC production ceiling was due to increased demand for OPEC oil. . . He said the $18 per barrel base price meant 'the beginning of OPEC's long term price strategy'[63]

These views contradicted the authors findings in 20th April 1988.[64] Today it is obvious that none of OPEC's predictions came true. For example, the price fell several times as low as $10 per barrel; not all OPEC member's kept the level of production as low as their quota, and above all the non-OPEC exporters not only did not co-operate with OPEC, but were in fact producing and exporting to their utmost. In this way non-OPEC exporters were the winner of a bigger share in the world oil market and played a more important role actually hampering OPEC's efforts to stabilise the market. They have been successful in pushing the price up by creating crisis and war in the region and excluding the exports of some OPEC members. With this mechanism in the periods of high glut in the market they maintained the price above the $18 per barrel, the desirable price for the off-shore production economy.[65] The author has analysed the effect of the war on the world oil market. Wars and crisis inspired by Western governments' are to be expected, but at least one may hope that they will involve less bloodshed?

> 'The global arrogance and its allies have resumed the war of oil with an aim to de stabilise the oil prices' said Majlis speaker Ali Akbar Nategh Noori announcing that: 'another goal of the 1373 budget was to reduce the share of oil in the country's total revenues and decrease reliance on it. **The country's revenues should be raised through boosting productivity and exports and improving the quality of domestically made commodities to deter any problems arising from fluctuations in the prices of oil** '[66]

With regards to the first part of the comment the imposed war of oil is in agreement with the author's argument presented in appendix 2 with only one difference: the war not to reduce, but rather to increase and stabilise the price of oil at a level over the economic floor for non-OPEC producers and the Seven Sisters[67].

But with regards to the second part of the Speaker's comment, this is in total agreement with the author's hypotheses and proposals for the CI. This rising awareness of the

statesmen constitutes the first steps towards the improvement of the situation but must accompany appropriate policies for 'boosting productivity'. That is to create a socio-political and economic environment encouraging entrepreneurs in all industries, particularly and first of all the construction industry, to invest and work hard to achieve this boost.

7.2. The business environment in which the construction industry operates

Apart from the discussion on the economic environment in relation to the demand side, the CI is greatly influenced by the business environment. In Iran, 'the financing needed by contractors in the form of guarantees and working capital is provided principally by banks while equipment requirements are financed mainly by dealers'.[68] In the worst periods of cutting development expenditure, and at the most vulnerable times for the industry, the banks became increasingly reluctant to provide these facilities owing to the high risks involved.

There were periods during which commercial banks were competing to issue these facilities. The author enjoyed a period in the 1970s when the bank manager used to come to the company for an assessment of the financial situation of the company, discussions with the accountant, etc., and then one day later would re-visit the office to personally deliver the letter of guarantee. There was another period in which the banks only issued guarantees against frozen savings accounts or property whose mortgage worth was several times the guarantee sums. The attitudes of dealers and building merchants were even harder: no credits, no instalments, no cheques and no draft or I.O.U. notes, only hard cash and full payment. The economic situation in which the CI operates is directly and drastically influenced by the macro-economic environment and the capacity of the government to tolerate a decrease in the oil revenue.

The modern sector of the industry was hardly hit by the effects of war and changes due to the revolution, while the traditional/ conventional building industry, being considerably less dependent on public spending, was less affected. The nature and situation of demand in the T/C sector will be examined in the following Chapter in relation to the housing demand.

8. Summary and conclusion

The construction industry is characterised by several features which differentiate it from the majority of other industries. These features not only make the industry a unique one but also affect its efficiency and productivity.[69] 'It is a rent and rate free industry'[70]. 'It is an industry on the paper'[71]. **For this reason it is considered as an easy entry easy exit industry which does not attract long term investment.**

Definitions of the construction industry (CI) seem to be as numerous and varied as the countries. UNCHS defines: 'The construction industry is composed of contractor organisations and individuals. . .'Jill Wells, pointing out difficulties in framing a definition, states: 'The fragmentation of the construction industry, leads to difficulties in the definition of its boundaries. To our definition **it includes not just activities generally carried out by main contractors but rather the whole construction process, including the process of planning and design, in both public and private, formal and informal sectors.** Building materials industry which is involved with the production of basic materials such as lime, cement and reinforcing steel, as well as more composite components such as block, brick, tile, and glass - are not included and are considered as separate industries. These are included either in the building materials or the building components industry. Others are also excluded such as building merchants and building plant manufacturers, suppliers and transport agents.

The structure of the industry is shaped by a number of factors such as nature of the work to be done, geographic dispersion; the choice of technology. It is also affected by the social and economic environment, which in turn is conditioned by the general structure and state of the economy and by political organisation[72] and the traditions affecting the manner in which business is carried out.[73] In the last 15 years two major events of war and revolution have affected both the economic and business environment. The most influential effect has been the drastic decline of the oil revenue in the economy in general and in the context of the construction industry in particular.

The construction industry in the majority of developing countries can be divided into four categories. This study suggests to acknowledge a two tier building industry in Iran: 1) **The traditional/ conventional ; 2) The modern sector.** This, with the study of the structure and organisation of these two sectors will be discussed in detail in Chapters 7 and 8. The traditional/ conventional sector is exclusively dealing with residential and

commercial buildings and hereafter it is referred to as the traditional/ conventional building industry or simply as the T/C sector. The modern sector which deals with development planning projects includes both building and civil engineering works and is referred to as the modern construction industry or as the CI.

There are three other types of 'division' which applies particularly in the modern sector organisation: design and building; architectural and structural ; public client and private contractor. These will be discussed in the analysis of the modern CI in Chapter 8.

The construction industry, is significantly affected by the economic conditions. 'Building needs a stable economic environment to bolster general business confidence'[74] The construction industry as an 'organic' being is affected by all aspects of social and economic environment in which it operates (lives on) and develops (grows).

In the Middle Eastern oil exporting region as a whole the modern CI is, in some general aspects, similar to that of the rest of the third world. It also has similarities to the CI of developed countries. Indeed, the CI in this region is constituted in a quite different way to other third world countries with regard to the availability of hard currency. Since the discovery of oil in Iran in 1891, oil revenue has become a key factor in the economy of the country. The share of oil revenue in overall government income has been significant in the 1970s. Between 1982 and 1986 the share of oil and gas revenue declined from 44.9 to 32.5 percent and since then is continued to decline.

The development of the world oil industry and changes in the pattern of energy and the oil market have caused alterations in the political economy and industry which have been reflected in technological development and other qualitative and quantitative changes in the life of the people. In the 1970's during a period of relatively high oil revenues, the country spent 30 - 40% of these 'petrodollars' on its CI. One could almost call it a 'Construction-Economy'. During the 1980's, in the context of a protracted imposed war and a drastic decline in oil revenue, construction had all but stopped. What revenues there were went towards the war effort. During 25 years practice in the CI, the author has been a close witness to drastic changes in its capacity, structure and technology, caused by fluctuation in the oil revenue. These fluctuations have had disastrous consequences for the modern CI.

Despite the increase in world energy consumption, 'OPEC share of the world oil demand has been reduced to 40% from 70% in the 1970's because of introduction of

non-OPEC oil to world market'[75]. In fact even OPEC's export has declined from 36.5 million barrels in 1973, to 24.5 million barrels per day 20 years later in Feb. 1994.[76] The price of oil declined from $ 40 per barrel in 1981 to just over $ 15 per barrel in 1986 and later on some occasions to nearly $ 12. It is currently around $13 (Feb. 1994).

The development of new energy forms to supersede old ones is continuous and oil will find itself no exception. It is clear that new forms are jostling to take over this leading position and that nuclear, solar, wind energy or a combination of these will soon be dominant. The question is not if this will happen, but when. This is a long term view , but even considering short term prospects, recent trends in the last decade suggest that not only is the boom in oil revenue of the 1970s unlikely to recur, but that the price of oil and the purchasing power of petrodollars will continue to decline[77].

Fluctuations in oil prices have always had a determining and profound effect on the CI. An example of this is when: 'oil revenues quintupled from 1963/64 to 1970/71 and made it possible for the Plan Organisation to finance most development projects under conditions which protected domestic contractors from foreign competition'. [78] Since 1949, the country has experienced nearly five decades of government effort towards economic development. These construction efforts depended upon the seven Development Plans (DPs), five of them during the former regime, and two since the Islamic republic.

Shortage of building materials has always affected the CI in different periods but in different ways: 1) material shortage in periods of high workload and abundant foreign exchange ; 2) material shortage in periods of scarcity of foreign exchange. The effects of shortage of building materials on building productivity will be further examined in Chapters 6 and 8.

The Iran-Iraq war and changes due to the Islamic Revolution had a major impact on the construction industry. Disruptions of war and subsequent changes in the economy, social and administrative affairs of the country were so intense that in a retrospective view it seems difficult to separate the effects of war and the changes due to Revolution. Although there was no shortage unskilled labour but a combination of factors lead to a general shortage of building materials which gradually improved after the war ended. However, the lasting effect was in the economy as a whole.

The shift from development to war economy had the greatest initial impact on the CI in

the form of decline in demand. As the war progressed its impact on the economic conditions was disastrous resulting in further decline of development projects and thus demand for construction. The effects of the Islamic revolution on the basics of social, political and economic policies have been discussed in the previous chapter, and changes due to new rules and regulations will be discussed in Chapter 8. Since the 1979 revolution, the banks, petroleum industry, transportation, utilities, and mining have been nationalised. In January 1990 the First Development Plan called for the transfer of many government-controlled enterprises to the private sector.

On the 9th of Feb. 1994, as a result of a 20 percent cut in the oil revenue, the government had to announce austerity measures. As the oil revenue is decreasing other government revenues, taxation in particular, will increase as much as possible, but there is a limit to tax increase the only option remains a reduction in public spending. It is impossible to reduce most elements of current expenditure. In the 1994 Budget Bill 'the Majlis cut the current expenditure by 6.3 percent.[79] But reduction in the oil revenue was considered to be 40 percent, and drastic reductions on development projects seemed inevitable (see Figure 3: 1). The effects of these sudden and often unpredictably large reductions are disastrous for the modern sector of the CI.

'Still more than 80% of Iran's foreign revenue comes from oil, thus the economy remains vulnerable to the world oil market fluctuations. This year was the worst year for the oil market in five years . The price fell by more than 25%, and left its mark on the economy. The country failed this year to attain the oil revenue target of 16.8 billion dollars . . . Since the first plan projections for oil revenues did not materialise, the economic officials and planners moved with more caution and are considering a figure of a little over 10 billion dollars for oil earnings in the 1994-95 budget.' [80] Majlis speaker Ali Akbar Nategh Noori announcing that: 'another goal of the 1373 budget was to reduce the share of oil in the country's total revenues and decrease reliance on it. **'The country's revenues should be raised through boosting productivity and exports and improving the quality of domestically made commodities to deter any problems arising from fluctuations in the prices of oil '**[81]

This rising awareness of the statesmen constitutes the first steps towards the improvement of the situation but must accompany appropriate policies for 'boosting productivity'. That is to create a socio-political and economic environment encouraging entrepreneurs in all industries, particularly and first of all the construction industry, to invest and work hard to achieve this boost.

The CI is greatly influenced by the business environment. The financing needed by contractors in the form of guarantees and working capital is usually provided by banks

while equipment requirements are financed mainly by dealers. In the worst periods of cutting development expenditure, and at the most vulnerable times for the industry, the banks became increasingly reluctant to provide these facilities owing to the high risks involved.

The modern sector of the industry was hardly hit by the effects of war and changes due to the revolution, while the traditional/ conventional building industry being considerably less dependent to public spending was less affected. The nature and situation of demand in the T/C sector will be examined in the following Chapter 4 in relation to housing demand. The effects of war and changes due to the revolution will be further discussed with the problems of the industry in Chapter 8.

9. End notes

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[1] ILO, ,'Factors affecting productivity in the construction industry '1953 pp 7-16

[2] Chaldecott Nigel in a discussion with the author; CIRIA; 1989

[3] Cockburn C. in a discussion with the author; IoAAS; 1989

[4] Centre for Strategic Studies in Construction ; Research team leaders: Bennett J. and Flangan R.; Building Britain 2001 ; University of Reading; 1988

[5] For basic information on the economic environment in Iran see appendix (1)

[6] World Bank, principal author: Henroid Ernesto E. The Construction Industry: Issues And Strategies In Developing Countries; The World Bank; the International Bank for Reconstruction and Development 1984 p29

[7] Bennett. John, International Construction Project Management 1991 p180

[8] UN HABITAT; The Construction Industry In Developing Countries Vol. 1 Nairobi, Kenya 1984 p20

[9] Wells JIll; The Construction Industry In Developing Countries: Alternative Strategies For Development 1986 p 13

[10] Wells D.; 'Who Serves Construction' ; Construction Journal Jan 1986 p15

[11] Op. Cit Wells D. Jan 1986 pp16-21

[12] List of Organisations serving the British building industry:

Association of Consulting Engineers. ACE.

British Aggregate Construction Materials Industries. BACMI.

British Board of Agrément BBA.

British Precast Concrete Federation

British Standard Institution BSI.

Builders Merchants Federation BMF.

Building Advisory Service BAS

Building Centre

Building Cost Information Service of RICS.

Building Employers Confederation BEC

Building Maintenance Cost Information

Building Research Establishment BRE.

Building Services Research and Information Association BSRIA

Cement and Concrete Association C&CA.

Chartered Institute of Building CIOB

Chartered Institute of Building Services Engineers CIBSE

Confederation of Associations of Specialist Engineering Contractors CASEC.

The British Constructional Steelworks Association

Electrical Contractors' Association of Scotland

Heating and Ventilating Contractors Association

National Association of Plumbing, Heating and Mechanical Services Contractors

Metal Window Federation

National Association of Lift Makers

Scottish and Northern Ireland Plumbing Employers' Federation

Constructional Steel Research and Development Organisation

Construction Industry Computing Association CICA

Construction Industry Research and Information Association CIRIA

Contraction Industry Training Board CITB

Construction Plant-hire Association CPA

Department of the Environment DoE

Federation of Civil Engineering Contractors. FCEC

Federation of Manufacturers of Construction Equipment and Cranes FMCEC.

Federation of Master Builders FMB

House Builders Federation HBF

Institutions of Civil Engineers ICE

Institution of Mechanical Engineers. I Struct E

Meteorological Office Met

National Council of Building Material Producers BMP

Property Services Agency PSA

Royal Institute of British Architects RIBA

Royal Institution of Chartered Surveyors RICS

Timber Research and Development Association TRADA

Transport and Road Research Laboratory TRRL

13 Raftery John, Principles of Building Economics: An Introduction. 1991 p35

14 Op. cit. World Bank, 1984.p29

15 Mitchell M. and Bevan A., Culture Cash and Housing: Community and tradition in low-income building., 1992 pp 33 -53

16 Op. cit. World Bank. 1984 p29

17 Building construction in the modern sector usually includes government office buildings, schools, hospitals, army buildings, government housing projects in big cities, army barracks, and large scale and usually specialised factory buildings. Civil engineering construction includes all sorts of infrastructure

projects like highways dams and irrigation networks, airports, railways, ports, offshore and in land oil rigs.

18 Raftery John, Principles Of Building Economics 1991 p 43

19 Meaning: (and their costs)

20 For basic information on the economic environment in Iran see appendix (1)

21Op cit. Raftery p43

22 Chardin. Sir John, travelled to Iran at the time of Shah Abbas the Second (1642) of the Safavid Dynasty. He lived long enough in Iran to learn Farsi and Turkish and wrote a 10 volume comprehensive travel account. Chardin was of French origin but settled in England and was buried in Westminster Abbey. Among various translations of different parts of his writings the most significant in relation to Persia is: Sir John Chardin's travels in Persia. With introduction by Sir Percy Sykes. (Editor: N. M. Penzer) pp. xxx. 287 Argonaut Press: London, 1927

23Brien T.P.O.; Turin D.A., Building Materials Industries: Factors Affecting Their Growth in Developing Countries. University College Environment Research Group UCERG.

24 Op. Cit. ILO 1951

25 ILO, ,'Factors affecting productivity in the construction industry '1953 pp 7-16

26 Ibid p 15

27 Turin D. A. 'Building as a process' Transactions of the Bartlett Society ; vol. 6; 1968; p141

28 Moavenzadeh F.; ' The Role and Contribution of the Construction Industry in socio-economic growth in Developing Countries'; Report prepared for UNCH Habitat; 1980.

29 Op. cit. Wells Jill ;1986; pp 11-33

30 Op. cit. De Wilde et al, vol. III appendix 2 p2.

31Ghanbari Parsa Alireza; 'The Interaction of Planning Policies and Construction Technologies in Iran; With reference to China and Japan'; PhD Thesis. Department of Town and Country Planning; University of Newcastle Upon Tyne. 1989. pp 26 - 40

32 Centre for Strategic Studies in Construction ; Research team leaders: Bennett J. and langan R.; Building Britain 2001 ; University of Reading; 1988 p82

33 In spite of the introduction of the floating exchange system by the banking system and their sale of foreign exchange on a large scale from April (1993) , the exchange market went through two bouts of frantic fluctuation. In the first one the price went up from 1400 to 1850 rials per dollar. and in the second bout to 2800 dollars in 1994. It is worth noting that government efforts to stabilise the value of rial and remove the gap in the two tier values (free market and official rate). although succeeding for a short period through the Central Bank intervention of buying rials in the market. were hampered by the decline of hard cash revenue from oil sales.

34 IRNA (Iranian News Agency) Feb 16 Vienna.' OPEC Has No Other Choice But to Reduce Production' Kayhan International 17th Feb. 1994 p2

35 Ibid

36 A detailed study of the subject is presented in Appendix 2

37 De Wilde John. C., Gates Marvin., Werth Nicholas., Cockburn Charles., A 'Framework For The Development Of Construction Industries In The Developing Countries' 1972 World Bank: Report of a Special IBRD Mission vol. I p21

38 Mofid. Kamran., Development Planning in Iran; from Monarchy to Islamic Republic. 1987

39Ibid p47

40Ibid p48

41 Op. cit. Wilde John 1972 The Mission included John C. De Wilde as the chief of Mission and Economist; Marvin Gates as Advisor on Costs and Contracting Procedures; Nicholas Werth as Civil Engineering Advisor; and Charles Cockburn as Architect and Advisor on Training.

42 Ibid

43 Ibid

44 Katuzian H., The Political Economy of Modern Iran: Despotism and Pseudo-Modernism 1926 - 1979 New York University Press. 1981

45 Op cit. Mofid K., 1987 also for further information on the issue see pp 89-100

46 The plan in turn greatly affected the construction industry both in a positive sense through its provision of training at all levels and by increasing its capacity in general but also in a negative sense. A lack of competition, an increase in the cost of labour and the general chaos in the social aspects of the work environment as well as weak management, all continued to bring about a decrease in Productivity.

47 Brick laying and plastering for instance are quite different in Iran, and it is quite impossible to employ an Indian or even British tradesman for these jobs in Iran for simple reasons such as the quality of brick and gypsum let alone the more complicated considerations of compatibility in management.

48 Quoted as K Mofid, op cit. p96

49 OCA, *Daftare Omour-e Peymankaran va Sazandegan* (The Office of Contractors Affairs), *'Fehrest-e Sherkathay-e Sakhtemani, Tassisaati va Tadjhizati Baray-e Daavat be Monagheseh.'* (List of; Construction, Services, and Equipment Companies for Invitation to Bidding) *Bahman 1364* (1986)

50Op. cit. Mofid K., 1987 p140

51Barakat S. ; Reviving War - Damaged Settlements: Towards an International Charter for Reconstruction After War' D. Phil dissertation in Architecture: University of York 1993

52 700 companies were resolved in the war period (more on this in Chapter 7)

53 Amirahmady H. . ' Destruction and Reconstruction: A strategy for the war damaged areas of Iran. Disasters, the International Journal of Disaster Studies and Practice, Vol. 11 No. 2 1987 pp 134-147

54 Roger Mathews. 'The economy: damage limitation'; Financial Times survey on Iran; Section III; Feb 8 1993 pIII (Iran 3)

55 Ibid.

56 Dareini Ali Akbar, 'Nation Wide Celebrations Mark Anniversary of Revolution.' *Kayhan Havai*, 9th Feb. 1994

57 *Kayhan Havai* News Desk, 'Parliament Adopts Austerity Budget; Parliament lowers government forests revenues by 20 percent; Taxation will increase but fuel and gas prices will remain unchanged' *Kayhan Havai*, 9th Feb. 1994

58Nategh Nouri Ali Akbar, speaker of the Iranian parliament (Majlis): in a news conference; Kayhan International, 'A Look At 1994 Budget Bill Approvals ' Kayhan International 17th March 1994 p3

59 Ibid

60 Ibid

61 Ibid

62Kayhan International 'Iran's Economy in 1372 (1993-94) - An Overview.' Kayhan International, 17th March. 1994. pp 8 - 15.

63 Ibid.

64 K. Memarzia 'The decline of oil revenue in the context of Construction Industry in Iran' A paper submitted to IoAAS University of York as part of this research, and in the stage of transference from MPhil to DPhil. 20th April 1988. for full account of this paper see appendix 2.

65 See 'The problem of keeping the price up' title in appendix 2

66 Op. cit. Nategh Nouri, 17th March 1994 p3

67See appendix 2 'The Dance Of Seven Sisters'

68Op. cit. De Wilde et at Vol. III p 14

69 ILO. ,'Factors affecting productivity in the construction industry '1953 pp 7-16

70Chaldecott Nigel in a discussion with the author; CIRIA; 1989

71Cockburn C. in a discussion with the author; IoAAS; 1989

72 For basic information on the economic environment in Iran see appendix (1)

73 World Bank, principal author: Henroid Ernesto E. The Construction Industry: Issues And Strategies In Developing Countries; The World Bank; the International Bank for Reconstruction and Development 1984 p29

74 Centre for Strategic Studies in Construction ; Building Britain 2001 ; University of Reading; 1988 p82

75 IRNA. (Iranian News Agency) Feb. 16 Vienna.' OPEC Has No Other Choice But to Reduce Production' Kayhan International 17th Feb. 1994 p2

76 Op. cit. IRNA, 17th Feb. 1994 p2

77 A detailed study of the subject is presented in Appendix 2

78 Op cit.De Wilde et al vol. I p21

79Nategh Nouri Ali Akbar, speaker of the Iranian parliament (Majlis); in a news conference; Kayhan International, 'A Look At 1994 Budget Bill Approvals ' Kayhan International 17th March 1994 p3

80Kayhan International 'Iran's Economy in 1372 (1993-94) - An Overview.' Kayhan International, 17th March. 1994. pp 8 - 15.

81 Op. cit. Nategh Nouri, 17th March 1994 p3

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CHAPTER 4
The need and approach to improve building productivity.

1. Introduction

Housing demand is the major source of workload for the building industry. Yet despite the increasing need the situation of demand has been deteriorating, particularly in the last two decades. The increasing number of people in need of housing without the economic power to create a demand in the market leads to a widening gap between need and demand. This suggests that there is a deteriorating housing situation. An attempt is made to understand this deteriorating situation from the point of view of improving the efficiency and productivity of the building industry. It is worth admitting that housing problems, particularly for low income people in developing countries, have different aspects, many of which lie out of the scope of this dissertation. However, those which relate to the building industry are considered to be dealt with. To this end, this chapter draws a picture of the structure of need, demand and supply of residential building in Iran. Then the widening gap between need and demand and its effect on the supply side will be studied. The third task for this chapter is to discuss different approaches for narrowing the aforementioned gap, by increasing the ratio of output to input in the context of 'sustainable development' of the building industry.

Never before in our history has the improvement of productivity been more urgent than the present time, particularly in the field of building and civil engineering. Although the outlook of the economy as a whole is not promising, the recent statement by the Majlis speaker, 'The country's revenues should be raised through boosting productivity'[1] must be considered as a step in the right direction. However, it is clear that an all-out effort must be made in all spheres if this goal is to become a reality. A national strategy will be proposed in this respect.

Considering the key role of the modern sector of the CI in economic development and infrastructural projects on the one hand, and the crucial role of T/C building industry in housing on the other; 'The industry cannot afford to waste manpower, machines, materials or money and the problem of increasing productivity therefore deserves the serious attention of all who are in a position to contribute to the output and efficiency of the industry.'[2] Productivity in the construction industry should be understood in relation to the special features of the industry and the characteristics of its organisation,

management, and use of technology. These need to be examined in order to find appropriate methods for improving productivity in both sectors.

Improvements in productivity and better management of resources are achieved by the rationalisation of the building process within the context of the building industry as a whole. In this respect increasing labour productivity may be gained through better management practices, training and rationalisation of the existing traditional/ conventional sector that must be preserved and improved.

> 'Rationalisation, which aims at the optimal utilisation of manpower, building materials currently in use, tools and equipment, does not require considerable investment or important changes in the existing structure of the building industry, therefore, special attention should be given to rationalisation as this is an important step in the process of gradual building industrialisation.'[3]

Of more than a hundred prefabricated building factories which were nationalised during the Islamic Revolution, about 17 are now in operation[4], with less than half their nominal capacity, and yet prefabrication of building is repeatedly considered as the ultimate solution to be favoured. Efforts to bring most of these factories, based on heavy closed systems of building, back to production were fruitless. The reasons given for this failure by the research bodies has been the lack of funds and the flight of the factory owners abroad. There appears to be no concern about the main problem of 'considerable investment or important changes needed in the existing structure of the building industry'. However this chapter is a theoretical exploration on factors affecting building productivity and a search for finding an appropriate method of 'industrialisation' that is compatible to the local building industry.

1.1. Definition of terms

> 'The body of thinking known as 'economics' has developed, primarily over the past two hundred and fifty years, through many differences of opinion and emphasis, through testing and development of previous work and through responses to presenting social problems of the day. The range of contemporary economic concerns from the fight with inflation and unemployment through to green issues, is no exception.'5

In the light of the above statement, some key terms used are defined breifly here. There are other concepts which will be defined in relation to the case in the course of this study.

Cost (financial)**:** The cost of a commodity, whether it be a simple one like a length of timber or a complex item like a building, is the sum of all the payments (whether money or otherwise) made to the factors of production engaged on the production of that commodity. Factors of production are defined in economics as land, labour, capital, entrepreneurship. Land may be defined as natural resources; labour as human resources; capital as money, machinery, plant, equipment and any man-made components not used up in the production process; and entrepreneurship as the risk taking process of organising the other factors of production.

Price: 'Price is the amount (of money usually) that someone is willing to pay for some particular good. It can either be determined by the interplay of supply and demand in the market situation, or else fixed by the entrepreneur or the authorities. There is not always a very strong relationship between price and cost'[6]

Demand: 'In economics the term 'demand' has a meaning which is not the same as everyday definition. Demand, in the former case, refers to the amount of good which consumers are both *able* and *willing*, as opposed to merely wishing (or needing), to purchase at each price in the conceivable range.'7

Supply: 'The amount of goods supplied is influenced by the price obtainable relative to the costs of production (potential profit). Thus, supply can be influenced indirectly by any change in market conditions which affects the price obtainable and also by changes in technology which may influence the cost of production.'8

2. Affordability

The deteriorating housing situation suggests that new residential buildings are increasingly less affordable for those who are in need of shelter. In other words the basic need for shelter cannot be translated into viable economic demand. Less demand means lower supply which leads to lower capacity of supply. And a lower capacity to supply contributes to price increase. Price increases in turn depress demand and this vicious circle results in an increasing gap between need and demand.

2.1. The relatively high cost of building, and increasing price.

'Historical evidence suggests that the costs of buildings will tend to rise relatively faster than costs in general.'[9] This universal trend has been rather dramatic in Iran in the last 15 years as a result of the imposed war and other economic problems.

During the last five decades changes in the people's aspirations and subsequent changes in the design, quality and technology of buildings have caused increases in their cost. There has been a rise in space standards; the inclusion of an indoor toilet, bathroom and kitchen; an increase in the area of other spaces, as well as the total building area; in the quality of components, and in the mechanical and electrical fittings. As a result of these qualitative and quantitative changes there has been a steady rise in the cost and price of houses. Another important factor affecting the rapid rise of housing costs has been the increase in general building costs.

In the decade between 1974 and 1984, the cost of building labour rose ten fold and materials three fold[10]. It is worth noting that compared with the building sector, increases in wages were considerably lower in other sectors of the economy. In that period, the increase in the wages for factory workers was little more than two fold and for office workers and government employees even less. This has resulted from a general reluctance of urban, and even rural unemployed, workers to take up this type of low status, unstable, and 'laborious' employment.

The effects of post-revolutionary government policies on the housing market have been dramatic: Lack of a sound policies, irresponsible and contradictory decision making have had the result that a historic opportunity, which had been created after revolution, not least as a result of rapid decrease in price of land, was lost. Social and economic conditions as the result of revolution, the imposed war and shortages of hard currency, resulted in the limitation and shortage of materials and an increase in the price of land. These eventually resulted in record increases in the cost of building and price of housing. This situation in turn had an adverse effect on the economic condition of the country as a whole. Instead of acting as a regulator for the economy, the housing sector caused more inflation and rapid increase in prices.[11] At present (in 1994) the situation in an average city, Arak for instance , the cost of building a minimum acceptable house with the area of 130 square metres, is approximately 20 million rials, where the annual salary of a school teacher is currently around 2 million rials. Thus Cost of construction alone (without the land price) equals to 10 years of a teacher's whole salary. When it comes to the

purchasing price, it is considerably higher, and exceeds 20 years of her or his salary (the cost of land in currently 50% of the cost of housing).

2.2. Increasing need.

Developments in Iran during the last 15 years, particularly the rapid growth in population (average birth rate from 1967-1992 was 3.6%[12]) and average annual growth of urban population due to rural-urban migration (1.63% between 1967-1992) [13], as well as the effect of war and natural disasters, have created a situation in which housing needs in urban areas are soaring. The Director of Housing Management of the Ministry of Housing and Development predicts that 'in the in the year *1390* (2011) the country will face a population of 120 million'[14], from the present total of 60 million.

These rising building needs when thre is already a considerable deficit, are acute and basically stem from : 1) high birth rate; 2) rapid rate of growth in rural-urban migration; 3) rising expectations and aspirations. There have been also other factors exacerbating the situation such as the effect of war damage on the building stock, the effect of earthquake and other natural disasters, low life-cycle of buildings, the need for replacement of old housing stock and the already existing deficit.

1) High birth rate. 'Population structure will dictate future needs'[15]. Obviously changes in the structure of population affects the need for all sorts of buildings in the public services, such as education, health etc., as well as for residential buildings. All governments in developing and developed countries work for greater stability in the birth rate. In the context of post-revolutionary Iran, 'the war period spawned inconsistencies, with population control taking a back seat. Early marriage, high fertility, widespread lack of contraceptives and preference for large families are major factors for rapid growth of population.'[16] To get a picture of population structure formal statistics on current and predicted urban population are given below.

There is a density of 1.82 *families* per housing unit. The Government's objective is to reduce this figure to one family per house over the next 15 years.[17]Ironically, despite the economic problems, there is a baby boom in the country. At present the country is the 20th most populated in the world.[18]

The Islamic government now fully supports population control. In fact on May 16th 1993 the Majlis (parliament) ratified a long awaited Bill approving the Five Family Norm, i.e. parents plus three children. This means that all privileges that are granted to children under the law will not be granted to the fourth child who is born after the ratification of the Act. The need for family planning cannot be over emphasised. Government efforts are not going to take effect unless a smaller family culture develops. This means that the whole nation should think in terms of smaller families and women must play a pivotal role in family planning.

Table 4:1

Urban population in Iran, 1978-1993

YEAR	Number of persons (millions)	Number of families (millions)	Average family (persons)
1978	16.3	3.4	4.83
1983	20.5	4.4	4.63
1988	25.2	5.7	4.43
1993	30.1	7.1	4.23

Source: Plan and Budget Organisation (PBO)

Even if birth control planning policies are going to succeed, it will take a long time. Besides, birth control will not solve the problem in the cities because of rural - urban migration.

> 'Another turn of events which was initiated by the government in the aftermath of the 1979 revolution in order to satisfy those who demanded a better deal for mainly low income people in urban centres, was a policy of land allocation to landless people. This caused a sudden wave of migration of people from the rural areas to cities in search of free land, and it had unimagined affects on the country as a whole. Faced with enormous difficulties by their decision the government had to act and introduce more rigorous conditions for land allocation.'[19]

2) rapid rate of growth in rural-urban migration. This migration is difficult to control. Implementation of policies to discourage rural- urban migration should involve economic development policies, notably policies designed to slow down migration to the cities. They should also encourage investment in rural areas, which have been neglected for various reasons, including their geographical diversity and a lack of roads and other facilities.

The Islamic government's planning policies during the war have not been concerned with slowing down the growth of the population. They only began after the resolution of the war. However efforts to control migration were implicitly incorporated into rural development policies within the context of The First Development Plan of the Islamic Republic (1983-1988).

3) rising expectations and aspirations. Influencing the rising expectations and aspirations of the people seems to be the most difficult task. Although this has traditionally been a task for the Islamic clergy, the Islamic government does not seem to have had any influence on this matter. And in any case who would possibly argue that a basic right of a 'minimum shelter' is a high expectation.[20]

2.3. Situation of demand

'Construction activity is characterised by two important features. First, demand is subject to considerable fluctuations, which can have serious repercussions on the utilisation of resources.'[21] This is true not only in the case of the modern building sector which is directly dependant on fluctuating government public spending, but also in the T/ C sector. This sector is affected indirectly by the effects of government spending on the economy as a whole. These in turn are related to the financing of the private building sector, land use policies, as well as rules and regulations governing private house building activities.

In a reasonably stable market situation, housing demand is related to affordability, and can be described as an economic measure based on the ability of households to pay for the building they need. But affordability for low income families can only be feasible with high government subsidies. 'Demand for private sector (owner-occupied) new housing depends on the size and condition of existing stock , demographic change, real interest rates, and the level of disposable income of the family unit'[22] Or: 'In the private sector, the underlying determinants of construction demand are basically an interaction of quantifiable factors, such as incomes, and non quantifiable factors, such as value judgements. These determinants are to a large extent uncontrollable and, under circumstances where supply capacity is limited, can influence a pattern of demand far in excess of existing supply capacity.'[23]

Growth of demand is thus influenced by the rate of income growth, the growth in expectations and aspirations, the cost of building and the capacity of the building industry to supply. To this the cost of land must also be added. Between 1973 and 1979 the average share of the cost of land in the cost of residential units was about 46%. After the Revolution in 1979 this figure dropped sharply to 28 % and then to 27% in 1980. but started to rise again in 1981 to 29%, reaching almost 50% again in 1984.[24]

As a result of this, the gap between need and demand widened and those in need of basic shelter in urban areas could not afford to house themselves. 'Nevertheless, it is likely in most circumstances that the greater the relative prices for building services, the lower the effective demand for them'.[25] These conditions have resulted in a situation where the building industry currently suffers low demand and has fallen into its deepest recession of the last 20 years. Director of Housing Management of the Ministry of Housing and Development (MHDU) believes that this recession is a result of reducing affordability. That is due to rapid increase in housing cost on the one hand and little increase in the households income. He stated that with sound planning and the help of the banking system the government is trying to boost the demand and rescue the housing sector out of this recession.[26]. These policies in the past have only had a short term effect and can in fact result in further price increases. Perhaps the only way for the building industry to solve its own dilemma is by seeking to lower prices and stimulate demand through increased efficiency. 'It is, therefore, in the interests of the building industry, as well as the community, for the building industry to be as efficient as possible.'[27]

2.4. Growth of supply

In a healthy economic situation demand would increase and the industry would respond. By increasing supply, business would expand and the industry would grow and develop. The whole industry, including building materials and component industries, would be encouraged to invest and through competition, prices would be controlled. In this kind of situation no direct intervention by the authorities would be necessary.

In the authoritarian situation of most third world countries the word 'supply' is changed to 'provision' by politicians. While 'Some countries have fostered the development of their domestic contractors by protecting them from crippling risks and assuring them of profits for investment'[28], the politicians devise plans, often without taking account of those who are, in reality the tools for the realisation of these plans. Plans for the growth

of supply are inevitably hampered by a failure to boost the demand. In this respect an examination of long term plan by the Planning and Budget Organisation (PBO) in 1977 is interesting.

The objectives of this Plan were not realised. In May 1993 Mohammad Samari [29] (The Director of Housing Management of the MHUD announced that the average floor area of housing units had increased to 160 square metres instead of the planned 110 sq. m.(he did not give any reason for this increase[30]), and the construction of 295,000 units a year was still far beyond reach. The proposed industrialisation of building by PBO in 1978[31], which was designed as the backbone of the plan's implementation, was also not realised. In 1993 the conventional building industry finds itself in a serious recession. The government's new policy to lead the housing industry out of recession is to inject money into it by providing easy loans to boost demand. This may have a beneficial short term effect on recession but will certainly push prices up and lead to lower productivity. Further increases in price will in time further reduce demand, which will in turn push the industry into a deeper recession.

3. A basic approach for the improvement of demand

The solution to this mounting problem of has to be tackled on two major fronts, controlling the needs and increasing the building stock at the same rate as increasing needs. Controlling the growth of urban population involves birth and migration control, and slowing down the increase in rate of people's expectations. Increasing the building stock involves refurbishment and maintenance of existing building stock, and increasing building production. There seem to be two basic approaches for increasing the building stock. The first, allocation of more resources, and the second, .**Increasing the ratio of output to input (productivity).**

The refurbishment and maintenance of the existing stock and increase in the production of residential buildings has been the central task of the traditional conventional building sector. However, resources are often very limited and this situation is unlikely to change for the better given the fall in oil revenue and the overall economic conditions. The problem of the allocation of more natural resources against non-renewable materials and their consequent effects on the environment will be further discussed. Common sense therefore indicates that it is necessary to get more out of what we have already got. The building industry's ratio of output to input (productivity) needs to be increased. But

understanding productivity as a concept and the ways of achieving it, particularly in the building industry, needs detailed examination.

Conventional wisdom in the third world attributes many of the achievements of the West to technology - the 'magic wand'. This fascination extends to the intellectuals, researchers and academics, who are confused between the goal and means, between the agent and the outcome. The main reason for developing technology, which is a subagent, is to increase productivity, that is the main agent and goal. Fascinated by the role of technology, not only are other ways and means of increasing productivity neglected, but the means or solution (technology) becomes something that is to be imported and not developed. The following quote from a research commission of the BHRC is interesting as the productivity factor is only discussed under the 'building technology' title.

> 'In recent years for the construction of one square metre of residential building 4-5 men[32] have been used. But in industrially advanced countries the average figure is 1-2 persons. Moreover, traditional building operations are sequential and this implies the need for a large labour force with low productivity. Considering increases in wages, the weakness of building technology result in the increasing cost of building'[33]

Contrary to this conventional view, in this research, technology is dealt with only as one factor among many other ways and means to achieve increased productivity. In the following Section the concept of productivity is examined in more detail not only as one of the main research themes, but also because it may help fellow professionals in their awareness and understanding of productivity.

3.1. Management of Resources

In the context of Western economic development the keyword is productivity. The word is used frequently by the media in any analysis debate or comment addressing inflation, the foreign trade deficit, employment or pit closures for example. However, in the context of third world economic development, the word productivity is seldom used, instead the term 'resource management' seems to be more acceptable. But aren't they the same?

> 'In its broadest and most fundamental sense, the problem of increasing productivity may be described as the problem of making a more efficient use of all resources of production - of using them to produce as many goods and services as possible, of the kinds most wanted by purchasers, at the lowest possible real cost.'[34]

So called development activity is usually associated with the enhanced management of resources and greater production with the term 'productivity'. In a discussion with Charles Cockburn he stated: 'I can say that development and production are the same thing as seen from different perspectives, one from the socialist point of view and the other from the capitalist point of view. Because the notion of planned, state organised development came from Russia via Eastern Europe and India into the U.N., they became accepted as State mechanism'. Nevertheless productivity seems to be a valid concept both in planned and market economies, and more precisely appropriate for the analysis.

3.2. Definitions of Productivity.

'Productivity' is commonly defined by economists as the ratio of output to input, and it is a term that can be applied to any factor of production - land, labour, capital, raw materials and entrepreneurship (management) - to measure the output of each unit. When applied in this way it is called partial or specific productivity. Productivity as a whole is generally quantitative and therefore, in principle, measurable. It does not necessarily represent the efficiency of the specific resource used in the input measure, for example labour, but rather the combined effect of a number of factors, among them the *organisation* of production.

The broadest definition of productivity is the ratio between output and the total input of factors required to achieve it. In this sense productivity is the end result of complex *social* processes including: science, research and development, education, technology, management, production facilities, the administration of organisations. Productivity in this case is **called the total factor productivity or overall productivity**. Of course it is not easy to measure such a huge complexity and virtually all analyses must be confined to partial or specific productivity. Productivity measurement is important for economic assessment, in comparing two different technologies for example, or the relative efficiency of the public and private sectors of a given production process, productivity can be measured at different levels: at the level of the building site, the company, industry, or a branch of the economy or the national economy as a whole. [35]

Although the factor of time is implicitly included in the equation - for example labour productivity is measured by labour hour per unit - some economists include it in their definition. The same is true with the factor of quality. However, 'although there is not

complete agreement on the meaning of productivity, ***we will define it as the output-input ratio, within a time period, with due consideration of quality***. It can be expressed as follows'[36]

$$\text{Productivity} = \frac{\text{Outputs}}{\text{Inputs}} \text{ within a time period, quality considered}$$

Thus productivity can be improved by increasing outputs with the same inputs, by decreasing inputs but maintaining the same outputs, or by changing the ratio favourably by increasing output and decreasing inputs. Productivity is also expressed as input per unit output. For example 20 man/day per sq. m.

'Productivity although implies effectiveness and efficiency in individual and organisational performance but has different definitions. *Effectiveness* is the achievement of the objectives. *Efficiency* is the achievement of the ends with the least amount of resources.'[37] Normally efficiency is defined as increasing output of at least one good whilst holding inputs constant. Alternatively it is defined as reducing the quantity of at least one input holding output and all other inputs constant.[38]

3.3.Productivity as a concept; Improvement and importance.

The more efficient use of 'limited' resources in the production of different commodities and services, with a concomitant distribution of income, is the main concern of economics. Historically growth in productivity has been accepted as the way of improving the material quality of life for the individual. Conscious concern about productivity arises particularly in times of rising competition, need associated with shortages and hardship. After the Second world War for instance, a period of acute housing shortage in Britain 'coincided with expressions of concern within and outside the industry about its level of productivity'[39]. The recent statement cited in Chapter 3 by Nategh Noori (*Hojj*), the Speaker of the parliament, is another indication of this fact.

Productivity growth in developed countries is sought after for a number of reasons: to obtain higher standards of living, increased production output, lower inflation, and an improved balance of trade. **In developing countries however, with fewer factors of production, its main relevance is in getting more from limited resources to overcome shortages.**

Any extra value of output which is gained as a result of an increase in productivity can be partly passed on to consumers in the form of lower prices and partly distributed to factors of production - labour, capital and raw materials - in the form of higher wages, higher investment in the plant or higher prices paid for the raw materials. In any case higher productivity will result in an increase of real income for someone. Any increase in wages or price of materials, which is not accompanied by an increase in productivity, will result in higher production costs and an increase in the price of the end product.

Furthermore, productivity is an indicator of the competitiveness of a country's product in world markets. If the national productivity of an export oriented production declines compared with other countries, that country will lose customers in the international market. Labour productivity together with population and output trends are increasingly regarded as major factors used in economic growth models to forecast output and employment, manpower levels and other resource utilisation and distribution in different sectors of the economy. If any development is to happen, and the gap between different nations is to decrease, increased productivity must be at the heart of the solution, or more specifically an increase in the total factor productivity of each developing country. 'The political problem of mankind is to combine three things: economic efficiency, social justice, and individual liberty (J. M. Keynes).

For these reasons it is a great challenge for all the parties involved in all sectors of the economy, but particularly the researchers and policy makers, to discover ways of raising productivity.

Productivity improvements are now understood to be the result of varying determinants: physical, cultural, and political. This means that advances in technology, although the key issue, cannot be properly implemented without the necessary changes in social and economic institutions and values. In this respect the process of growth and the study of productivity is very much related to the social sciences: sociology; psychology; behavioural relations and management sciences. On the workshop floor or building site, increases in productivity depend to a large extent on advances in knowledge and technological know-how, and the utilisation of this in cutting production costs. In this respect it is related to engineering, but as a result of the continuing drive for greater efficiency, productivity analysis has reached out into other activities as well.

There is an agricultural term in Farsi similar in meaning to productivity, which is: *Haselkhizi* (agricultural productivity). This word led the author to consider the role of *Haselkhizi* and to realise its central importance in the development of ancient (pre-feudal and feudal) civilisations. As man intervened in nature more successfully and the cultivation of crops became increasingly central to the developing of pre-feudal cultures, the concept of `productivity' appeared for the first time. Hunter-gatherer societies probably had a primitive conception of productivity, accumulating food in an ad-hoc, relatively unsystematic fashion. Cultivation though obviously requires knowledge and a better understanding of nature, the use of tools, planning as yearly crops vary with changes in climate etc. As understanding grew, so did awareness of the factors affecting 'productivity' (getting more out of the available resources). Attempts to increase productivity produced food surpluses, for the first time. This provided the time and opportunity to pursue other arts and crafts which are a feature of the developed, sophisticated cultures. This evolutionary process was the dominant model until the Industrial Revolution, which can be described as a revolution in the mode of production of crafts aimed at increasing productivity.

> 'Whatever brought about industrialisation in its original home, it can be said that other countries received it, along with much else of European origin, as an import. Such a statement poses many problems, not least how it was that countries which had developed civilisations many centuries ahead of Europe, were subsequently left behind because they failed to **apply knowledge to raising the productivity of labour'.**[40]

Higher productivity is not of course an end in itself. Or as Charles Cockburn puts it, increasing productivity in the building industry, for instance, must not mean profit for the contractors and tears for the workers.

> 'The relative utility of the industry's output must be judged by wider issues including the value of the output to society, the quality of life of those engaged in the industry's activity and of those indirectly affected by these activities or their outcome, or by both. Single minded pursuit of higher productivity assumes scarce resources, or at least an imbalance between the intentions of an organisation and practical achievement. Social benefits from higher productivity are deployed on the next most important activity'[41].

For more information on the importance of productivity and different aspects in relation to its improvemet see appendix 4.

4. Building productivity; measurement, and comparison

Building productivity can be expressed in different ways. In some cases it is very close to profitability when it is measured as the 'output' in monetary value, or it can be measured as the output achieved by some physical measure per operative employed. There are various measurement methods for both these concepts. However it must be said that productivity measurement in the construction industry is particularly difficult due to the nature of the industry.

> 'In building economics there are few technical issues which can generate more muddled thinking than productivity. While there is general agreement that 'high productivity is a good thing', there is far less agreement on definitions and methods of measurement of productivity. Newspapers, and sometimes more authoritative sources, report on something called 'low productivity' when what they frequently mean is low *labour* productivity. This is often implied to economic 'inefficiency'. In fact, in a labour intensive process, 'low' labour productivity may well be an indicator of *high* efficiency in the use of resources'.[42]

For these reasons productivity comparisons are particularly difficult. 'International comparisons of productivity indices can often be misleading unless the method of determining the data has been carefully defined.'[43] Different methods are used at different times in different countries. Even in the European continent, with relatively harmonious industrial structure, different patterns of building industry have developed and methods of productivity measurements are different in different countries at different times.

For example in the UK (in 1962) the method of determining the productivity index was as follows. From a representative sample of volunteer firms, selected data are collected for the value of work produced, the costs of materials, and the number of persons employed. A productivity ratio expressing the net value added (difference between value of product and cost of materials) per person employed is then determined. The indicator is corrected by means of a price index to a figure corresponding to a base year, and is finally converted into an index based on that same year. In Germany instead of a sample, full coverage statistics of product value and employment, but limited to housing sector are used to calculate a productivity figure representing value of product per person employed. This is without any attempt to calculate value added. The resulting figure of course is adjusted to a base year by applying a price index, and is then itself converted into an index.[44]

'Any study of productivity must accurately define the circumstances to which it applies, if the results are to be comprehensible to those not directly concerned with the study and comparable with other studies'.[45] Despite this, labour productivity of residential buildings in different countries are compared to show the efficiency of their building industry. Table 7:1 ,shows the number of labour/ hours to build one square metre of residential building in some industrialised and less industrialised countries.

Table 4:2

International comparison of labour productivity in dwelling construction.

Nation	Productivity: (man-hours/m^2)	Date	Information source
Netherlands	12.3-18.3	1973	EEC survey
Sweden	11.3-12.7	1973	EEC
USSR	15.3-28-8	1973	EEC
Poland	15.0-27.8		
Czechoslovakia	9.4-22		
Yugoslavia	21.5-46.0U		
UK	20.2 conventional 13.8 System built	1972	UK BRE survey
Netherlands	23.7 conventional 5.9 system built	1973	Aust. CSIRO DBR Report.
UK	19.6 conventional		
USA	9.2 conventional; 6.5 system built		
Australia	5.5-6.0 conventional	1973	Aust. CSIRO DBR

Source: World Association For Element Building and Prefabrication (WAEP)[46].

The Australian figures quoted are the result of site observations and undoubtedly represent virtually the best the industry is capable of anywhere. It has been suggested though that something in the range of 8.6-14.5 man-hours/sq. m with a national average of 9.5 man-hours/ sq. m. might be more typical for Australia. In the UK and Netherlands the figure for the conventional method is around 20 man/ hour per square metre, which seems to be more likely.

Acosta Domingo,[47] pointing out the low level of labour productivity of residential building in the context of the conventional building industry in Venezuela, states: 'For example, the average requirement of man-hours per housing unit was around 4200 from 1974 to 1983. This is high when compared to the average in countries such as France, where conventional construction requires from 1000 - 1500 man-hours per unit and is even lower for prefabricated construction.

There seems to be a technical problem in Domingo's comparison, and that is a lack of consideration of the area of residential buildings. Among other conceivable differences between the situation in Venezuela and France it is probable that there is a difference between the size and other characteristics of residential buildings. Usually the productivity figure is calculated and expressed in terms of man-hours per square metre rather than per house unit. When he compares the productivity between public and private housing in Venezuela again he compares the figures in terms of per unit house and concludes that public housing enjoys higher productivity, without pointing out the obvious differences in the building area. Domingo is probably looking at the subject from a more equitable or socialist point of view. The larger area of private housing can be considered as a factor of waste effecting productivity as a whole and not accountable from that point of view.

In Iran, 'based on available information and statistics with traditional/ conventional methods **31** man-hours/sq. m. is needed for residential buildings (14 unskilled labour + 17 skilled labour)'[48]. Hosseini and Lotfi,[49] also without a mention of the source, state the same figure as 31 man-hours per square metre for residential buildings. The Planning and Budget Organisation (PBO), has estimated the manpower requirement for the first Five Year Plan of the Islamic Republic as 4.67 man-day/sq. m. If we consider the daily average of 9 hours work which is common in traditional/ conventional industry, the result corresponds to **37.36** man-hours/ sq.-m. The PBO has also not specified the method of calculating this figure. However even the smaller figure is still twice the worst record shown in Table 4:2.

The difference between labour productivity in different countries can be attributed to a variety of reasons, such as traditions in design, technology used, organisation of site working conditions and even statistical conventions and so on. From all these factors the only factor which is usually mentioned in related literature in Iran, is that unskilled labour content in the context of the T/C building industry is very high. This leads to the argument that a radical technological based solution is required to improve things. In other words the comparison is often made to condemn the traditional/ conventional building industry in favour of 'prefabricated building', industrialised or system building. However, it is important to understand the reasons and contributing factors for big difference in order to find an appropriate way of improving the condition.

Productivity improvement can be considered on different levels; national, regional, each sector of the industry, company or production unit, and individual trade. Here the issue is examined in two levels: 1) the national and regional; 2) the industry and site level.

5. National strategy for resource management.

Efforts to establish that it is important to devise a national strategy for improving productivity in building and construction as a whole and in residential building in particular. To this end not only all segments of the industry must get involved and try to achieve greater efficiency, but also other related bodies and government organisations. This is not only important for the health, wealth and the growth of the industry, but also for the country and the needs of society. 'The key message is that 'Growth in productivity must be planned. . . . improvements in productivity will not necessarily come from merely concentrating on the ability to lay bricks faster on site. The whole process has to be considered'.[50]

Here as an example of the major issues of concern, the approach by the Ministry of Housing and Urban Development (MHUD) for an overall strategy for improvement of efficiency will be presented. Following a decision by the MHUD in July 1986, '. . . to prevent waste and increase efficiency in the building sector', they sent a circular to their regional offices, some notable consultants, as well as professional bodies in order to seek their advice on the matter. The starting paragraph read: 'In order to put the potentials and resources of the country into correct (good)use, and also to prevent wastage of capital, materials, and labour in these particular conditions of the imposed war, it is envisaged that action must be taken in the area of economising in the building and housing sector by creating a new culture of building in a way that, in addition to preservation and even improvement of the quality of building, the buildings could be built with lower cost and increased strength and durability'[51].

A copy of this letter came to the Society of Architects and Engineers of Fars Province (SAEF) in Shiraz. In order to prepare an answer, the author, being the deputy Chairman of the SAEF, referred the task to three different committees of 1) Architects, 2) Civil and Structural Engineers, and 3) Mechanical Engineers for a week. At the end of the week a one day seminar was organised to sum up the conclusions and finalise the results. Each committee comprised ten members chosen by SAEF and all hundred and twenty three members were invited to the final seminar, in which seventy three members took part.

The outcome was prepared into an eleven page document giving general measures and specific recommendations.

The entire letter although interesting is too lengthy so here the most relevant extracts are presented. It must be emphasised that these are presented as the views of SAEF members and a general consensus of the professionals' opinion in Iran. The author, particularly as a result of the present research, does not agree with a number of these ideas which will be identified were appropriate.

a) General aspects and policy considerations in the national and regional level.

1) **Social research and data collection:** More systematic collection and analysis of information about past indicators and present needs to enable better predictions of future social trends. In this respect considerations of population growth, as well as changes in the quality of life was considered important. Particular attention should be given to the necessity of evaluating mass housing schemes of the last 25 years and their positive and negative effects.

2) **Public spaces**: Creation of necessary public spaces such as parks, swimming pools, restaurants, hotels, motels etc. to prevent inclusion of such spaces in private dwellings.

3) **Social environment**: Creation of a safer social environment so as to reduce the quantity of materials used for the sake of protection against theft. The amount of steel bars and profiles used for high fencing and window grills outstrips the amount of steel used for steel windows itself.

4) **Building industry statistics and information:** Lack of reliable data and information concerning building materials production, their capacity, location and performance characteristics is seriously hampering planning and programming of production at all levels and also contributes to a high percentage of waste, lower quality of product, and increased cost of buildings. SAEF proposed an information unit to collect all relevant information both at the provincial and national levels.

5) **Research co-ordination and establishment of the National Building Order:** (*Nezam-e Sakht*)[52]: The much needed research work related to building is fragmented. All the research already done by the BHRC, the Office of

Standardisation and Industrial Research, and universities must be co-ordinated, evaluated and published or made available to researchers and the public.

6) **Abandonment of owner-built and dispersed housing** (in favour of mass housing) [*This research argues against this idea in favour of the promotion of the IFC sector*]: The letter reads 'One of the major reasons for the increasing cost of building, the deteriorating structural quality, and the general shortage of housing is fragmented building, particularly in the private sector. This situation has unfortunately deteriorated as a result of the provision of land (not housing) by the government since the Islamic Revolution. This has produced higher labour wages in the construction sector and this has attracted incompetent people to the building industry. Buildings built for low income groups in this way will cause tremendous financial damage and loss of life. In the case of mass housing production it will be possible to reduce overhead costs, improve the quality of work, stabilise labour wages and advance building technology'.

7) **Industrialisation of building and expansion of building technology:** The letter reads; 'It is worth noting that although efforts have been taken in the direction of industrialisation and factories like Itang[53] have been imported, unfortunately these factories are not used and without apparent reason no effort is made to put them to work .' It semms that there is a lack of understanding that why this wasted resources can not be used. This will be examined later in this chapter under 'building industrialisation'.

8) Considering the increasing role of concrete it is absolutely vital that the government attempts to increase the number of cement factories.

9) **Training, education, and continuing education:** There is no tradition of continuing education for engineers and architects, which should be arranged by their related professional organisations. Technicians and skilled workers like welders and shutterers must be continuously trained, tested and awarded certificates through the Ministry of Works. Close links between educational institutions and different sectors of the industry should be developed and strengthened.

10) **Management:** Proper planning and correct execution of any task requires sound management. Better management means better use of resources, and better quality

of buildings. Management today is a discipline to be learnt systematically. Mere experience and talent is not enough. Relationships between all parties involved in the building industry must be managed. To this end, rules and regulations are necessary. For example, regulations need to be introduced to prevent consultants from implementing safety factors to a higher degree than necessary in their structural designs.

11) **Site inspections:** In order to avoid mistakes, bad workmanship and waste of resources site inspection and supervision must be carried out properly. Quality control is particularly important in relation to the building's strength and stability against earthquake and flood. It is the duty of consultants to appoint an experienced person to control the contractors' work. In the private sector, with its owner-built houses, it is usually left to the owner who often does not have the necessary knowledge and expertise.

12) **Repair and maintenance**: One of the neglected areas in the country is repair and maintenance. It has been repeatedly observed that in installations important enough to be called national, costly resources have been destroyed because of negligence in allocating sufficient funds for their proper maintenance. Demolition followed by reconstruction, rather than repair and maintenance, is a common practice both in the public and private sectors, this causes a tremendous waste of resources every year.

13) * **Revival of growing trees such as aspen**, plane , maple tree, pine and walnut in different parts of the country. These trees traditionally were used in building work but were abandoned in favour of steel and imported pine timber. They could be used again for doors, windows and even roofing if treated against termite and other pests.

14) **Transportation:** Sound transportation planning and a reduction in the transport of materials and movement of labour is one of the principles of building economy. Building appropriate roads and using and expanding regional resources is vital. In doing so encouragement must be given to the use of local materials in building design, rather than, as at present, materials which require transportation from other regions. There are important considerations for building economy and the national economy as a whole. It is worth noting here that the vast province of Fars and its important location with its link to the open sea, is lacking in railways. We should

propose now a plan of action for the establishment of a provincial railway network.

15) **Decentralisation:** With the growing sophistication of the country's economic system, an efficient use of the various resources available will be possible only with the regionalisation of the decision-making system. This approach would gradually result in a reduction of unnecessary expenses, less waste, and a more efficient use of resources.

b) Specific recommendations at the construction industry level:

I Architectural design measures

1. Prevention of unnecessary and wasted space at the design stage.
2. The use of minimum dimensions and space standards.
3. The limitation of window area, helping to minimise heat loss and heat gain during winter and summer.
4. Greater consideration of multi-purpose spaces.
5. Design according to climatic conditions, employing passive heating and cooling concepts in order to minimise the energy consumption.
6. * The introduction of a modular design co-ordination in order to make it possible for the prefabrication of building components.
7. Orientation in plot designs in land use schemes to facilitate the south facing of buildings, in order to enjoy maximum sunshine during winter and minimum during summer.

II Structural design, building technology, and the use of materials and components.

1) The greater use of local materials in order to minimise transportation and imports.
2) The use of a concrete shells (domes and vaults) in order to eliminate the use of steel for roofing construction.
3) * Proper use of local bricks and concrete blocks both as a load bearing and at the same time a facing material.
4) * Standardisation of different parts of the building such as window, door, lintel, and door and window frames.
5) * Promotion of the use of light weight building materials such as hollow clay blocks and Syporex blocks in order to decrease the dead load.
6) * Standardisation of specification and properties of building materials and control

of production necessary for proper structural design. This may help eliminate the structural engineers' tendency to over-design which is a major source of material waste.

7) Economising on the use of steel by preventing its use where it is possible to use other materials, such as prefabricated concrete lintels.
8) * Replacing the use of tar-hessian with ready to use tanking membranes, made in the country.
9) Closer collaboration between architects and structural and mechanical engineers with the objective of finding the most economic solutions. For instance, a reduction in the amount of pipes by placing kitchens and bathrooms closer together and considering the increased use of exposed pipe rather than buried pipe, so reducing the corrosive effect of the soil.
10) Better preparation of architectural, structural, and services detailed drawings in order to prevent demolition and rebuilding during construction.
11) Heat insulation through the use of cavity walls and hollow roof blocks, and the application of layers of less heat conductive materials such as `Plastofoam'. Reduction of the window size and double glazing must also be considered.

The list of views and specific recommendations originally consisted of 42 items. Technical recommendations by service engineers on lighting, heating and cooling design were omitted. In addition to a general contribution, seven recommendations, identified with an asterisk, were initially proposed by the author.

This list of measures prepared by the SAEF in Shiraz condenses those major questions whose solution is seen by building professionals to be critical for an increase in building efficiency. The list is varied and some factors such as 'the creation of a safer social environment', are to a large extent outside the influence of the building industry. Some of these factors are simple common sense, whilst some are more controversial. The most controversial issues like greater industrialisation of building, or '**abandonment of owner-built and dispersed housing** (in favour of mass housing), which damages the T/C sector, have already been discussed specifically in this dissertation. All controversial matters require comprehensive research and social debate.

The initiation and co-ordination of a national strategy for the improvement of productivity requires a responsible body and an enthusiastic and experienced director of the BHRC. This organisation has been involved in mainly technical research and much less in the needs of the country.

The main function of the BHRC should surely be the promotion and co-ordination of building related research. This supervisory role will oversee the utilisation of those human and natural resources needed to create, operate, maintain and renew the built environment. It should also try to stimulate the cross fertilisation of knowledge from different areas of the arts, sciences, and technology with the aim of giving them a building application.

The views of this sample of architects and engineers in Shiraz (the SAEF proposals can be considered as a consensus among professionals in Iran as a whole) represent a valuable contribution for the development priorities of the building industry. A comprehensive approach for outlining a national strategy for improving productivity in building and construction needs an analysis from a variety of standpoints. This would include multi-disciplinary seminars in conjunction with research schemes and collaboration of all research bodies.

Seminars are held sometimes as a means for propaganda, without any real outcome for the participants and society. However, when a responsible body with a dynamic, experienced chairman is appointed, the Continuing Professional Development (CPD) seminars can be a useful tool to enhance research, and the spread of improved practices. The CPD seminars can take this important task on board and by detailed research and analysis would show the most appropriate methods and policies ahead. Some of those factors which have basic influence and a bearing on the hypotheses will be examined here.

Some areas and issues which have to be considered at national level have been mentioned in Appendix 4. However, efforts to plan for higher productivity at a national level requires: 1) delineating and developing a better understanding of the factors influencing productivity in the process of development and expansion of the built environment; 2) determining how these factors affect productivity; and 3) deciding on the course of action in the light of this analysis on the building industry.

6. Factors influencing productivity in the building process.

While capital, labour and materials, are factors of production, progress in **management** at different levels, and **technology** must also be considered as necessary catalysts for the

improvement of productivity. Apart from the substantial capital needed for the economic development projects, the industry itself is in need of investment in all factors of production.

Development of human resources at the higher education level is a government responsibility, while at the lower level of trade skills governments have so far not paid the necessary attention or investment. The development of material resources can also be considered a matter of capital and investment. This varies according to the type of material and technology of production. The capital expenditure necessary to establish various building materials manufacture varies for example from a traditional lime and brick kiln to millions of dollars for steel, cement and aluminium plant. In Iran the heavy industries of steel, cement and aluminium have been the responsibility of the government. This seems particularly necessary while there is a continuing lack of confidence in the private sector for large investments.

6.1. Managing the building process.

'Construction is mainly considered to be a management problem'[54]. 'Managing is concerned with productivity, that implies effectiveness and efficiency'[55] Here management is defined as the process of designing and maintaining an environment in which individuals, working together in groups, accomplish selected aims efficiently. The managerial functions of planning, organising staff, leading and controlling. Management is concerned with effective completion of the contract that is on time and to cost. The importance of management in relation to productivity is thus a matter of complexity and scale and the more complex the procedure the higher the management skill to improve productivity.

> 'Construction of a complete building is a very complex process, arguably the most complex undertaken by any industry, Indeed, such is its complexity that it has not yet been turn into a completely integrated production process. The Japanese manufacturing industry is generally the most productive in the world. The particular Japanese genius is in managing very complex manufacturing processes. In a relatively simple process, for example steel making, Japanese and US productivity levels are approximately equal. However, in more complex processes which involve many separate steps, for example producing motorcars, Japanese productivity is more than double that in USA[56]i

This leads us to the fact that the more complex the organisation of the construction industry the more difficult the control element will be. In fact contractors in the modern sector, are affected by a lack of authority and control which not only makes innovation difficult, but also makes for inefficient management. This is partially due to the division of design and production, in the process of design itself, and in the structure of the public client bodies and the organisation of the private contractor. Not all divisions are counterproductive or opposed to efficiency and productivity: 'building activity, particularly in the more developed world is divided between the site and a large number of factories, which may be located anywhere in the world. . . . . and the managers of construction projects have an influence over only parts of this total system.'[57]

Factors affecting productivity in the building industry can be considered from a variety of standpoints such as organisation; management; law and regulations. However, much emphasis is placed on the effectiveness of management. 'No single factor affecting productivity in the construction industry is of greater importance than the organisation of work on site. All too frequently man-hours and machine-hours are wasted due to haphazard layout of construction materials, plant and equipment, and to delays in the delivery of goods to the job.'[58]

As management is the most important factor in the construction industry and control is the keyword in management, most building economists explore the productivity of construction in a framework of two main factors; those that are **internal** to the industry and those that are **external.** It could also be divided into those factors controllable on the site and those outside the site. The internal factors are the level and mode of decision-making and the rate and effect of technological change, while the external is changes in demand from various causes.

Major factors outside site control are climate, material shortage (resulting in delays in materials delivery), rules and regulations, and design, which exert important influences upon the efficiency of the construction process and yet are outside the immediate control of site management.[59]

6.2. Technology in the context of the building industry.

While the introduction of new technologies in the construction industries of industrialised nations has been the prime factor increasing productivity, the export of those

technologies to developing countries has not usually been effective, and has always been a matter of controversy. 'Introduction of new technologies in the construction industry has been the prime factor in the gains in productivity that have been achieved in the industrial nations. The contribution of technology can be divided into 1) software - including planning and analysis techniques, design methods, management information and control, and construction methods, and 2) hard-ware - including new and improved materials (and components) and equipment.'[60] To this definition even management has been seen as a matter of technology. However in general terms technology affects production relations in four ways:

1. The relationship between inputs and outputs
2. The input *intensity* of production (labour intensive, capital intensive or material intensive),
3. the substitutability of inputs for a given output, and
4. The economies and diseconomies of scale.[61]

New building materials and components affect production function and have been the main factors in technological change and improvement of productivity. Building material technology is an area that, whilst progressing in several of the more advanced developing nations, is in a primitive stage of development in the majority of others. The building materials industry offers more stable job opportunities for semi-skilled and unskilled labour, reduces imports and helps to generate the crucial backwards and forwards linkages to other local industries.

However, production functions[62] are not constant over time. They change according to socio-economic development in an evolutionary manner. Any imported technology contradicting these general truths has little chance of success or even survival. Technology affects productivity not only directly, by changing the production function, but it also indirectly affects management at all levels. New technologies bring new procedures and necessitate a greater level of understanding from the managers planning for these new procedures in relation to the whole process.

These days technology in the context of management, refers primarily to the increasing use of computers in both developed and developing countries. Although Computer Aided Design (CAD) has already been adopted in the field of structural design, for both medium and large scale buildings in Iran, contractors find it difficult to use Project Management software, mainly because of an acute shortage of materials, equipment and

spare parts. The delivery date of materials and spare parts are unpredictable and planning ahead is just impossible. 'Most of these advances have been put into practice through the existing international firms. No substantial efforts have, however, been made to study the effect of computers on organisation and operation of this industry in the developing countries.'[63]

Although contractors in Iran are enthusiastic about the application of computers, they find it irrelevant at present, as a result of the high factor of unpredictability in the business environment. The most important examples are in relation to the delivery of materials and subsequent long delays in their payment. However, although contractors are increasingly using computers for their accounting and monthly statements, there are problems at present as it takes some time to actually see the benefit from using management software. Advertisements are appearing increasingly in professional magazines for different CAD software and CAD design services. Design and structural analysis, particularly for more complicated development projects, is a highly technical field requiring well educated and experienced professionals. As these are sometimes not available to the required standards 'the novel application of computers could very substantially increase the capability and the productivity of this scarce talent (designers) and also provide incentives for innovation and adaptation in design consistent with the local environment and requirements.'[64]

The use of computing technology by *memar*s seems for the moment a long way off. *Memar*s are already using electronic calculators and these are a great help to them, particularly with their accounting. The time saved on calculation can be spent on managerial duties, thus increasing the *memars*' efficiency and overall site productivity. However, computers are, for the moment anyway, a step beyond this.

6.3. Internal and external factors at industry level.

To identify and explain the effects of major internal and external factors E.W Cooney[65] takes a historical point of view when looking at the British building industry. He believes that 'understanding is distinctively enhanced by awareness of the deep roots of the present situation'. His analysis focuses on the important issue of the level of decision making. In an initially long historical view he argues that in the course of the nineteenth century the construction industry in England underwent a process of internalisation of decision-making within firms of contractors. At the beginning of this century, contractors

sub-contracted widely for works they were not themselves equipped for. Outside the contractors firm there was another centre of decision-making which was increasingly separate. This was the architect, who had the status and the authority to be seen as 'the head of the building team'. 'The last twenty years or so have shown signs of great changes in the position of the architect . . . ' He continues to argue:

> 'Why did the nineteenth century contractors commit themselves to the costs and risks of organisational innovation? How did they succeed?...The world of the first Industrial Revolution, accompanied by accelerating growth, wealth, urbanisation and internal migration. Growth of demand gave confidence that the greater investment required for a comprehensive establishment comprising all the trades of building together with a gradually growing investment in workshops, machinery and fixed plant, would be employed. At the same time the greater efficiency and certainty provided by the increase of decision-making within the firm enabled the more highly integrated firm's competitive tendering for contracts to be more frequently successful. Thus the increased productive efficiency of the innovative firms was rewarded by greater profits.'

Cooney then suggests that 'growth of demand was probably the most important cause of this change'. Another external factor he identifies which has been working with increasing force was in the sphere of the social environment. 'This was the growth of a public opinion which favoured open competition, believing that it was the condition for productive efficiency'. In his belief these two external influences were probably much more important than any technological progress, until at least the last quarter of the 19th century. The same author concludes:

> 'The long historical view, extending over almost two centuries, shows an industry in which there has been movement of integration of decision-making away from the levels of the architect and the contractor, where it had become concentrated during the nineteenth century. It has shifted upwards in some sectors, with **greater involvement of the clients**, such as the commercial property developers and large industrial and commercial companies. Equally striking has been the **downward movement of decision-making to the growing body of trade and other specialists**, working generally as subcontractors to the main contracting firms. Along with this there is a tendency for those main contractors to become specialists in co-ordination of contracts rather than direct employers of skilled tradesmen and unskilled workers in the old way'.[66]

Of course the matter is far from being the subject for direct analogy, but there are a few relevant points to be made.

The first is that the external factors such as socio-economic and political environment as well as direct government intervention were more powerful and determinant than the internal ones. This is certainly true regarding the development of the modern CI. This will be examined in Chapter 8 in detail.

The second is that copying organisational factors from other countries with obvious historical, social, economic, and cultural differences is more likely to be inappropriate than the accompanying technological changes. This was studied in relation to 'three divides' (design and built; structural and architectural; and public client -- and private contractor) on innovation. 'Three divides' can also affect decision-making in the building process. The kind of effect and its extent depends not only on the adequacy of the system, its legislative framework and individual participants, but also the whole cultural, economical and political environment. One may copy the organisation but not the environment and such a contradiction would certainly be counterproductive.

The third is the importance of the effective market demand which is the force behind the recent increasing tendency of the modern sector to shift from unreliable public sector clients to more stable private sector ones. Unstable demand directly influences the level of investment in tools, plant and machinery necessary for productivity improvement. A sub-factor, or the fourth factor, is the importance of public opinion against the modern sector, which creates unfavourable working conditions and business environment.

There are of course other external factors which affect the industry, its productivity and development. Some of these were discussed in the context of the economic and social environment in Chapter 3. The point to make here is that government, which is in a position to correct the adverse effects of external factors, is sometimes itself the creator and prime cause of many problems in developing countries.

7. Productivity and special Features of the Building Industry.

'Over the long periods, 1856-1913 and 1924-1973, construction was found to have had the lowest growth of productivity in a group of seven major sectors of the economy. Agriculture for instance - also an 'open air' activity and closely dependent upon the varying qualities of its sites - progressed at twice the rate in the earlier period and more

than six times faster in the second.'[67] However, in every sector, including construction, productivity grew faster between 1924 and 1973. But in later in that period, between 1937 and 1951, it was found that the 'trend in construction productivity is unique'. For example, the general rule of economies of scale does not always apply.

> 'The construction sector has low levels and growth rates of labour productivity. It is generally considered that the continued survival of a large number of small construction firms reflects the fact that construction is essentially an on-site activity which must use traditional and specialised labour inputs and materials and which allow few scale economies to emerge in the production process'[68]

Compared with other industries the building industry is characterised by special features which make it unique: the difficulty of co-ordination; average small size of undertakings; variety of sites; temporary duration of jobs; geographic mobility of manpower; labour turnover; weather, and instability of employment.

7.1. Variety of end-use

The building industry is characterised by the variety of the end-use of its products. For this reason, construction is commonly seen not as an industry at all but rather as an activity, or a collection of activities. In most countries there is hardly any construction industry as such, because the sector does not exist as an umbrella institution. It does however in the form of different components and activities which come together to produce any single output in construction. By implication, the term construction industry is tantamount to the structure of the industry in terms of its segeregated components.[69]

> 'It is true that construction products serve a wide variety of functions, so in fact do the products of other industries, from textile to automobile, to steel. The problem of the variety of the end- use in these industries is overcome by the maximum possible standardisation of the products and also by Standardisation and mass production of the parts, or components, that make up the production of the finished article. This can happen to some extent in construction. So that even if a house is not the same commodity as a hospital or a school, there can be standard houses or standard schools. Even more significantly, there can be standard components for houses or schools which may also serve as inputs to a wide variety of other buildings'[70]

7.2. Climate.

One of the most distinguished features of the building industry is that a great part of the job must be done in the open air and/ or under adverse weather conditions. 'Climate may affect productivity and it must be accepted that high temperatures and humidity levels have a debilitating effect upon work effort.'[71]. Cold weather, snow and rain in winter which affects productivity in northern and central parts of the country whilst in southern regions the tropical and arid climate seriously affects the workers performance.

Iran has a varied and complex climate, ranging from sub - tropical to sub - polar. In winter while high pressure from Siberia creates a driving wind from the west and south towards the interior of the Iranian plateau, low pressure develops from the warm waters of the Caspian sea, the Persian Gulf and the Mediterranean. In Summer one of the lowest pressure centres in the world prevails in the south and as a result different wind patterns are created in different regions. The principle winds are the north-westerly *Shamal* which blows from February to October, and the ' 120-Day' summer wind in the Seestan region.

Temperatures vary from -37 C. (-35 F.) in Azarbaijan in the north-west to +51 C. (123 F.) in Kusistan in the South. About 1.2 million square kilometres (73% of total land) has an arid climate, 400,000 square kilometres (24.4%) is temperate, and about 40,000 square kilometres (2.4%) has a cold 'mountainous' climate. Shiraz and most of other cities of Fars province are located in arid zone except for southern cities of the region which are located in hot and humid zone. Temperatures in thet arid zone vary between 35-40 degrees in summer and 0 to -5 in winter; in the hot and humid zone between 35-40 and 0 to +5.

Adverse climatic conditions all over the country affect the efficiency of labour both in summer and winter time in different regions of the country. Even in Shiraz, which is considered to have a temperate climate, during two summer months, and about one winter month, weather conditions hamper site activities and affect building productivity. One can only imagine what working conditions are like at - 37 C. in Azarbaijan province or + 51 C. in Kusistan.

There are measures which can be taken to alleviate the adverse effect of climatic conditions on productivity, particularly with the introduction of flexible working hours. Working in the cooler hours of morning and later in the afternoon in hot areas has

proved to be helpful. Providing temporary shelter from either sun or rain is also helpful for those operations such as concrete mixing which are continued for a longer period of time in one place before the building is roofed. Roofing the building at the earliest possible time to provide shelter from sun and rain is also important. Early roofing of the building can be decided upon at the design stage, for instance through the use of steel frame and prefabricated roofing components. The use of building components can also reduce the time spent on site and eliminate the adverse effect of climate.

8. Productivity on site

One of the major factors influencing site productivity is the planning and design of works comprising: the need for fully-detailed plans; efforts to avoid alterations; working drawings for each trade; repetitive designs; attention to the layout of temporary plant and equipment; attention to welfare on the site, and advantages of consultation with employers and workers. However, 'manpower is the contractor's most precious resource and every effort must be made by management to avoid wasting it'[72]

Donald Bishop[73] suggests that: . . . to improve productivity on site may be divided into two groups: '. . . .**to improve management**, control and utilisation of resources and control of timing. The second comprises those intended to improve the efficiency of tasks in so far as they are independent of their external world. Materials manufacture, designers, contractors, and sub-contractors all contribute to the productivity of the industry The largest 'component' capable of being directly influenced by 'the industry', is however, site labour which probably contributes about 40 percent of the output.'

Researchers in Iran are often interested in this '40 percent' labour factor in identifying low productivity. Very little interest is shown in their point of view, but it surely must be consulted. Health and safety and the adequate nutrition of workers, particularly unskilled workers, must be taken into account.

The problem of site management is determined largely by the nature of the design as this determines the technology used and thus the complexity of the operations. Of course whatever problems are set by the design, the site manager is determined to gain the highest possible productivity.

8.1. Managing the site.

Whatever the design there are certain widespread problems which are to be found on most building sites, such as allocation of resources, timing of delivery of materials, labour performance and discipline, waste of materials, weather effect and so on. Careful examination of these with the aim of increasing productivity is the essence of good management.

INCENTIVES + GOOD MANAGEMENT = HIGHER PRODUCTIVITY[74]

> 'A construction programme is **a statement of intended actions**, which when properly used provides management with its plan of campaign. It should communicate unequivocally, providing the common reference for the timing of all activities related to the project.'[75]

Four commandments of site management are said to be, **1) No construction work improves with age**. There is the common saying among Shirazi building workers '*Karoo Mozd-Khor Shod*' (the job was consumed by wages due to the long duration) **2)The guiding principle should be 'get in and get out'.** Once you have planned the job to be done and organised it, the sooner you can get on site - do the job - and get out, the lower will be the cost of operations. **3) The shorter the time schedule the more planning is necessary. 4) Putting a team together from the outset and having them available whenever you need them.**

Work on the building site comprises various operations carried on by a gang, helped by other gangs working with small plant and site machinery. There are always periods of waiting for the other gang or man. It must be noted that there are natural intervals which are associated with hard physical activity as Raftery mentions: 'Hard physical work, discontinuities between tasks and between projects and the question of ensuring that work is meaningful and that employees retain self esteem and reasonably comfortable working conditions are some reasons why at least one writer has questioned the whole basis of conventional productivity analysis as applied to construction process'.[76] These 'natural' energy regaining periods can not be avoided, but can be reduced by the use of power tools and simple machinery such as hoists.

The manager's task is to ensure a smooth flow of work and to arrange an acceptable balance between the rate of progress of work and minimising the non-productive time. Bishop mentions that 'much happens to interfere with the smooth flow of work; **delays**

occasioned by the weather, by **materials not being available** or by being rejected on inspection and technical hitches (**breakdown of equipment and the like**); uncertainty caused by inadequate detailing on the part of designers and delays whilst drawings are either rectified or produced for the first time.'[77] However Bishop states that non-productive time may arise in four ways, each of which can be further distinguished.

1) When a site is working below full capacity. For example unexpected soil conditions or by a major change in a client's requirements or unexpected delay in material delivery.

2) When a gang or an individual is delayed either because work is not available or whilst awaiting service from other gangs or mechanised equipment.

3) The non-productive time of the gang due to unbalanced allocation of resources.

4) Workers' discipline, which has several elements, including walking time (on a dispersed site for example), avoidable idle time such as late starts, early finishes and casual conversations, and deliberately incurred idle time.

Bishop argues: 'In aggregate, non-productive time can account for a significant proportion of the total hours worked on site. The actual incidence as recorded from intensive site studies varies from almost 80 percent on one site with a difficult and broken sequence of tasks to a few per cent for gangs of labour-only bricklayers tackling straight-forward and uninterrupted work. High non-productive time does not necessarily indicate that a site is badly managed: sometimes tasks are so intertwined that high non-productive time is inevitable'. However factors 1, 2, and 4 have been put to test in the questionnaire survey along with climate considerations and problems in the use of equipment and machinery.

Nothing can guarantee the avoidance of non-productive time. He then says that 'componentisation' can affect increasing productivity.

'Common sense indicates and simulations confirmed, that reducing the number of stages substantially improves 'control' of the system, even if the average variability of the remaining stages is unchanged. Similarly 'control' is improved by reducing the number of activities contributing to a stage. Finally there is a substantial improvement in 'control' if all resources can be committed at the earliest rather than the latest start time. Taken together these tactics can help to produce higher productivity by creating circumstances in which resources can be committed with confidence. **Their effect is reinforced if the designers adopt 'component'**

building, a term that does not necessarily imply factory production. It entails designing the building as a relatively small number of components whether in-situ or prefabricated, so that each is a substantial part of the whole building and can be completed by the work of one gang, preferably under the direct control of the main contractor. This reduces the number of stages (and gangs), and can simplify management by placing more work directly under the main contractor or in the hands of substantial contractors. Such a pattern was characteristic of traditional building and well understood by early examples of industrialisation. The crystal Palace was one example. 'Easiform' and 'no fines' construction are others. More recently component building has been implicit in many systems including the output of schools consortia, rationalised traditional building systems, and large panel construction.' [78]

8.2. Mechanisation

The reasons why any industry makes use of machines include:

1. To increase production
2. To reduce cost.
3. To perform work that cannot be done by hand.
4. To eliminate heavy manual work.
5. To maintain production when labour is unobtainable

1 and 2 are the main aims of mechanisation and usually go together, although the situation can arise where all is sacrificed to speed or to the reduction of costs. Aim 3 mainly concerns the handling of components that are far beyond the capabilities of a man to lift. There is a general tendency in all industries towards aim 4; and it is one that will be intensified as time goes on. A classic example of 5 occurs in traditional house building when a hoist or other lifting device is installed when hod carriers are unobtainable, though this could also be held to be example of 4.[79]

Mechanisation in the context of civil engineering work which needs expensive and heavy machinery in developing countries, is a question of balance between the cost of capital and cost of labour. Mechanisation in this context is also judged in relation to employment. The World Bank, concerned about the excessive use of machinery in civil construction in some countries of the third word with abundant labour and scarce capital, launched a research and application scheme to assess the possibilities of labour intensive technologies. 'The results of research and application works carried out in Honduras, India, Indonesia, Kenya, and other countries showed that labour intensive methods were

technically and economically feasible for a wide range of construction activities and their products were of a quality comparable to that produced with equipment-intensive methods. Whereas traditional labour-intensive civil works construction has frequently been inefficient, the introduction of managerial and technical improvements can lead to considerable increases in the productivity of labour'[80].

In the context of the building industry the matter is different. Power tools which are in direct support of manual tasks are considered desirable and are becoming a part of the task they serve. They are cost effective and are considered an integral part of the cost of labour. Using small plants like electric hoists or small mortar mixers, if affordable by the *memar* or small contractors, can create better conditions for labour and be rewarding in the improvement of productivity and quality of work.

Larger building contractors in the modern sector have increasingly been using plant and machinery on site, such as: larger concrete mixers with batching plants, dumpers, small and large loaders and tower cranes, particularly for high rise buildings since the 1970s. The mechanisation of building and civil engineering in the context of the modern sector was rapidly increasing, particularly with the scarcity of construction labour. This scarcity led to the influx of about one million unskilled labourers from Afghanistan despite rapid mechanisation. However, by the time of the Revolution most companies had already acquired a considerable amount of plant and machinery. After the war and the rapid scarcity of foreign exchange these companies suffered considerable loss as a result of scarcity and expensive spare parts. By this time the modern sector, and indeed perhaps even the whole of society, was addicted to the heavy use of machinery. However the modern sector lacks both managers to be able to manage labour- intensive civil engineering works and the workers who accept those jobs.

9. Building industrialisation

After the industrial revolution in Europe and the change of the mode of production from small scale workshop-based production to industrial production, traditional crafts gradually gave way, one after the other, to industrial, factory production. Construction was the last large industry to submit to the structural changes demanded by the capitalist mode of production. The reasons for this resistance to change, and also the precise nature of the changes when they eventually occurred, is related to technological and organisational innovations, and can only be understood when this historical perspective is

born in mind.

These changes in the West occurred in response to the change in overall social and economical structure and in harmony with the level of technology and industrial development. 'Major changes in demand, or major decreases in availability of resources for satisfying existing demands, appear to have been more important than considerations of costs or the emergence of new materials. There has moreover, been an absence of what may be called spontaneous initiative on the part of designers. Some other peculiarities were also identified. The building industry in the widest sense of the term appears to depend to a considerable extent on other industries for the development of techniques, rather than itself contributing to technical development in other industries. The industry in this country has also tended to depend on inventions and development of technical knowledge in other countries since the latter part of last century, most obviously in the case of reinforced concrete.'[81]

Currently there is a confusion between industrialisation and prefabrication. The same confusion did exist in the 1960s in the UK. 'Industrialisation of the building process is currently, in 1965, as fashionable a panacea for the difficulties of increasing the production of buildings as prefabrication was just after the last war (2nd world war). To many people the term seems to be merely a synonym for prefabrication.'[82] Bowley then argues that in fact industrialisation is not the same thing as prefabrication, as the latter may or may not involve an industrial process. Then she states that: 'The term industrialisation is used to indicate the application to the building process on the site of the principles of organisation used in modern industry. The principles involved are:

1) The breakdown of jobs as far as possible into simple repetitive activities. This is to use the advantages of division of labour in order to increase the speed of operation due to repetition of operations.

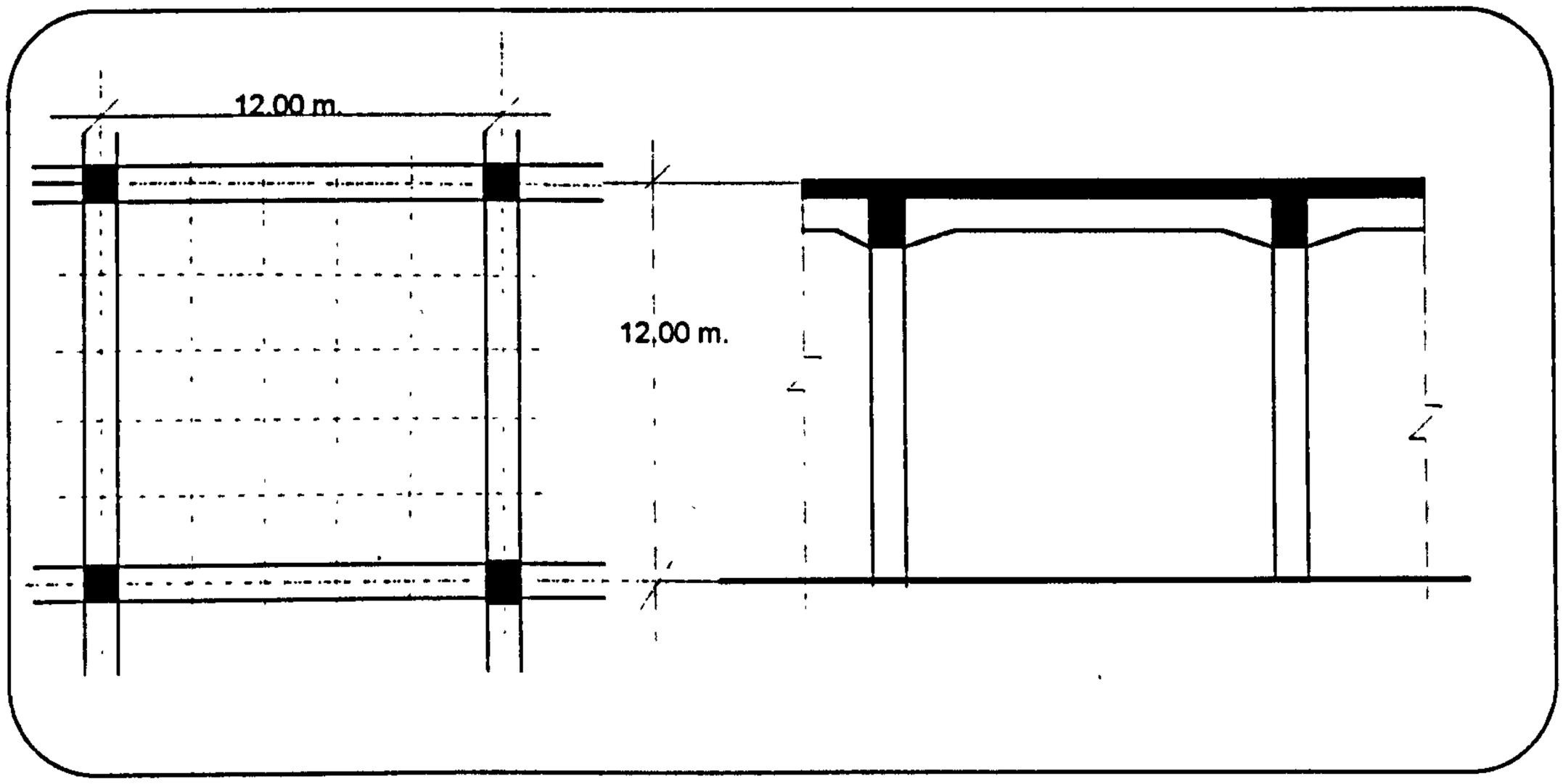
2) The building site should be treated as an assembly line which differs from assembly lines in factories in that it is stationary instead of moving and the workers, materials, and other equipment, move round it.

'It must be noted, however, that though principles of industrialisation of the building process can evidently be applied both to traditional and non traditional methods of building, and to prefabricated systems and 'un-prefabricated' systems, its application is likely to be most effective on projects that are not very small.'[83] In this sense feasibility

of industrialisation, in addition to being a matter of economic necessity, is to a large extent a matter of scale. The application of industrial methods would be a 'natural selection' if the conditions within the industry allow an industrial approach.

The case of the Shiraz Telecommunications factory is interesting both for a detailed understanding of the implications of industrialisation and also to relate the subject to Iranian conditions. The project was a large scale two storey factory building. The structure was of reinforced concrete and as the facing was to be exposed concrete (no plastering or paint), shuttering had to be executed with extra accuracy and quality. By the time the construction of the ground floor roof (the floor of the first floor) began, the prices of timber for shuttering and wages of the skilled shutterers had increased considerably and the operations lagged behind schedule. The delay was caused by war conditions, late delivery of materials as well as some complications in the laying of foundations (due to a high water table and the discovery of an ancient *Ghanat*)

Figure 4: 1 Shiraz Telecommunication factory project.



The first 12x12 metre sector was completed using conventional methods with skilled shutterers working with a mixture of metal and timber formwork. Although the site was equipped with a tower crane, (many building sites use cranes for material handling) the organisation and process of work was traditional/ conventional (non-industrial). The cost study of this first sector indicated that the actual cost was 30 percent above the contract price list and still increasing. The company was on the verge of evacuation and bankruptcy. The author, being the chairman of the company, embarked on a method of

industrialisation of the process.

The jobs were broken down as far as possible into simple repetitive activities. Division of labour was devised and designed to the extent of de-skilling each operation. In fact no expensive and scarce skilled shutterers were needed anymore and the speed of operations increased considerably due to the repetition of operations. The building site was treated as an assembly line, as the formwork table used for a unit of 12 m. x 12 m. was designed to be mobile (on wheels), and as a result the workers, materials, and other equipment, were moving with and around it. This was in total agreement with what Bowley mentions as the principles of industrialisation.

Not only was there no original intention of design on industrialised process, the other company partners were reluctant to accept the author's proposal. The client was indeed very resistant to the idea because some changes had to be made to some design details. However the client was desperate for the completion of the job and had to give us a last chance as the contractor in charge before a decision to evict and choose another contractor, itself a lengthy process with uncertain result. Innovations and the non-traditional methods were developed as a matter of necessity and right from the beginning everything had to be based on considerations of the work environment, appropriateness, feasibility and so on.

Although the experience seemed a one-off case, its influence was later evident as many companies started to copy parts of the experience, which led to the use of a new, locally made, modular metal shuttering solution. The reason was probably that the solution was endogenous in the sense that it did not involve any patent, import, expatriate, foreign company or expertise. The job was done with the use of local capacities and no special machinery was needed. However, there would be no harm in using industrial methods with indigenous capacities.

When innovations were imported along with modern infrastructures, such as railway stations and factory buildings, with them came new organisations of work. The example was the organisation of the modern sector which will be discussed later in Chapter 8. However one should not deny some benefits in the area of 'technology transfer'. For example, in the 1930s metal roof trusses of factory buildings often came complete with the machinery as a package and were assembled on site by the foreign contractor. Only later and gradually were they designed and built by Iranian consultants and contractors. In this way some of the new technologies were transferred to the country.

The issue of industrialisation in building relates very much to the whole process of industrialisation in the country. After many decades of planning, the country is still a long way from achieving any of its main planning objectives such as self - sufficiency, export - diversification and less dependency on oil revenues. There are broad reasons for the failure of industrialisation in Iran (see appendix 3). Is it possible to overtake the industrialisation process and industrialise building ahead? Referring to the limited capacity of the traditional/ conventional sector in the last four decades, the industrialisation and prefabrication of building is repeatedly cited as the solution to the problem of the increasing housing deficit. Building industrialisation is considered to be the only way to improve the housing situation and at the same time reduce the cost of building.

Efforts for the industrialisation of building were made as early as 1955 by the former *Bank-e-Sakhtemani* (Construction Bank), Rima Construction Company and some other foreign companies. In 1971 MHUD decided that it was inevitable that building must be industrialised.[84]

In the economic situation of the 1970s, not only politicians but also some independent researchers were recommending that: 'As far as the construction sector is concerned its progress should be geared to a higher degree of rationalisation as well as to industrialisation **comparable to that already achieved by a number of developed countries**'.[85]

The 'Crash Housing Programme' of the 1970's is a good example of industrialisation of building by decree. In 1971 the MHUD following the decision to industrialise building, commissioned a United Nations' advisory team to prepare a specification for the programme as well as an evaluation of existing building systems. The UN advisory team specified 33 building systems, and specifically recommended the following:

1)No-fines Building System by Wimpy from the UK. 2) Tunnel Shuttering Systems by: Outi-Nord; Batiment; Tracoba from France and Peva from Hungary 3) Lightweight Concrete Systems by: Cheecholite from the UK: Siporex - Iporibeton from West Germany. 3 - 1) Light weight aggregate by : Serama from France; Stiropor from West Germany; and Eti from Hungary. 4) Large panel prefabrication methods by : Florio and Costa Magna from France. 5) BRE Cast System (BRECAST), a System designed to be compatible for use in developing countries, from the UK. 6) IMS by: The institute for

Metal Testing and Research from Yugoslavia. All these patents were concrete based systems.

Later, the Ministry of Housing and Development took the initiative by holding a seminar within the international exhibition of building materials in Tehran. As a result of this seminar a number of contracts were signed between foreign European firms and Iranian companies. This was a golden opportunity for many foreign companies to export their unwanted products to the Iranian Market. It seems that almost all industrialised and prefabrication systems in the world found their way to Iran in the hope of capturing lucrative contracts. The Americans alone were to provide twenty prefabricated housing factories in order to construct 100,000 apartments, five hospitals and other buildings.

After a year or two the machinery arrived, was installed, and 38 firms started to produce. These firms can be categorised into four groups, according to the type of their products: 1) 10 heavy, closed-prefabrication systems to be used mainly for housing schemes; 2) 7 industrialised in-situ concrete buildings with the use of metal formwork (shuttering) to be used for housing and commercial buildings; 3) 6 prefabricated steel structures for industrial buildings and storage barracks; 4) 15 open light weight joist-block roofing systems[86].

A drastic shortage of cement in 1973 caused great concern among these newly established factories. When the shortage was overcome and national income rose considerably due to the increase in the price of OPEC oil, this infant industry had a short period of development. Apart from the success of the third category, which is exclusively used for factory and storage barracks and has no effect on residential or other kinds of building, it is important to mention here that only the fourth category (The open light weight joist-block roofing systems) eventually succeeded and later developed all over the country.

After the Islamic revolution of 1979 most of these factories stopped production for a number of reasons. These included the flight of the owners along with some technical staff, followed by nationalisation of those companies and the shortage of raw materials, spare parts, and expertise (dependence on foreign technology).

Many independent researchers conclude that the 'Crash Housing Programme' was a failure despite the large volume of investment and all the political pressures. The failure was not only because it envisaged that 200,000 houses would be completed before

March 1978, whereas they had barely been started, but also with regards to what happened later; the huge amount of capital invested remained idle and almost all factories were closed.

When a survey by *Markaz-e Tahghighat Sakhteman Va Maskan* (Building and Housing Research Centre) was carried out in 1990, 180 firms were identified but only 67 apparently had an office and a telephone line at which to be contacted. With the exception of these firms which produced open, light weight joist-block roofing systems, most of them had collapsed.[87]

Whatever the reason for that collapse, it seems obvious that the Ministry's decision to industrialise and their choice of technology was wrong and taken without proper impartial (honest) research.

It is interesting that the same story is tending to reappear. Recently (20-30 January 1992) following a decision by the Ministry of Housing and Development to build 20 new cities[88], a seminar (*Seminar-e Sannaye-e Sakhtemani-e Alman* (Seminar of German constructional industries) 28-30 January 1992.) was held by the Tehran Syndicate of Contractors inviting German firms to give their assistance in implementing industrialised systems for the building of these new cities.[89] History is repeating itself in the 1992 seminar as the purpose and manner in which it was held is quite similar to the Iran - Danish symposium in 1976 held in the wake of the Crash Housing Programme .

Even independent and impartial researchers are confused. Our knowledge is inadequate, and the limited study of the subject not only does not relate to the existing building industry, it is also inadequate in the area of technical matters concerning the products or the problems surrounding production. But more important is the attitude towards research in the country. All research starts with a prejudice and the assumption that the traditional/ conventional sector is inadequate and industrial production of building is necessary and inevitable, and that it must be considered as a goal.

9.1. Choice of technology in the building industry in Iran.

It is ironic that after all these repeated failures on **imported** technologies the conventional wisdom among professionals and decision-makers still looks at technology as a magic wand. The following quotation from Kayhan International weekly

magazine(22 July 1993) which can be considered as the official paper reflecting government views is interesting.

> 'The government 's approach to housing should be two-pronged. On the one hand, it should **import** an appropriate and innovative housing technology which is cheap and easily available, particularly to the middle class and lower income groups. Absence of modern low cost housing , for different strata of people, necessitates the use of innovative technology. On the other, it should evolve some sort of a rent- control mechanism.'(Kayhan International 22 July 1993)[90].

In a discussion about 'the manner of the need for prefabrication in building',[91] in which the participants comprised influential professionals and academics, the same views on the necessity for prefabrication and industrialisation of building were expressed. It is worth noting that at the end of this discussion A. Majd concluded that: 'The process (of prefabrication), from the stage of research to end product, must be divided into three phases. The first is research on natural environment, climate, and typology (of the region). This must be done by universities and research institutions in the country. The second stage is the design, which must be done by consultant firms. The third is the execution, which must be done by the contractors.' It is interesting that the discussion shared by academics, consultants (architects and engineers), and professional contractors ended with a fair share for everyone.

During that period, these decisions were made in a despotic atmosphere and mainly for political reasons. The Shah rejected the views of the planners and insisted on imposing his own ideas, particularly with regard to the Fifth Development Plan and the 'big push' strategy which led to disaster (see Appendix 3). It is certain that planners are still either actively involved in politics or highly influenced by politicians. With regards to the construction industry, which has traditionally been used by most politicians, such influence often overshadows social and cultural factors, market conditions, and even economic considerations.

The Building and Housing Research Centre (BHRC), being the advisor to the aforementioned 'Crash Housing Programme', commissioned a UN team of experts to prepare a report on evaluation methods for building systems. The team listed detailed information on industrialised systems, but after a year's work they had not collated any information on traditional building systems. 'This clearly reveals a deliberate **attempt at neglecting the traditional modes of construction** and an active role in the promotion of the prefabricated and industrialised building systems' states Ghanbari Parsa when he

refers to this programme. He also mentions that: 'As we examine the nature of the programme it seems that an international conspiracy is being unravelled, which Mc. Cucheon identifies as an international club that existed in the 1960s and 1970s of European and American experts who promoted the use of prefabricated and industrialised methods of construction.' [92]

Those were the days of the despot, when the government ignored the experts' views. These days it seems that the 'experts' themselves are to be blamed since they influence the politicians at the highest level. This is revealed in the following extract from President Rafsanjani's message addressed to architects and engineers of the country, taking part in the first Congress of the *Nezam-e Mohandessi* (The Architectural/ Engineering Order). Mr. Rafsenjani states: 'Try to promote the modern methods of building production and the industrialisation of building, whilst at the same time preserving the valuable indigenous principles of architecture and city planning.'[93] But aren't valuable indigenous principles related to those 'industries' which created them? And is industrialised building capable of sensitivity to this indigenous principles? These are questions to which architects, engineers and all parties involved with the built environment should find a proper answer.

It is obvious there are different ways to implement modern building science and methods of production, or to industrialise building. Unfortunately the focus of discussions amongst executives and academics thus far has been around the trend towards prefabrication of building, mass production of housing, and imported (high) technology. It seems that we are attributing our failed experiences of the past to rather trivial factors and make all sorts of justifications to repeat the same mistakes. Not only have we failed to learn the lessons from the past, but there seems to be little awareness concerning the bad record of system building elsewhere.

It seems surprising how people are ignored in the name of the people. In their choice of development strategy they ignore the fact that development starts with people and their education, organisation, and discipline. **In their choice of building technology they ignore the whole body of the traditional/ conventional building industry.**

While government policies influence the choice of technology in general in the context of the modern construction industry doing so through development planning projects and city planning regulations, the private sector is influenced above all by market conditions. Another factor which influences the choice of technology particularly with residential

building is, 'the people's aspirations', which has been discussed in detail in Chapter 2 as well as the close relationship between client and *memar* in that context.

The point to highlight here is the market influence which can act as a cost control mechanism in the conventional building industry, where government authorities' decisions are often arbitrary and cost control studies are usually bent to justify 'mass housing' projects in favour of modern-sector, large local and foreign joint-venture companies. The only economic factor here must have been the need for higher commissions and consultancy fees on the part of the consultants and contractors.

An example of such influence and distortion of facts and figures can be found even in developed countries. In post war Great Britain for example, the government's 1965 subsidy arrangements gave local authority housing departments every incentive to build high. In this case the use of industrialised building systems were advised by the National Building Agency influenced by big contractor/ manufacturers.[94]

However the choice of technology by people themselves is in a quite different manner. Market prices for land, building materials, and labour influence the design of buildings and the choice of technology. When the price of certain materials increases it does not usually take long before a change in the building technology patterns occur. In the decade between 1974 and 1984, the cost of labour rose 10.64 fold and materials 3.41 fold.[95] Differential increases in the price of skilled and unskilled labour had influenced the choice of technology and encouraged mechanisation to reduce the unskilled labour content through the widespread use of light machinery on site, such as electric hoists and concrete mixers. In Shiraz the first building machinery hiring firm emerged in 1984.

The reduction in steel and cement production after the events of 1979 and the ensuing economic crisis made more people turn to the use of bricks. In 1977 29.2% of buildings in all urban areas of the country and in Tehran 76.6% were built using steel or reinforced concrete frame structures. These figures fell to 25.3% in all urban areas and 50.2% in Tehran in 1979 after the revolution. It was mentioned earlier that the government is the sole producer of steel and to some extent cement. The government also controls the import of these products. By price control, it again influences the choice of technology.

In a period of breakdown of government control during and a few years after the 1979 Revolution, there was widespread squatting on land. Later, the government itself took control of the situation by a policy of land allocation to landless people in the urban

centres. This had a tremendous effect on the type of buildings constructed. Government can even influence the peoples' aspirations by setting standards in public buildings, planning policies, and rules and regulations. In every small city or village after the construction of a development project, be it a clinic, school or any government office, the government will influence technology, materials used, and even style of house building. We already discussed that how the courtyard house was abandoned; partly as a result of planning policies, and how these policies encouraged high density population in urban areas and facilitated apartment housing in the 1970s.

Although market conditions are influential in the choice of technology, the market itself is sensitive to major economic changes and government policies. Thus the government's influence at the two micro and macro levels is considerable and thus must be held responsible in both the market and planning areas.

9.2. Need for a framework of criteria in the choice of technology

The government seems to be determined to intervene in the choice of technology, and decisions appear to be made without a framework of criteria. Even with the best of intentions politicians and executives are floundering in the assessment of technology. The wide range of choice between labour intensive traditional methods and sophisticated capital intensive systems makes it difficult to chose the appropriate one. Traditional methods, although considered more appropriate to local conditions, are perceived as less efficient and are often associated with low quality buildings, while imported systems have proved to be neither efficient nor appropriate to local conditions. Economic assessments both in the public and private sectors are confused as a result of distortions in the market conditions suffered by most developing countries.

> 'The private costs do not always represent the value of the real costs and benefits accruing to the society. Government interventions in the market system, which take the form of imposing different regulating policies (such as duties, subsidies, price and quantity restrictions) distort market prices so that they over or under represent their real values. Other market imperfections such as underemployment and disguised unemployment also distort market prices. On the other hand, market prices usually fail to represent the real costs and benefits of other non-market values such as pollution and other externalities. The distortion of these prices from their real values gives misleading signals to the market, so that the choice of technology becomes inconsistent with the factor endowments of the country and the real costs and benefits accruing to the society. Therefore, the private costs-

> which use market prices as their base - inherently neglect the impact of the choice of technology on the economy as a whole.'[96]

To address the problem of choosing construction technology needs comprehensive research, approached with due consideration to not only architectural and engineering aspects, but also to other important areas such as the economic environment of the country and social, cultural, and aesthetic considerations. The approach should include national development objectives and should treat buildings as the major lifetime investments of the private sector.

10. Rationalisation of the building industry

> 'Clearly, industrialisation of building is an aspect of design, of construction and the organisation of the building industry itself. Perhaps rationalisation is a better word to describe the application of science to building than is the term industrialisation.'[97]

Rationalisation of the building industry involves the improvement, refinement, and development of all aspects of existing components of the industry in order to improve efficiency and productivity. This includes improvement in design, management techniques, traditional construction techniques, and production - and the use of building materials.

Apart from the technical meaning of rationalisation as an equivalent to the definition of industrialisation given by professor Stone, there is much in the literal meaning of the word which will contribute to the improvement of efficiency and productivity. There is a lot to be found which is irrational in all aspects of organisation, design, process and construction techniques. For the majority of developing countries the first step for the improvement of productivity would be a consideration of the rationalisation of the building industry in the literal sense of the word.

10.1. Rationalisation of building design.

'Inefficient design of buildings means that the designs require the use of more labour, materials and other resources than is necessary to achieve their objects, or the objects are not achieved and the buildings are themselves inefficient for the purpose for which they

are used.' [98] Efficient design prevents waste in different ways, waste which affects all factors of production in all stages and also in the actual use of building. Efficient design for instance is easier to build:

> 'We have carried out a large number of studies on site. All too often the design is such that production on site cannot be efficient because the designer either did not understand or did not care about the influence of design on production. Often this is demonstrated by the fact that individual trades must make repeated visits to each part of the building to complete their tasks. The resulting interference between them leads to more waiting time, more non productive time. Designs can be rationalised to achieve greater productivity'[99]

In the T/C sector where the traditional design process still lives on, the problem of understanding the design does not exist to the same extent. This is partly as a result of the close collaboration of *memars.* Having a profound grasp of traditional design and construction, in a context where house building designs are not as varied and sophisticated as other buildings, this problem is considerably eased. This was particularly the case when *memar*s were still responsible both for design and building. However with the increasing shift of design to architects and engineers comprehending design has become a bigger problem.

In the case of the conventional building industry it can to some extent be said that: 'The designs incorporate the practical knowledge of building problems, of practising builders together with the expertise of professional designers.'[100] More sophisticated designs however belong to rich clients who either employ more experienced *memar*s or pay the architect or engineer for site supervision and inspection as practised in the modern sector.

Designs can be irrational in other respects, such as the inclusion of unnecessary spaces or over-designed structural dimensions. The main problem is the overall large area of houses. As mentioned earlier, the average area of the residential urban house is between 140-160 sq. m., whereas the average household is 6.52 persons (in 1984)[101]. This is considered to be high. A group of five researchers[102] was commissioned by BHRC to define and devise standards for 'minimum housing'. The final aim was declared to be the 'optimisation of the building area' and their proposal is shown in the table below.

Table 4: 3 Proposed area of 'minimum housing'.(square metre)

Type of space	1-2 persons	3-4 persons	5-6 persons	7-8 persons
Main living room	12	12	15	18
Multi purpose 1	9	12	12	12
Multi purpose 2	-	-	12	12
Multi purpose 3	-	-	-	12
Guest room	-	15	15	15
Kitchen	3.6	5	6.5	8
Shower	2.1	2.1	2.1	2.1
Toilet	1.5	2	2	4
Store	0.8	1.5	2.5	3.5
Bedding store	0.8	0.8	0.8	1.6
connecting space	3.4	5-6	6-8	8-10
Total	33	55-56	74-76	96-98
per capita	16.5	10-14	10-13	10-12

Proposed spaces are based on the minimum required space and are defended strongly by the authors. Based on this proposal, on 20 th Jan. 1993 the government declared a 'pattern' for optimum housing. According to the government's model the building area for a unit house in Tehran and five major cities of Karaj, Tabriz, Mashhad, Shiraz and Isfahan was declared to be 75 sq. metres and for other cities 100 sq. metres. This was claimed to have been calculated on the basis of 18 square metre of building and 40 square metres of land allocated per person.[103] However, once again there seems to be a contradiction between the peoples' aspirations and expectations and the government's rules and regulations. Although government policy is to subsidise residential building units built according to the declared 'model', the result and the effect of this policy is uncertain.

The main contribution to the rationalisation of design must come from improvements in relation to the process and products of the building industry is so much as they require less labour, less materials and land, and less capital. Designs are also expected to consider the more efficient use of the building and a longer lifetime. If the designs can accommodate an easier method of construction not only the productivity of the industry will improve but also easier design will contribute to the revival of self-build or BIY (Build It Yourself).

10.2. Rationalisation of construction techniques.

In the majority of developing countries, a great contribution to the improvement of productivity can come from the improvement of existing methods of building. Such an achievement can be obtained from the improvements in workmanship and methods of different trades such as scaffolding and material handling.

Rationalisation of construction techniques is usually defined in relation to some radical techniques: 'The most prominent method of rationalisation of the construction technique is the ZAC system'[104]. These types of radical technological 'breakthrough' used to create a considerable enthusiasm, particularly among young students. 'ZAC is characterised with the application of the rational industrial type process with a minimal need for capital-intensive production and construction machinery and equipment. Therefore the ZAC system can be used in urban and semi-urban areas, and, possibly, in rural areas. 'The ZAC system is a construction method that is based on the rationalisation of the construction technique. . . Based on the use of the ZAC system in Egypt, Iraq, Lebanon, Sudan, Saudi Arabia, Bahrain and Iran, the system has proved to be efficient for low cost housing construction in developing countries.'[105] Despite initial claims of success, ZAC and other 'technical breakthroughs' such as Surface Bonding promoted by 'AID' (Agency for International Development) seldom proved to be of any significant influence.

The reason for the failure of these methods is a lack of link between **local culture and industry** and also socio-cultural considerations. Even the work of Hasan Fathy in New Gourna in 1954, which claimed to consider socio-cultural factors, remained an isolated experience. Since 1954 Fathy's work has enjoyed a universal appreciation and many research students, mostly from the region, have praised the work with great enthusiasm: 'in designing the dwelling units, Dr. Fathy took into consideration people's needs and customs, and then tried to integrate as much improvement as he felt they could absorb at one time. . . . Dr. Fathy considered the psychological and sociological character of the townspeople who would inhabit New Gorna'.[106] Then why did the ideas of 'New Gorna' not appeal to the people themselves?

A more recent example is the new idea of Geltaftan (Firing Clay) by Nader Khalili an Iranian architect. What had Nader Khalili to offer the people of Iran who had already abandoned the most excellent example of earth architecture which had been developed trough 4000 years of trial and error? In a recent interview with Kayhan[107]he stated: 'When I went to the *kavir* (the central desert) with my dream; that people can build their

own dwellings; I knew there were two main problems in building with earth. As I said it has reached its pinnacle in places like Yazd and Kashan. . . .But there are two draw backs. One is the earthquake and the other is erosion by water. I have compared the earthquake in Tabas in 1978 and the 1970 quake in Los Angles. Tabas was destroyed by a tremor measuring 7.4 on the Richter Scale and the concrete buildings in Los Angles were toppled in a quake measuring 6.4. . . . At Tabas, adobe and adobe brick buildings stayed in place 100 metres from where steel buildings had collapsed.' After a discussion on the advantages of vault and dome in earth architecture he then claims that the firing process will not only strengthen the structure but also solve the problem of erosion. He argues that 'if we fire a building or prefabricate components and fire the modules, we can produce ceramic houses.'

Khalili's idea has apparently gained some international appeal. 'The earth architecture idea is being promoted by the United Nations Development Organisation (UNIDO) and they have proposals and a wealth of research to back up what they say; For Iranians what should be of even more specific interest than what UNIDO has on offer, is the work being done by Nader Khalili. . . . . Interestingly enough, America's National Aeronautics and Space Administration (NASA) has questioned him about how to go about applying Iranian earth architecture principles for building on the moon! Ironically, the majority of housing decision makers here at home, consider the question of earth architecture as a relic of the past.[108] While it is not difficult to judge Khalili's ideas from the technical point of view, contrary to the Kayhan International editorial article 'Walking on the Solution to the Housing Crisis', the author doubts the extent of its impact on the housing crisis.

In the New Ghorna example the government of Egypt have been blamed for the ignorance of the splendid idea of Hasan Fathy as a reason for it being abandoned. In Khalili's case the government is already blamed for ignorance in helping the idea being promoted. The author believe that **there is a missing element in the very nature of those kinds of ideas - and that is the people themselves. Moreover, right from the beginning these ideas were either not designed for development or there has been a lack of understanding and appreciation of the (local) building industry.** In much writing there has been implied criticism of governments for their failure to impose those ideas on the people. All too often those who analyse the reasons for this resistance or lack of appeal face the subject with an arrogant lack of respect for the people. This is the same arrogance from modern architects and engineers towards *memar*s (more on this in Chapter 7). This attitude stretches even to the academic environment and international

organisations concerning the problems of the third world. The subject is diverse and deserves a thorough discussion, but a good summation is provided by John F. C. Turner.

> 'When dwellers control the major decisions and are free to make their own contribution to the design, construction or management of their housing, both the process and the environment produced stimulate individual and social well-being. When people have no control over, nor responsibility for key decisions in the housing process, dwelling environments may instead become a barrier to personal fulfilment and a burden on the economy.[109]

In contrast to radical solutions, a very small improvement of traditional or indigenous techniques may have a great effect. An important example is the state of bricklaying practice in Iran. Detailed discussion on this will be given in Chapter 7 as a task for training in the context of traditional/ conventional building industry. There, it will be explained how the mortar is laid and vertical joints are left empty. The effect of this not only affects the life-time of the building but also necessitates thicker walls thus reducing productivity at all levels, let alone the damage imposed in times of earthquake.

It is worth noting that although the necessity of the filling of vertical joints has been emphasised by the Iranian seismic code, the practice has been going on all over the country anyway, unnoticed by professional government authorities and all involved. If this research can contribute nation-wide on this point only and be able to propose solutions for eliminating this wrong practice (leaving vertical joints blank in bricklaying), as an old religious saying goes: 'Seven ancestors of the initiator (the author) will go to heaven'.

10.3. Rationalisation of the use and production of building materials.

The aim of rationalising building materials production is to improve and produce materials which are of better quality and better properties (physical characteristics, structural strength and durability) to economise the use of building materials. In the context of developing countries the emphasis on low cost materials, the use of indigenous building materials, and also labour intensive vs. capital intensive production are matters of prime attention. 'As far as building materials technology is concerned, more efforts are being made to develop cheap, serviceable, and easily assembled building materials. This development is currently grouped around two approaches to the problem: the first aims at the improvement of traditional building materials and methods, while the

second aims at the development of new materials or components that will be integral parts of modern building systems.'[110]

One example of rationalisation of the use of building materials is the use of cheaper and more easily produce cements, instead of high quality expensive cement which is commonly used. While in the developed world cement consumption and production is in decline, in the majority of developing countries increasing need (and not the viable economic demand) overrides the increase in production. Abtahi M. from the Bank of Industry and Mines[111] believes that while the annual capacity of the country's cement industry is about 17.5 million need during same period is estimated at 25 million ton per year.

Whilst Mr. Abtahi pointed out the government plans to increase the capacity of the industry to the required level, he indicated measures for the improvement of the existing situation. Among these measures were alternative cements such as puzulan; the establishment of 'mini cement plants' on a regional basis to reduce transportation and attract small investments, and the design and building of much of the necessary machinery and plant inside the country. The other example of the use of alternatives which has been a matter of constant attention is the use of mud or earth architecture and its adverse effect on the agricultural land.

> 'Difficulties of dry farming; soil erosion; abundant sand and gravel land; lack of 'soil' in central parts and shallow soil in other parts; poor soil condition in terms of soil structure and lack of organic materials and living creatures, salty soil and so on means that the situation of farmland in this country is critical. . . Increasing use of soil for brick production and trends in use of bricks for buildings is worrying.. . . instead of clay (mud) bricks, sand-lime or sand-cement bricks and blocks should be used'.[112] See also productivity and the natural environment in appendix 4.

The author believes that a great contribution to the issue of rationalisation of the use of building materials in Iran is in relation to direct waste. Tipping sand and lime and even cement (a result of the periodic shortage of cement bags) and a generally careless attitude towards waste inherited from the affluent years of the 1970s, means that a considerable percentage of materials are wasted on sites. Any improvement of transport and material handling would result in a considerable saving and result in higher productivity in the use and transport of materials. There are other areas of rationalisation of production and use of materials which are in the domain of BHRC for both research and then initiation of an appropriate course of action.

10.4. Component building and production development.

Component building, which is considered as one of the concepts of rationalisation of the building industry, includes rationalisation in building design, building process, and material production. In the craft-based traditional industry, there was a limited and well-understood range of technologies; almost any design would re-combine well-established materials and techniques. With the ever increasing technologies, designers are in a position to be able to select from an ever widening variety of materials and technical solutions. Therefore designs produce a different combination of technical solutions and a new range of problems on site. While the design task itself may be made less complicated by restricting choice, for example in standard details or in extreme cases typical regional designs (for example primary schools in a particular region), the task of management and the building process would be made less complex. This may lead to what is called catalogue building. Catalogue building is defined by Donald Bishop as 'a tactic that does not introduce yet another range of specials on the market. In this of course, offices require the designers to avoid *de novo* designs by using products selected for their performance, and ability to be combined to produce a pleasing result. . . . .Standard detail and catalogue building contribute to the productivity of design offices which are therefore relieved of the task of re-inventing the wheel.'[113] 'Catalogue building' requires the development of performance specification procedures. Bishop further states:

> 'Performance specifications apply naturally to components, i.e. to significant parts of building to which comprehensive statements of performance apply. In the United Kingdom components specified in this way have been relatively simple units e.g. windows, door sets, partitions, flat roofing systems. In the United States of America there has been a tendency led by Ezra Ehrenkrantz, to specify complex components embracing building and mechanical engineering.. . .Whatever the scale of application, the intention remains the same, to create conditions in which manufactures can design components to meet the performance requirements of designers and thereby to reduce the cost of production, site erection, and maintenance. **Thus component building creates conditions likely to lead to high productivity**. . . . .Variety reduction, an essential concomitant of component building, requires a universally accepted code of dimensions.

11.Summary and conclusion, reaching a hypothesis.

The building industry

1. The deteriorating housing situation suggests that new residential buildings are increasingly less affordable for those who are in need of shelter. In other words the basic need for shelter cannot translate into economic demand. Less demand means lower supply which eventually leads to lower capacity of supply. And this causes the unit price to increase. A increase in price in turn depresses demand and this vicious circle results in an increasing gap between need and demand on the one hand and supply and demand on the other. This, in addition to other unfavourable conditions, can lead to a serious crisis. Economic problems as a result of eight years of devastating war, and frequent natural disasters notably earthquakes and floods during the recent decade, are some of these unfavourable conditions. The cost of construction today (without the price of land) is equal to 10 years salary of a teacher.

2. Growth of demand is influenced by the rate of income growth, the growth in expectations and aspirations on the demand side and on the cost of building and the capacity to supply. These conditions have resulted in a situation where the building industry currently suffers low demand and has fallen into its deepest recession of the last 20 years. Government officials are currently seeking different ways out of this problem.[114] It is, therefore, in the interests of the community, that the building industry becomes more efficient.

3. The basic solution must surely depend on a) controlling the need, and b) increasing the building stock Escalating price ending to decreasing demand and therefore decrease in the ability of the industry should be stooped, and at the same time the rate of growth of the urban population must be reduced. The prospects of success in the latter task are a long term concern and a difficult task for any government. Moreover, the situation is already out of control as the housing deficit grows every year and will naturally escalate in the next 15-20 years, as a result of the population structure.

4. Iranian society is highly complex and diverse, developing from a long pre-Islamic history, the significant later Islamic influence and more recently an increasing international influence, not only due to modernisation but also with regarding social and personal aspirations. Individual lives are moulded by factors that cannot always

be controlled by direct policies. Increasingly the aspirations of the people are beyond the control of governments and politicians. However, even if the society does allow changes in policies, ideas, morals etc. and the opportunity to voice opposition, any course of action is nevertheless constrained in some way. There are legislative and institutional constraints as well as covert cultural determinants which, if not taken into consideration, can act as powerful forces against change and a constraint on development. Cultural myths, which act as constraints to development, must be addressed and correctly understood.

Productivity

1. As a genuine solution to the problem of affordability, the discussion suggested the importance of resource management and the concept of 'Productivity', and its relationship to social, economic and environmental aspects, and thus to sustainable development policies. Much conventional wisdom in the third world attributes the achievements of the West an increasing investment in technology and assumes it is the key activity in the development of resources. Too often decision-makers as well as intellectuals, researchers and academics, are confused between the goal and the means, between the agent and subagent. The study considers that 'technology' is a subagent to 'productivity increase'. Fascinated by the role of technology, not only are other ways and means of increasing productivity neglected, but the means or solution (technology) becomes something that is imported and not developed locally. Contrary to this conventional view, in this research, technology is dealt with only as one factor among many other ways and means for the achievement of increased productivity.

2. The broadest definition of productivity is the ratio between output and the total input of factors required to achieve it. In this sense productivity is the end result of a complex social process including: science, research and development, education, technology, management, production facilities, workers and manufacturing organisations. Productivity awareness is usually created in times of hardship and serious shortage. After the Second World War for instance, a period of acute housing shortage in Britain 'coincided with expressions of concern within and outside the industry about the level of productivity'[115]. The recent statement cited in Chapter 3 by Nategh Noori (*Hojj*), the Speaker of the parliament, is another indication of this fact. The almost 40 fold devaluation of Iranian currency and rocketing inflation have been attributed, among other factors, to ever increasing wages and subsequent

increases in materials prices. In fact, any increase in wages and the price of materials which is not accompanied by an increase in productivity, will result in higher production costs and an increase in the price of the end product.

Building productivity

1. Productivity in the construction industry should be understood in relation to the special features of the industry and the characteristics of its organisation, management, and technology. These must be examined in order to find appropriate methods for improving productivity. The difference between labour productivity in different countries can be attributed to a variety of reasons, such as traditions in design, technology used, organisation of site, and working conditions. There is a prevalent notion in Iran that the productivity of the T/C sector is very low compared to a number of countries, in spite of the unskilled labour content being high, with the resultant conclusion that there is a need to import 'new' technology. Although the considerable differences are not justified, the study shows that the low level of productivity is not merely a technological problem, or the solution confined to improvements on site. Productivity improvement can be gained by a combination of measures.

2. It is important to devise a national strategy for improving productivity. The key message is that growth in productivity must be planned. In relation to national strategy, all controversial matters require comprehensive research and social debate. 1) Delineating and developing a better understanding of the factors influencing productivity in the process of development and expansion of the built environment. 2) Determining how these factors can affect productivity. 3) Assessment of the course of action which must be taken in the light of this analysis.

3. Initiation and co-ordination to organise efforts for a national strategy needs a responsible body with proper authority and funds to implement changes. The BHRC has been involved mainly in technical research and less in much needed co-ordination and guidance of research in the areas of socio-economical or socio-technical procedures. The involvement of the private sector organisations and professional bodies like SAEF are necessary to achieve these objectives. However productivity is a multi disciplinary matter and needs the participation of all disciplines.

4. While capital, labour and land (material), are known as factors of production,

progress in management at different levels, as well as technology, are considered as necessary catalysts for the improvement of productivity. The importance of management in relation to productivity is a matter of complexity and scale. The more complex the procedure the higher the management skill needed to improve productivity, the more complicated the supply organisation the more complex the situation of housing would be. This leads us to the advantage of the simple *memar* system for the problem of housing to be simple!

5. 'No single factor affecting productivity in the construction industry is of greater importance than the organisation of work on the site' [116] **Incentives + Good Management = Higher Productivity**[117] 'Among the major determinants to productivity in the building process are delays, disruptions, and deferrals'[118] The shortage of material and unknown delivery times of material hampers any planning. Site management is the task that ensures a smooth flow of work and to arrange a balance between the rate of progress of work and minimising the non-productive time. Donald Bishop argues: 'In aggregate, non-productive time can account for a significant proportion of the total hours worked on site. The actual incidence as recorded from intensive site studies varies from almost 80 percent on one site with a difficult and broken sequence of tasks to a few per cent for gangs of labour-only bricklayers tackling straight-forward and uninterrupted work schedules.

6. In the majority of developing countries, a great contribution to the improvement of productivity can come from improvements in workmanship and methods of different trades, scaffolding, material handling and so on. Despite the initial claims of success by radical technological solutions they seldom prove to be of any significant influence. The reason for the failure of these methods is the lack of link between **local culture and industry** In contrast to radical solutions, a very small improvement in the traditional or indigenous techniques may have a great effect. An important example is the state and manner of bricklaying practice in Iran. It was mentioned that how mortar is laid and vertical joints are left empty. This not only affects the life-cycle of the building but also necessitates thicker walls, thus reducing productivity at all levels.

7. While introduction of new technologies in the construction industries of the industrialised nations has been the prime factor in the gains in productivity, the import of those technologies to developing countries has not usually been effective. Copying organisational factors from other countries with obvious historical, social,

8. On the subject of external factors influencing the Iranian building industry, there are four main points to be made.

- The first is that the external factors, as a result of the government's over-intervention in the modern sector, tend to be more powerful and determinant than the internal ones.

- The second is that government imposed organisational factors, copied from other countries, are inappropriate and damaging.

- The third is the manner in which the demand affects both sectors in different ways: While the modern sector suffers unstable demand generated by the government, a tendency grows towards private sector demand in the T/C sector which can seriously damage this sector. Contractors, in order to shift from an unstable development projects workload to the more stable private sector housing demand, influence government executives and are the main force behind their decisions towards 'mass housing'.

- The fourth is related to the third point and that is the importance of public opinion against the modern sector which implies that the modern sector's share of private market can only be served through government intervention as developer and a tendency towards mass housing..

Component building can play a part in increasing productivity in the process of rationalisation of traditional building process. Moreover the trend towards component building is likely to involve the modern CI in the production of building components and reduce the pressure towards 'mass housing'. Its effect in boosting the demand will help to alleviate the housing industry and thus housing situation.

In the light of the above theoretical discussion, the second hypothesis can be formulated as: One of the appropriate ways to increase productivity in both modern and traditional/ conventional sectors of the building industry is rationalisation of design and process of building with a gradual introduction of **light- weight, loose fit, low technology components (LLLC) have a role to play.**

12. End notes.

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These aids are sometimes even direct in the form of generous unit prices, and tax incentives

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30 This is mainly as a result of the promotion of Islamic lifestyle which combines social and private life, and transference of leisure activities from the public places to homes.

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CHAPTER 5
Methodology: pilot survey

1. Introduction.

The approach to this study and the research methodology, introduced in Chapter 1, is based on 'system approach' - the study of the background, development, current conditions, and environmental interactions of different parties involved in the Iranian building industry. This has involved a combination of data collection methods, and the use of various observations and records in relation to internal and external factors influencing the industry's organisation, operation, and development. To explore the relevant issues and reach conclusions, a combination of empirical evidence and theoretical perceptions and methods of analysis has been used. The study of the nature and organisation of the Iranian construction, while using different methods and approaches have substantially used the author's experience.

'1. There are different approaches to the study of human organisations.

2. Each approach has a positive value
3. Each approach is essentially incomplete relative to the ideal of a satisfactory study of human organisations.
4. There is a reasonable possibility that the different approaches are complementary, in the sense that some combination of two or more of them will prove better than any one of them alone.'1

This Chapter, while giving a more detailed account of the research methodology, the process of formulation of concepts and hypotheses, is an examination of a questionnaire survey in the context of the British building industry. The British survey was carried out as a pilot field study. An account of the field study in Iran, consisting the survey report and data analysis as well as primary and follow up interviews will be presented in Chapter 6, followed by a detailed examination of the structure and organisation of the T/C and CI sectors of the building industry in Chapters 7 and 8.

2. Methodology: formulation of concepts and hypotheses

The data collection methods used in this study and development of this dissertation were:
1) a continuous literature survey during the course of the study, of English and Persian sources
2) a pilot questionnaire survey in the British context
3)a number of interviews in the Iranian context
4) a structured questionnaire survey in the Iranian context
5) a number of follow up interviews.
The authors 25 years of professional experience and active participation in different professional institutions have contributed both in provision of data and in their analysis.

The literature survey was conducted to broaden the author's knowledge and understanding on the issues related to construction industry, its socio-economical environment and its development in general terms, and in the Iranian context in particular. The study of building traditions, combined with the authors personal experience, lead to the recognition of the unique nature, structure and organisation of the local construction industry. This in turn lead to the study of the merits, potential and problems of traditional/ conventional building industry in the Iranian context, and its importance as well as its role in housing. These two sectors while have separate institutions and operate in different ways should not be considered as separate organisations, as they influence each otheres behaviour, standards of operation, and goals. 'One organisation **A** is independent of another **B**, if the **B**'s behaviour does not influence the goals or standards of **A**'[2] All these lead to formulation of our first hypothesis which was first introduced in Chapter 3 after a brief description of the building industry and its characteristics in Iran.

Hypothesis 1: There is a two tier building industry in Iran: the traditional/ conventional and the modern sector, with a rather weak relationship between them. Implication of this hypothesis suggests that the lack of recognition of this unique structure and patricularly the importance of traditional/ conventional sector and its crucial role in housing may result in inappropriate decisions for 'building industrialisation', or 'mass housing'. Both sectors have their role to play, and it is for the benefit of both sectors to maintain a better relationship, to help one another's development, instead of damaging one for the benefit of the other.

The search for a better understanding of building industrialisation lead to the study of

industrialisation in general terms and the notation of 'productivity'. 'Yesterday's concepts are forgotten for the sake of today's notion. . . . .Who wonders in what respect they are different answers to the same concern, or whether they tell the same story in different words? And where is there real continuity in the formulation of theories.?' [3]This old concept was used with different interpretations and helped the author in the course of analysis of data and reaching conclusions. As 'the concept is shown to consist of a complex combination of phenomena, rather than a simple and directly observable item.'[4] However, this, in turn helped us in the analysis of data and the formulation of the theory leading to some of the conclusions. This is reflected mainly in Chapter 4 and in appendix 6. Apart from productivity, this study has used a number of other concepts

> 'Concepts are abstract ideas which are used to classify together things sharing one or more common properties . . . Concepts are, of course, the basic elements of theory. They are, in a sense, the mental units which the researcher manipulates and redefines as he attempts to build explanatory models of the social world.' [5]

Other concepts, or pivotal subjects, emerged in the course of the study. The background reading of 'industrialisation', in particular with reference to the non-western world revealed the importance of 'productivity' as a concept and its implications in economic development and the construction industry. The subject of 'Development' as a central issue in the study of developing countries, and the major source of demand in the construction industry.

> 'The researcher in social sciences does not have a completely free hand when he starts his project. He will have at his disposal the results of some research which may be relevant to his own intended investigation. His study may be a replication of previous research in which case he has a great deal to draw on. But even if there are no directly empirical findings there will almost certainly be a range of theoretical concepts about the topic of interest. These existing ideas will interact with the researcher's own theories and will to some extent influence the course of the investigation.'[6]

Apart from the use of well established concepts such as 'productivity' the research also dealt with 'concept formulation'.

> 'In essence a concept is a useful idea with a name and concept formulation is thus intimately associated with the idea of language. . . . relatively little work seems to have been done on how to effectively formulate concepts from textual data (Bolton 1977). It seems likely, however, that an important method is the use of analogy'[7]

The concept of 'componentisation' emerged in a tutorial session while 'industrialisation' was being discussed along with the use of building components and its effects on increasing productivity. The word 'componentisation' was suggested by Charles Cockburn and was uesed as a concept for appropriate industrialisation. This further developed to became the basis of our second hypothesis which was first introduced following a theoretical discussion in Chapter 4.

Hypothesis 2 One of the appropriate ways to increase productivity of the building industry in Iran is rationalisation of design and process of building with a gradual introduction of **light- weight, loose fit, low technology components (LLLC). This idea of 'componentisation'** may have a role to play : in improvement of overall productivity in both T/ C and CI sectors of the building industry; help in solving problems of both sectors and maintain necessary link between them; and increase housing supply.

In order to support the main arguments of this dissertation in addition to other methods of gathering data, it was felt necessary to carry out field work to provide empirical data. Prior to the field survey in Iran, an open questionnaire survey was carried out in the context of the British building industry. This survey was devised as an example with two goals in mind. Firstly, it was assumed that exploring the issues raised in this survey may help a better understanding of the issues involved in the improvement of productivity as well as providing more information and coverage in examining the issues which may act in the case of Iran. Secondly, it was seen as a pilot study to assist us in the development of the questionnaire and an approach in selecting the method of conducting the main survey.

> 'Questionnaire development involves the application of a number of different requirements, the first of which is the researcher's understanding of his subject. . . . to determine the kind of information he needs to collect. . . i.e. the questionnaire coverage.. . . .The second requirement has to do with the questionnaire as an instrument of communication. Although the researcher may be clear as to his final information needs, he still needs to know how to get there. These aspects usually mean that some kind of development phase has to be undertaken.'[8]

There was a period of 'questionnaire development' between our survey in the UK launched in Jan. 1989, and the Iranian survey conducted in Jan. 1990. During this time there was a preliminary trip to Iran (22 March- 5th July 1989) to develop the final schedule. This was done by conducting group discussions and in-depth open interviews

with individual professionals (*memars* architects, engineers, material producers, etc.). Group discussions were held in the Society of Architects and Engineers of Fars (SAEF), Council of Contractors, and *Memar*s and Technicians Union (MTU). The main survey (15 Jan.-21 Feb. 1990) was followed up by a number of interviews in the third trip (5 Feb. -7 March. 1992).

2.1. Objectivity; empiricism, and value judgement.

> 'Empirical research in the social sciences has of late come under severe attack from several quarters. One of the centres of criticism contains mainly ideologists who see the study of human history and human behaviour as a fertile ground for the propagation of certain viewpoints and for whom the idea of neutrality is anathema.'[9]

We acknowledge that neutrality and objectivity are basic premises which guides the activities of most researchers in all disciplines as well those related social science. On the other hand there is a common belief that the academic research, particularly related to social science should be analysed in relation to, and carry with it, some value to the society. 'For this reason at the doctoral level there is a flavour of the legal process about analysis. It should be seen that it was done for good cause.'[10] This is where value judgement may interfere with objectivity.

Our social beliefs which are a genuine source of motivation (in addition to considerations of future careers for young students), can positively affect the process of research. There is a tacit agreement of this among social research methodologists.

> There is no necessary conflict between personal, subjective interests or values and the scientific goal of truth (see Psathas, 1973; Rainbow, 1977; Hunt, 1984; Krieger, 1985). personal interests hold potential for new insights and creativity inspired by emotional and intellectual identification with the topic of study (Johnson, 1975, 1977)' [11]

Rather than hiding and denying personal interests and values, the researcher needs an awareness of how these thoughts and feelings relate to the facts and can influence research. Another group of social science methodologists question the feasibility of ever attaining true objectivity regardless of ideological considerations. This they say 'is because complete detachment is unattainable in a field which deals with subjective aspects of social phenomena.. . .But this in itself cannot question the need for objectivity

in the operational aspects of research.'[12]

Moreover there may be a 'universal' consensus about certain values such as freedom, justice or peace - exactly how these values apply in particular cases is a matter of concern. In other words, the researcher needs to consider what values are involved and what implications these values hold for truthful findings. In this case, however, social beliefs, although has proving ample motive for carrying out this lengthy research, have been kept in the background. Therefore, our position may be summed up as one which believes that the approach must be scientific; facts should be derived from the objective analysis of data attained from the 'real world'.

> 'Traditionally in the a Anglo Saxon world knowledge and research have been equated with the identification of causal relationships and research directed to this end has been accorded the highest esteem. Many fields have not yet developed to the level where causal explanation is possible or valid predictions can be made. . . . Nonetheless where sufficient knowledge exists to make explanation or prediction possible it is not easy to see what benefits would be attained if they were not attempted.'[13]

The study of the socio-economic environment of the construction industry in this research has used statistical data as well as the identification of causal relationships between the factors affecting the development of the industry. For example, the assessment of the future workload in the context of the modern sector of the construction industry lead to a study of the world oil market. Predictions made on this part of the study, based on causal relationships and reinforced by the statistics, were later confirmed by the developments in the world oil market and in the construction industry in Iran.

3. Literature survey and relevant citation.

The approach to this study needed an understanding of a broad area of knowledge in relation to the provision of the built environment, construction industry and its socio-cultural and economic environment. 'A number of different phases can be expected in the course of a literature search in accordance with the various stages of the research.'[14] The literature survey has been an on going and somewhat difficult task spread across the course of this research. This was due to a number of reasons: very limited existing research on both the subject and the context of this study; the fact that most of the

available literature on the construction industry in developing countries has little relevance to the Iranian context, due to its unique socio-economic structure and building traditions; a lack of data in almost all 'international' publications, and problems in accessing to the available data due to difficulties arising out of the imposed war, and the consequent socio - political conditions. However the literature survey involved:

'- the generation of a number of alternative subjects/keywords;
- deciding which subjects to pursue;
- deciding which subject to abandon;
- deciding when sufficient effort has been put in for the purpose in hand so that the process can be (temporarily) halted.'[15]

In the generation of alternative subjects/ keywords, our substantial personal experience was helpful. Nevertheless there was always the problem of deciding which subjects to abandon. 'Without mechanisms for deciding which lines of enquiry not to pursue most literature searches soon get completely out of hand. For this reason many researchers adopt the often somewhat arbitrary rule of scanning only *the literature of the subject*. In some well defined fields, for example, nuclear science (or well established subjects in other disciplines),.such a strategy is very sensible'[16]. This is not the case in the majority of undefined fields related to social sciences.

In an international on-line computer search by title keywords (or a combination of keywords) a limited amount of literature was found on the *construction industry - and developing countries* and less on the *construction industry - and Iran*. However the search had to be broadened to find relevant literature. The following subjects/ keywords or combinations of them were used: *Iran; developing countries; construction industry; building industry; construction management; building industry; development; sustainable development; development projects/ policies; construction workload; building demand; housing; building industrialisation; industrialisation; productivity; training; technology; appropriate technology; rationalisation of traditional building; building components; prefabrication; modular co-ordination; standardisation; production; marketing* and so on. A number of publications were found as a basis, and were then increased using other methods of search and sources of data . However their relevance and the nature of their relationship to the area of study and thus their relative importance were not clear to the author at that time. This became gradually clear in long process of development of the dissertation. For example, the relationship between some of these keyword/ subjects (in bold) could be detected in the following paragraph from

the introduction.

Study of the nature and **organisation of the construction industry** and its **socio-economic environment** is one of the prime aims. Another aim is to identify the specific problems affecting its **sustainable development.** Low **productivity** of traditional building is often mentioned as the main reason to justify policies toward **mass housing** and high **technology** system building. another major objective of this study the study of the different ways open to the industry to increase its productivity. **European experience** have already showed that **component building** has a significant role in **rationalisation of traditional building**. One of the objectives is to examine the potential role of light weight loose fit low technology building components in our context.

New subject/ keyboards emerged during the course of study which needed more investigation. Yet it was difficult to decide which subjects or publications should be included or excluded. However, to overcome the problem of selectivity we needed a great deal of background reading to search for appropriate concepts which could be used as tools for analysis and as criteria for deciding which subjects to include or abandon.

Apart from sources in English comprising a number of books, journal articles, thesis and dissertations, occasional papers, abstracts, codes of practice, and ephemera, this research had to look for similar sources in Farsi on a broader and more detailed scale. Additional sources in the Iranian context were: government publications, formal statistics, and archival data. Translating from these sources has been a complex and time consuming process. Direct translation from Persian to English is often difficult and can be misleading, partly as a result of cultural differences, and partly as a result of certain conventions, for example in letter writing or statistics.

In this multi-disciplinary and somewhat exploratory research, the designation of one or several chapters to the literature survey seemed both impossible - and irrelevant. Impossible because of the limitation on the length of the dissertation, and irrelevant because of the inter-relatedness of these subjects on the one hand, and relation to the context of the study on the other. For these reasons the literature survey is reflected in various Chapters usually concentrated on each chapter's specific point of focus.

4. Other data gathering methods

In addition to secondary data gathered in conjunction with the literature survey, different methods of collecting data have been employed. Secondary data acquired through the literature survey consists related measurements by other researchers in the Iranian context, for example by MM Zandi cited in Chapter 2.; statistics derived by government agencies; and archival data, such as those which was obtained from the Society of Architects and Engineers of Fars (cited in Chapter 4). Other important methods were interviews and questionnaire surveys.

The major assets for data gathering are time and access to data. 'Gaining access to data is often a problem for the student researcher. . . . .(the researcher) often finds that the organisations or groups that he wishes to study are unwilling for reasons of confidentiality or lack of time for providing him with data'[17]. Access to data in government agencies is particularly difficult for an independent student researcher who is not directly employed or affiliated to those agencies. This can be exacerbated in certain social and political conditions. However the main source of data came from the professional institutions without major difficulties.

4. 1. Observation and participation; personal experience.

Participant observation is often used by academics and professionals in human studies. There are different views regarding the validity of this method. 'From a positivist point of view - the view that human studies must conform to the methodology of the physical sciences, such as physics, participant observation sometimes is regarded as non-scientific. There are others who believe: 'information about processes and about invisible structures is not readily derived from counting things' [18] Mitchell (1992) believes:

> 'Perhaps more understanding can be gained, when the time is available, if the observer is also a participant in the practice which is being observed. This is particularly useful were qualitative understanding is being sought rather than just the measurement of quantities. The values that people have, their attitudes and behaviour, are best understood by participant observer who has time and inclination to get involved.'[19]

More commonly, however, it is viewed that this method is useful in exploratory and descriptive stage of research. 'Qualitative descriptions generated by participant

observation are used to formulate concepts for measurement, as well as generalisations and hypotheses that with further testing may be used to construct explanatory theories'[20]. 'Direct observation is the primary method of gathering information . . . depending on the nature and extent of participant involvement, the researchers immediate experience can be an extremely valuable source of data.'[21] However the author's direct involvement in almost all sectors of the Iranian building industry has been used in explaining the nature, structure, and organisation of the industry and understanding its problems from different viewpoints.

The author being from a family of memars used to spend a lot of time on the building site during (three months) summer holidays as a amateur *shagerd' bardast* (apprentice) of the father as mainly involved in bricklaying and plastering. From the age of 15 and during 1955-58 befor he started Higher Education, the author was involved in the traditional sector and closely worked with his father as a *memar*. The author's experience and areas of involvement following graduation with a degree of M.Sc. in Civil engineering in 1963 is summarised below:

1963 - 64 Trainee/ representative of Plan Organisation in Kurus Consultants Mashhad office, involved in water supply work for the city of Mashhad and a number of small cities in North-eastern Province of Khorasan.

1964 - 66 Established own Mohandess (architect/ engineer) consulting practice involved in architectural and structural design for a number of residential and commercial buildings in the private sector. During the same period taught on the Building Course at Mashhad Technical College.

1966 - 68 Military service (compulsory). After a short period of 3 months training in the Army Engineering Division in Tehran, sent on a mission to Shiraz as area supervisor/ inspector for military building projects in Fars Province.

1968 - 76 Employed by Modam Consulting Architects, Engineers and Planners, one of the major consultant firms in Iran, as the area supervisor and in charge of their office in Fars Province, with about 30 employees comprising; architects, engineers, draftsmen, and technicians. The main project was Shiraz University Campus, a project worth about £400 million. In this period with Jane Drew and Maxwell Fry (significant British architects of Fry, Drew, Knight and Creamer Architects and Planners Partnership), was involved with the Shiraz University Master Plan.

1976 - 87 Established three small to medium scale construction and civil engineering contracting companies; Nikeh Co. 76 - 79 with total projects worth 300 million rials equivalent to £3 million (1979 rate of exchange), including a 48 unit housing project, a health centre, and remodelling and refurbishment of a 200 bed hospital. Aturpat Co. 79 - 84 with total projects worth approx. 1500 million Iranian rial [22]. Projects included a number of educational facilities: a high school, workshops and classroom buildings for a vocational school, two halls of residence, and in a joint venture with another civil engineering company extension and repair works of the Shiraz International Airport. Abandad Co. 84 - 87 with the projects worth 1200 million rials, the major project was Shiraz Telecom Factory and warehouse mentioned in Chapter 4 for the unique approach of the author in industrialising the process and de-skilling of formwork and shuttering. All these companies were registered and qualified by the Plan Organisation. All projects were government funded and executed in the framework of the formal modern sector of the CI. The author's involvement with the T/C sector continued since the establishment of design practice in Mashhad as a second job occupying long afternoons, weekends and holidays. Majority of architects and engineers, employed (or self employed) in the modern sector, are also involved in the design and supervision of private residential and commercial buildings in the context of T/C sector. A more accurate measure of this will be given in Chapter 6.

The author also has been actively involved in professional gatherings, events, and organisations, and was elected, by the general assembly, as a the Chairman of the Board of Directors of the Fars province Contractors Council (syndicate) in 1983 for a two year period. In this period of mounting disputes between client (government) and contractors, as a result of the war and its concomitant shortages and difficulties, the author served not only the contractors interests but acted as a mediator in resolving disputes. Then in 1986 the author was elected as the Vice Chairman of the Board of Directors of the Society of Architects and Engineers of Fars (SAEF). Between these two periods, the author in close contact with *memars* and technicians, was involved in the establishment of the Union of *Mohandesin* (architects and engineers), and *Memars*. This later led to the establishment of The Memars and Technicians Union (MTU). The author's experience in this period not only helped in providing a better understanding of the nature and organisation of our building industry and its problems, but also he enjoyed a great deal of help and support in preparing and conducting the field survey.

5. The 'pilot' questionnaire survey: development of component building in the UK

Background reading in the context of the British building industry revealed that: while industrialised building in the sense of heavy closed system building failed, or was of limited influence in the UK, 'component building' developed further developed and enhanced the rationalisation of the traditional building process. The survey was carried out to gain an update on developments in the last two decades on 'component building' and assess its effects on productivity. 'Component building' has developed a long way and has shaped itself to the requirements of the British Building industry to become a common feature in the industry.

> 'Industrialised building, at least in the United Kingdom, had largely been restricted to the public sector. Even within the public sector, industrialised building seldom exceeded more than a fifth of starts or completion in a given period and between 1974 fell from 18.8 per cent of public starts to 4.6 per cent in 1979 (in a considerably reduced volume of public sector starts). Though it is true, however, that in the private sector there is an increasing tendency to substitute inputs which have been produced in off-site situations of potential scale economies, for on-site production. For instance, plasterboard replaces on-site plastering, pre-hung doors and aluminium window frames reduce on-site joinery inputs, etc. However, the capacity of the construction sector to further develop off-site preparation is largely related to the ability to produce and sell standardised output.'[23]

However in the motherland of industrialisation, despite its sophisticated industrial infrastructure, industrialised building was a failure even from the technical point of view. One of the main reasons for this failure was that it proved impossible to maintain a connection with culture as a whole and particularly with traditional architecture. System building obviously failed compared with the traditional building process, where productivity gradually improved with the introduction of various 'standard' components developed slowly and steadily with cultural connections.

In the last two decades since Donald Bishop gave an account of component building in the UK.(mentioned in Chapter 4), the development of component building both in terms of changes in the initial concept and the expansion of its influence on all aspects of the industry, has been great.

To become updated on the developments which have taken place in the last two decades in component building and make an assessment of the effects on productivity, it would

be helpful to examine the results of the questionnaire survey addressed to consultants, contractors, component manufacturers and academics.

5. 1. The Survey objectives and method of conduct.

The survey was carried out in January 1989 as a pilot study prior to the field survey in Iran. As a pilot survey it was to help in the preparation phase for the major field study in Iran. The other purpose of the survey was to identify the effect and significance of introducing new building components on improving productivity in the British building industry, and to identify other significant factors at work in different periods of its development. Exploring the issues raised in this study could help provide a better understanding, and necessary information to determine the extent of questionnaire coverage in examining the issues which may act in the case of Iran

Whilst not supporting the theoretical perspectives of the Modernisation Theory of development, which advocates 'following in the footsteps of the West', there are lessons which can be learnt from the process of development in developed countries. Third world development experts and academics occasionally use Western examples to explain and foresee similar phenomenon in developing countries. Mitchell and Bevan[24] , for example, used the process of development of Portland cement in the UK. to explain the importance of testing procedures and quality control measures in product development of soil - cement blocks in the countries of the third world.

There is no doubt that technical advancement has had an important effect on the increase of productivity and that innovation has been the key to these advancements in industrialised societies; but are these advancements transferable? or are these technologies appropriate in the case of building industry in Iran? These question could be answered only if we can understand these changes in their original context and the mechanism through which these advancements have taken place.

5. 2. The questionnaire

The open questions were chosen in order to provide a wider range of respondents, covering a wider area of issues . The main body of the questionnaire/ letter was:

> I am writing to request your help with my research. the theme of my research is 'To increase productivity of the building activity in Iran by the transference of in situ site work to factory production supplying building components, to an 'improved conventional' building industry.
>
> It would be most useful to learn from your country's experience in this respect and to examine its relevance to increasing building productivity in Iran. There are two main questions that I would like to put to the different parties involved in the building industry, they are:
>
> *1) From your point of view, what has most influenced building and construction productivity in your country;*
> *a) in the last 20 years?*
> *b) in the last 10 years?*
> *a) in the last 5 years?*
>
> *2) From your point of view, what are the best ways open to the building industry (and its clients in this country) to obtain higher productivity in the future?*
>
> I would be grateful if you briefly answer the above questions and attach a brief (one or two lines) information about your past and present professional experience and activities. Your early response would be most helpful.

The questionnaire were addressed to a sample of a hundred companies and individuals comprising, 30 contractors, 30 consultants, 30 building component producers, and 10 academics. The sample size were aimed to be between 40 to 50, as ' . . samples of less than 30 or 40 from large populations such as those covered in social surveys, are usually not adequate for statistical analysis'[25]. Consultant and component producers were chosen from the lists provided by the RIBA office in Leeds and component manufactures list was provided by the ABCM (Association of Building Component Manufacturers) office

in London. All academics were .They were all members or honorary members of the Institute of Advanced Architectural Studies University of York. Only 25 replied responding to the questions comprising: 6 consultants; 7 contractors; 8 component manufactures; and 4 academics. They were :

Consultants/ architects

1. Calvert S.M. ; Pearce Bottomley Partnership; Chartered Architects.
2. Jackson Adrian ; BDP; Building Design Partnership
3. Quaramby Arthur ; The Arthur Quaramby Partnership, Architects And Designers.
4. Rawson. K.J. ; Abbey Hanson Rowe Partnership
5. Shaw Roger ; Kitson And Partners; Chartered Architects
6. Sykes M. ; Sykes Able Partnership Architects

Contractors:

1. Duffy James A. Associate Director; Ashby And Horner
2. Fawcett A. (Dr.) Director Of Engineering Gkn Keller Foundations
3. Garland Julie ; Business Development Manager; Haymills [Contractors] Ltd.
4. Harmes. R.D. ;Group Technical Director; The Berkeley Group Plc
5. Morris Peter W.G. (Dr.) Bovis International Construction And Civil Engineering
6. Whitson R.C.P. Managing Director Barratt Construction
7. Wouldham M.W.; Trafalgar House Construction Ltd.

Component manufacturers:

1. Bonafont. R L ; Technical Director Ruberoid Building Products
2. Frost. N. ; General Manager Ibstock Warner Ltd.
3. Harper Digby J ; Marketing Director Celotex Limited,
4. Hayward M.C. ; Secretary The Brick Development Association
5. Jennings. David A ; Group Marketing Director J.M. Jones & Sons Ltd
6. Joshi. Arvina ; Director ABCM Association Of Building Component Manufacturers
7. Kelly. B.T. ; Chairman Compriband Ltd.
8. Wilkinson. David ; Managing Director Sfs Stadler Fastening Systems

Academics:

1. Clark. Tim
2. Cockburn Charles
3. Cooney E.W.
4. Loring John

The following 14 declared that they were unable to express an opinion on the questions:

1. Heaton H W ; Sales And Marketing Director Briggs Amasco
2. MarrA.M. ; John Laing Co.
3. Gillan Wates D.A. : Build With Care
4. Brown M.D. ; Managing Director : Door Closers.
5. Foreman John ; Training Manager Shepherd Construction Ltd.
6. Edwards E J Brassey ;Assistant Technical Personnel Manager Sir Robert Mc Alpine & Sons Ltd
7. Scholes J.R.B. ; Human Resources Manager Bechtel Limited
8. Downton C. H. ; Company Secretary NSM Plc.
9. Moore N G ; Managing Director Treetex Ceilings
10. Roberts P. W. ; Training Manager Edmund Nuttall Ltd.
11. Cobbold Anthony ; The Building Centre; Building Industry Centres In The Regions
12. Brettell C.E. Precision Metal Forming Limited.
13. Linstrum D.; IoAAS University of York..
14. Harris S.; IoAAS University of York.

There was no reply from the remaining 60. However only 21 out of 25 answered according to the questionnaire, and were used in the analysis. Thus we refer to those 21 as the respondents. The other answers were in a historical or comprehensive manner without pointing to the role of a particular factor in the periods asked. Nevertheless we have cited their comments in previous chapters where appropriate. A point worth noting here is that 20 respondents make a relatively small sample. When the size of sample is small it is either difficult to make generalisations or find patterns, and any case generalisations must be treated with caution.

5. 3. Respondents' views: classification of the data.

Classification, categorisation and finding common denominators is difficult and less reliable when the sample size is relatively small. However the sample was large enough 'for the effects of the "interest" to be detected'.[26] The answers were varied, from diverse points of view and embrace a wide range of issues from socio-political and economic implications, to management on site and technological issues. 'The successful

development of concepts results in a number of 'pigeon holes' into which individual objects can be classified'[27] Based on two main concepts of this research, i.e. productivity and componentisation, the answers could be fitted into two main categories:

1. Those who referred to a wide range of factors affecting productivity. ; Broad factors affecting productivity in the British Building industry
2. Those who referred to the role of component building in the improvements of productivity; component building development ('componentisation'),

The first section of respondents view refers to the factors affecting productivity in the British Building industry and the second section is focused on the role and manner of componentisation. The answers were diverse. They embraced a large area and identified numerous factors affecting productivity in the building industry. For example Calvert S. M. points out the importance of insurance policies and their effect on design, innovation and improvement of technology he states: '. . . Professional indemnity insurance I feel has also had its effects in so far as certain designers will use only tried and tested methods, even though they may take longer (and probably use more resources) .' Some were concerned about 'profitability' rather than productivity. Although related in certain ways but totally different concepts. For example Haward M. C. states:

' . . . over the last two to three years industry in this country has been profitable and this is reflected in the private commercial and industrial sectors' output and orders for the future.'

Respondents' views may also contradict each other. For example in the question of influential factors in the last 5 years Kelly B. T. states ' . . . For the most part buildings are still made from the same materials , steel , timber, brick, concrete etc. . While David A. mentions ' . . . the increased use of non-traditional construction materials' as the contributing factor. He continues . . .' such progress as we have made has been from development of how we use them and how we make them in a form where they are more intensively prepared than before.' And Frost N. points out that : ' . . . in the clay roofing sector we have seen very little change since our appeal is that of a traditional material, laid in a well proven manner.'

Some determinant factors mentioned by the respondents affect productivity in a positive way (increase productivity) and others have a negative effect. All these determinant factors are inter-related and some of them could be considered in more than one

category. Here they appear in only one place, that is the one we felt was more relevant and had a stronger link with that category. The answers were long, some of them in more than one page, and it was 'necessary to summarise them later, particularly for attitude questions which are breaking fresh ground.'[28] However, the answers could be divided into five major categories: **1) Government policies; 2) Market conditions; 3) Organisational factors; 4) Technological factors; 5) Productivity on site.**

Each one could be subdivided to different sub-categories. For example, government policies could be sub-divided to Macro economic, monetary, legislative, or housing policies. This did not seem appropriate as the size of the sample and the number of answers was not large enough to build on those sub categories. Nevertheless we emphasise (in bold) the main keywords in each answer, in order to detect potential sub-categories and also highlight the relevance of that answer to the same classification . However, each of the five categories are represented in four periods of time (the last 20, 10, 5 years, and the future), the same as periods under question. This is to show their developments in a period of 20 years. The respondents' opinion is often quoted directly.

5. 3. 1. Government policies and economic conditions

a) In the last 20 years: Hayward M. C. emphasises the role of government policy: ' . . . The main influence on building and construction in this country over many years was Government policy. The government has, up until very recently, used the construction industry as one of the main regulators of the economy. . . since the Conservative party came to power in the early 1980s, there has been a shift from the role of the public sector in construction and this is most noticeable in the reduction of **public housing.**' Shaw R. also points out to the government incentives' . . . **political incentives** from central government towards industrialisation and prefabrication to solve a tremendous housing problem and this was administered by local government.' Rawson K. J. identifies the fluctuation in demand and the unstable **economic conditions and its effect on training and investment**; '. . . the effects of economic boom and slump and has been unable to adjust to any reasonable plateau which would allow investment, proper training and the establishment of a realistic level of trained operative to meet the demand.' Loring J. also mentions '. . . the effect of continuing public sector **housing workload**, and the unregulated **national building programme** 1968 - 74 for both public and private sector.

b) In the last 10 years: Hayward M. C. states that ' . . . there has been a shift from the role of the public sector in construction (as client), this has shifted the balance towards the private sector.' Jackson A. believes that ' . . . Politics and the state of the British

economy most influence building and construction productivity 'in this period. Loring J point out the importance of: '. . . . the start of a **national monetarist policy** . . . restrictions on public sector expenditure . . . market orientated economy. . . reduced state funding . . . retail economy expansion. . . increased range of sources of finance. . . short term investment . . . low investment in construction craft or component manufacture. . . . fluctuation in financial market and interest rates'.

c) In the last 5 years: Most respondents did not make comments on the effects of government policies and economic conditions in this period. This was probably because, in this respect, they have seen this period as the continuation of the previous period. However Loring J. referring to this period points out the importance of ' . . financial/economic influences on policies, products and processes'.

d) In the future: Looking to the future the respondents gave more weight to the political environment and the possible changes resulting from **EEC developments.** It seemed more appropriate to categorise most of those views in relation to market conditions. However, Kelly B. T points out: ' . . . the **imposition of VAT** on commercial building may affect the balance between new construction and refurbishment and thereby methods of construction and materials requirement.. . . **increased legal activity** on product and contractors liability will encourage more management fee contracting as both designers and contractors try to further reduce their responsibilities to their client. Jackson A.' . . . the corollary of the point I make in my answer above is that, **if the economy were well regulated,** as in Germany, there would be a fairly **constant demand** for materials and skills, and therefore less of the **waste of materials and training** effort than we now see'.

5. 3. 2. Market conditions

a) 'in the last 20 years': Hayward M. C. considers the investment in plant and machinery to be most influential factor for the improvement in productivity in the building materials and component industry. He states: '. . . the private sector's decision to **invest** in construction will, of course, depend upon the strength of industry and the **profits** made.' Loring J. mentions a number of influential factors: 1)Restricted private sector **commercial/ industrial workload ;** 2) Expansion of British manufacturing base for materials and component inadequate for demand. 3) **Import of European materials** and components; 4) Industry and design professions extend investment un-reasonably in an **insecure market**. Excessive competition causes **price fluctuation** and regional price differences; 5) **Oil crisis** and rapid decline in market.

b) 'The Last 10 Years': David A. mentions that ' . . . there have been demands in the UK for the industry to respond more effectively to the demands of clients (private). Shaw R. believes that ' . . . The political will over the last ten years has favoured commercial competition to the virtual exclusion of local authority projects and demand is for smaller scale construction for which traditional methods, and this includes prefabricated timber framing, are the most economical'. Calvert S. M. points out that. . . .'The industry has been bust by the effects of **economic boom and slump** and has been unable to adjust to any reasonable plateau which would allow investment, **proper training** and the establishment of a realistic level of trained operative to meet the demand .' Loring J. point out the effects of '. . **Private sector finance**; market based developments. . . **Market led demand** for commercial/retail accommodation.

c) 'The Last 5 Years': Clark. T. explains that ' . . . in the last 5 years, aside from the sentimental aesthetic debates going on about 'architecture' the major influence on Building has been the **availability of cheap money** and the growth of new (government lead) initiatives in the private sector leading to buildings for small businesses, light industry and leisure. The housing sector has seen some growth, mainly in the **owner occupied category**.' Loring J point out to a number of market led influence. He identifies: ' . . .novel **funding arrangements** . . buoyant, unrestricted land and building **property market**. . . .rapid value increases . . . . rationalised expansion of the **Do - It - Yourself component market**. Industrial manufacture -and- retail interests. . . . high value added financial return.' Hayward M. C emphasises the role of market conditions in the level of **investment in plant and machinery** and its subsequent effect on increasing labour productivity. He states: '. . . the industry (building materials and components industry) has utilised the profits that it has made over the last few years to **invest in new plant and machinery** which increases productivity and also lowers cost. Examples of this are the new plants that are in course of planning and building which are very much larger capacity than existing plant with a very much lower labour force.'

d) The influence of Market in the future Kelly B. T states: Having myself been in this industry for some thirty years now and having seen many changes I have formed the view that **change comes about by market forces**, very often influenced by government and those changes are often perverse. . . The free market in goods from 1992 onwards may well affect prices of materials and labour in some EEC member states.. . .EEC codes will increasingly encourage the firms operating Europe wide to standardise and reduce the choice available to designers. Paradoxically in the early years after 1992 choice may

actually increase until competition sorts out the fittest to survive.' Shaw R points to the role of **competition in the market** economy when he states that : '. . . at the end of the day the **cheapest building method** acceptable will prevail and if mechanisation contributes then it will be exploited. This is evident from history throughout the world and I assume Iran is no exception. 'Rawson K. J emphasises the role of investment and the necessity of profitability in the industry to facilitate the necessary investment. He states: .' . . . **more investment is required and better profit levels** within the industry to finance the investment, together with a major realistic look at **the country's demands**, irrespective of the current financial climate. 'Loring J.' . . . Market: Client Base; Building procurement systems;

5. 3. 3. Organisational factors

a) 'In the last 20 years': Jennings D. A. points out the importance of the change in the organisation of the industry by the increasing emergence of specialised sub-contractors and the subsequent **effects of incentive**. '. . . this change in approach has had a fundamental effect on productivity in that **smaller subcontract businesses** which, in the main provide 90% of construction work on a project, have a greater **incentive to increase productivity.'** along the same lines, Shaw R. States: ' . . . industrialisation, prefabrication and mechanisation have stemmed directly from the building industry and architects have had very little influence other than as employees within the industry. Loring J mentions a number of organisational change as being important: . . **re-forming of commercial/industrial companies** . . . contraction of manufacturing and stock holding capacity. reduction in product range; . . . both potential clients and contracting industry manufacturers etc. involved in item 1; and . . . **development of new client groups**: community Co-operative' . . . lack of traditional and new construction and construction management skill.

b) Organisational factors: 'the Last 10 Years': Kelly B. T mentions more changes in the organisation of the industry. He states: .' . . . subcontract gang of men which is now such a feature of our sites. . . .this system in which one or two artisans employ large numbers of semi-skilled or unskilled persons to carry out the work for a fixed price; transfer of risk (from the main contractor) to the subcontractor' . Cockburn C. also mentions **changes in the methods of contract** he points to: ' . . . improved information and contract.' . . Labour relations stabilised by government legislation. Morris P W G. also mentions the importance of organisational changes and the influence of methods of contract, pointing to: ' . . . the advent of management contracting and construction

management.' Loring J mentions the effect of the ' . . .professional/**Industrial response to new methods**' Fawcett A. point out the influence of '. . growth of **design and built packages,** and. . . **training** to enable site-personnel to take maximum benefit from the introduction of emerging systems.'

c) Organisational factors: 'the Last 5 Years': Joshi A believes that ' . . . on the actual style of organisations, it is the fast track approach that has been the latest contribution to the construction output rates' Charles C points to the significance of the development of 'componentisation' in this period while he mentions the influence of : '. . . **improved component design procedures, supply and distribution**.' Calvert S. M. emphasises the role of scale and the average size of undertakings in originating organisational change. He states: ' . . . size of development has increased and so too the intensification of resources into select areas. These often under the umbrella of contractor managed (and sometimes designed) projects. Loring J mentions : '. . .profession/Industry polarising as **large or small operating units**'. . . **introduction of (more) quality control concepts/** practices. Fawcett A highlights the importance of change in contractual arrangements. He emphasises the trend toward the '. . . .**growth of design and built packages**'.

d) Organisational factors in the future: Kelly B. T. states ' . . . the harmonisation of **building codes** throughout the EEC will radically alter the way we build. Whose system will win we cannot yet foresee.' Frost N while emphasising the crucial role of training states: '. . . Building industry productivity in my experience can be very poor usually due to the quality of the people. The industry has an image of lack of stability and does not attract the best managers. Site management is a complex task and skill shortages are the normal picture. . . training is often hit and miss especially in the smaller, less professional companies. . . the industry **training bodies** need more support and commitment and they need to create recognised professional **site management qualifications**.' Wilkinson D. also mentions the role of training in both contractor and trades level in improvement of productivity, he states: ' . . . **training of contractors and their site operatives** in adopting their working practices to the use.' David A. while emphasising the role of pre-fabrication points to the building code development procedures, states: ' . . . with regard to higher productivity, this will only come through a more systematised/ pre-manufactured approach to building. Such a change will be slow due to the complex **nature of approval procedures** in the UK.' Clark T. points out the importance of building durability and lifecycle - we call that productivity with a time (building life) dimension, he states: '. . . The question of 'productivity' is probably more relevantly

posed to **quality rather than quantity**. The days of volume building are largely finished. New accounting methods are required to bring more certainty to the funding of buildings particularly in terms of maintenance. **The maintenance sector** is under-funded and uncoordinated. Clients require to define more precisely the 'life' they expect from a building. Maintenance plans should then be formulated at the same time as the capital plan. The Building Industry would then be able to forward plan with specific aims in mind. Cockburn C. points out another dimension of organisational change: '. . . **company restructuring** to encompass more of the process of building . . . better training of all operatives and **management**.' Calvert S. M. states that ' . . . Over the last 5 years, the increase in building activity has shown the lack of training of some site operatives and thus the question of **quality control** becomes more important. This may show itself in condemnation of shoddy work. The use of site operatives who have had a **proper apprenticeship** and practised in their art would help.. . . The growth of **design - and - build (contracts)** will, I feel, continue to affect the industry; its apparent advantage being to speed up the design stage' Loring J. also points out the importance of investment in training ' . . Management/Skills investment' Morris PWG. predicts that: ' . . .greater **single point responsibility and integrated operation/** construction may be a possibility also.' Fawcett A. emphasises project management and training when he states: ' . . increased emphasis on planning the whole project to achieve success and reduce time spent on potential problem areas. . . .training to enable site personnel to take maximum benefit from the introduction of new systems. Training seems to be a dominant concern for the future of the industry. This may possibly be the effect of boom period and sacrificing quality for speed and cost.'

5. 3. 4. Technological factors

a) 'in the last 20 years': Harmes R. D. states: '. . . **prefabricated concrete** and **timber houses** and **concrete high rise** blocks have influenced building and construction productivity most.' Whitson RCP points out that : ' . . . considerable strides have been made in the pre cast industry, concrete technology and the placing of concrete including pumping and gunnite applications.' Fawcett A. mentions a number of technological changes as being influential in the improvement of productivity: '. . . **mechanisation**; investment in **plant & equipment**; **prefabrication**; steel buildings & cladding in low rise industrial and storage; steel skeleton , high rise commercial; sectional buildings, including tube frame ; **fewer wet trades**; growth of **ready mixed concrete**.'

b) Technological factors: 'the Last 10 Years': Kelly B. T. points to the introduction of a number of new products and development of new technologies: '. . .

The multiplicity of types of **special purpose fixings**; the development of **push fit pipe jointing systems**; the increased use of plastics; the increase in **factory finishing or part finishing of units**, anodising, stove enamelling etc.; the development of high build stain systems in place of traditional paints which require no skill to apply; the development of **lighter weight components** for example steel lintels instead of concrete; growth in the use of **curtain walling**.' Bonafont R. L. states: ' . . . **Self adhesive roofings** are also coming along, and these make site work certainly safer and more convenient; the development and progressive introduction of **high quality membranes,** such as two layers which can perform better than three traditional layers, or one instead of two.

Harper D. J states: ' . . . I think the greatest impact has arisen from the development of **lightweight construction techniques,** both in housing (timber frame and steel stud frame systems) and industrial buildings (lightweight cladding and lining systems). The key feature of these lightweight systems is the associated reduction in the skilled labour content on site. Shaw R. states: . . **system building,** particularly multi-storied construction, did produce some faults with insufficient factors of safety, particularly taking into account any requirement for maintenance, but the majority of buildings remain sound. In Britain the failure of satisfaction with large estates and multi-storey blocks is a social one and not an engineering failure. . . for industrial buildings **prefabrication and modular packages** are now the tradition.' Loring J mentions the: '. . . focus on skeletal steel-frame multi-storey construction. . .more factory made components. Fawcett A. identifies a number of evolutions' . . . **fewer wet trades. greater use of plastics**; windows, plumbing, drains. . . **lightweight building blocks**. . . growth of ready mixed concrete. . . . **improved materials handling,** pallets, hoists etc. . . .improved control of plant and equipment via computer controlled monitoring, lasers, sophisticated instruments etc.

c) Technological factors: 'the Last 5 Years': Kelly B. T. states ' . . . for the most part buildings are still made from the same materials , steel , timber, brick, concrete etc. Such progress as we have made has been from development of how we use them and how we make them in a form where they are more intensively prepared than before.' David A. contradicts former respondents, he points out : ' . . . the increased use of non-traditional construction materials.' Wilkinson D. also refers to the use of non-traditional materials: ' . . . development and use of new materials e.g. composite products etc. Bonafont R. L states: ' . . . these more recent developments (new Ruberoid products) are designed to improve quality and to save time on site.'

d) Technological factors in the future: Viewing the future, Kelly B. T. states: . . there will be more emphasis on **lightness and simplicity of structures** to cut foundation costs.. . . further **automation of factory processes** will cut unit costs or at least hold them to below inflation. Frost N. states:' . . . there is major change coming from the continent with **improved manufacturing techniques** to produce a large clay tile which is flat enough to lay like concrete tiles i.e. almost skill free laying. Hayward M. C. from the perspective of a building materials producer believes that: ' . . . as far as the building materials industry is concerned the industry has utilised the profits that it has made over the last few years to invest in **new plant and machinery which increases productivity** and also lowers cost. 'Cockburn C. points out the ' . . . introduction of more **computerisation**. Morris P. W. G. also believes in the effects of the' . . . use of **information technology** for greater design construction co-ordination. In agreement with the two latter respondents Fawcett A. also identifies the role of ' . . . **improved control of plant and equipment via computer** controlled monitoring, lasers, sophisticated instruments etc.

5. 3. 5. Productivity on site

a) 'in the last 20 years': Kelly B. T. believes ' . . . the rapidly increasing **cost of labour** in mid sixty's was the force towards industrialised building'. Harper D. emphasises on the role of **lightweight construction techniques** and relates it to the reduction of labour content on site:' . . . I think the greatest impact has arisen from the development of lightweight construction techniques, both in housing (timber frame and steel stud frame systems) and industrial buildings (lightweight cladding and lining systems).The key feature of these lightweight systems is the associated **reduction in the skilled labour content on site**.' Frost. N.: points out the importance of **better site equipment'** . . . in the clay roofing sector we have seen very little change; The actual laying has been assisted slightly by better site equipment.' Cockburn C. considers the development of '. . .**winter building methods**' to have been of major importance.

b) Productivity on site: 'the Last 10 Years': Kelly B. T. points out a few factors , not necessarily with a positive effect, he states: '. . .deterioration in standards of site workmanship. . .use of more unskilled persons on traditionally skilled work.. . .much more work being more correctly described as **fixing than building**. This must continue to develop as fully skilled men become scarcer'. Kelly B.T. points to a major influential human factor: 'Basically what I am saying is that less and **less people want to work outside** in all weathers. As a result the materials industry has been giving most of its time and energy to making products which are more and more finished and require less and

less skill on site'. He also mentions '. . .the growth in use and availability of **'go anywhere ' power tools** both fixed and hand held'. Clark T states ' . . . a general shift into **high-tech - and - traditional** can be detected. Characteristic problems are the huge amount of new learning required to build high-tech well.' Calvert S. M. points out ' . . . the adoption of **off site production associated with high tech. or fast track building methods** which have speeded up construction, and the use of **strictly traditional methods which have had the reverse effect.** Harmes R. D. after describing prefabrication states: ' . . . Following from this prefabrication, we have had various forms of prefabrication in elements of construction until recently, when **fast track building methods and a greater degree of pre-planning** have contributed most to construction productivity. 'Whitson R. C. P. also states: ' . . . a variety of labour saving devices are continually being introduced through improvement in plant, prefabrication and materials handling systems.'

c) Productivity on site: 'in the Last 5 Years': We got very little comments regarding this category in this period. This is probably because of the continuation of trends from the previous period. However, Harmes R. D. points out the continuation of fast track trend, he states: ' . . . **fast track building methods** and a greater degree of pre-planning have contributed most to construction productivity.' Morris P. W. G speaks of .' . . . further **prefabrication and fast tracking.'** Fawcett A. highlights the importance of project management and weather protection methods in reducing wasted time on site, with: ' . . . increased emphasis on planning the whole project to achieve success and reduce time spent on potential problem areas. . .Use of 'envelopes' to protect sites/buildings from bad weather during construction'

d) Productivity on site: 'in the future' Harper D. J says : '. . . there is a lot of mileage yet to be obtained in the development of less labour intensive construction methods, than has been achieved so far. one of the greatest obstructions to building productivity in this country is the high level of site intensive ground and development work. An increased proportion of the time taken to produce a new building is in the ground. Bearing in mind the complexity involved in re-developing inner city sites and the need to reduce wastage of good agricultural land by developing green field sites, it is difficult to anticipate any significant improvements in the area.' Calvert S. M. points out that the future way of: ' . . . speeding up the productivity would be to increase the number of **standard components** in design. ' Loring J. refers to the role of **building component production development**:: ' . . . components: increased manufacturing output; Production standards - quantities; product selection. Harmes R. D. points to the

process of standardisation: ' . . . greater degrees of **standardisation in the housing and commercial developments** where virtually every design at present is a prototype. This situation obviously cannot help productivity and therefore the degree of standardisation must be much greater.' Morris P. W. G. states: ' . . . probably continued prefabrication. Fawcett A. points to a number of influential factors: ' . . **Use of 'envelopes' to protect sites/** buildings from bad weather during construction.. . . mechanisation: continued investment in plant & equipment. . . . greater use of plastics (windows, plumbing, drains) . . . lightweight building blocks .. . .concrete pumping.. . . improved site facilities for workforce and offices for site management.

5. 4. Component building development ('componentisation')

The views of those who referred to the role of component building in the improvements of productivity.

Development of component building in the context of the British Building industry as reflected in the respondents' views are presented in this section according to three periods of last 20, 10, and 5 years. The answers are also categorised according the respondents position in four categories of consultants, contractors, component producers and academics. This, despite the small size of the sample, is to detect any possible pattern, common agreement or difference in their views.

a) Componentisation 'in the last 20 years':A minority, 9 out of 20. of respondents' comments indicated that the development of new components have been influential in the gains of productivity in the British building industry in the last 20 years. They were:

<u>Consultants</u>

1. Shaw Roger.'. . .industrialisation, prefabrication and mechanisation have stemmed directly from the building industry and architects have had very little influence other than as employees within the industry'.
2. Sykes Michael. '. . . we suppose the biggest changes which we have found beneficial over the last decade or two, have been things concerning off-site fabrication, like roof trusses and door sets'.

<u>Contractors</u>

1. Fawcett A. (Dr.): 'Prefabrication. . . early attempts not successful but showed potential, steel buildings and cladding in low rise industrial and storage, sectional

buildings including tube frame, fewer wet trades'.

2. Morris Peter W. G: '. . . probably building components'.
3. Whitson R. C. P: '. . . considerable strides have been made in the pre-cast industry, concrete technology and the placing of concrete'.

Component manufacturers

1. Bonafont. R. L.'. . . as far as roofing construction is concerned, there has not been as much prefabrication of decking elements as there has been in certain parts of Europe.
2. Harper. Digby. J. '. . . from a building materials point of view I think the greatest impact has arisen from the development of lightweight construction techniques, both in housing (timber frame and steel frame systems) and industrial buildings (lightweight cladding and lining systems). The key feature of these lightweight systems is the associated reduction in the skilled labour content on site'.
3. Joshi. A.: The answer is one word; 'plasterboard'.

Academics

Loring John. '. . .expansion of British manufacturing base for materials and components inadequate for demand; increased import of European materials and components.

b) Componentisation 'in the last 10 years':15 out of 21 respondents pointed to various aspects of the developments in 'component building' during the last 10 years as the most influential causes of increased productivity in Britain.

Consultants

1. Calvert SM.: '. . . the adoption of off-site production associated with high tech. or fast-track building methods which have speeded up construction, and the (increased) use of strictly traditional methods which have had the reverse effect.
2. Shaw Roger. : '. . . for industrial buildings, prefabrication and modular packages are now tradition'.
3. Sykes Michael. : '. . . we suppose the biggest changes which we have found beneficial over the last decade or two, have been things concerning off- site fabrication, like roof trusses and door sets'.

Contractors

1. Fawcett A (Dr.): '. . . Steel buildings & cladding low rise industrial and storage; Some sectional buildings, including tube frame; Fewer wet trades; Greater use of

plastics; windows, plumbing, drains; Lightweight building blocks; Growth of ready mixed concrete'.

2. Harmes RD. : '. . . We have had various forms of prefabrication in elements of construction until recently, when fast-track building methods and a greater degree of pre-planning have contributed most to construction productivity.
3. Whitson R. C. P. : '. . . a variety of labour saving devices are continually being introduced through improvement in plant, prefabrication and materials handling systems'.

Component manufacturers

1. Bonafont R L.: '. . . there has not been as much prefabrication of decking elements as there has been in certain parts of Europe; the development and progressive introduction of high quality membranes, such as two layers which can perform better than three traditional layers, or one instead of two; Self adhesive roofing is also coming along, and these make site work certainly safer and more convenient' (,and perhaps quicker).
2. Frost N. : '. . . in the clay roofing sector we have seen very little change; The actual laying has been assisted slightly by better site equipment'.
3. Harper D. : '. . .I think the greatest impact has arisen from the development of lightweight construction techniques, both in housing (timber frame and steel stud frame systems) and industrial buildings (lightweight cladding and lining systems). The key feature of these lightweight systems is the associated reduction in the skilled labour content on site'.
4. Jennings David A.: '. . .The increased use of non-traditional construction materials'.
5. Joshi. A.: '. . . the two fundamental changes in building practices have been ready-mixed concrete and plasterboard'.
6. Kelly B. T. **:** '. . . much more work being more correctly described as fixing than building; This must continue to develop as fully skilled men become scarcer; Basically what I am saying is that less and less people want to work outside. . .the materials industry has been giving most of its time and energy to making products which are more and more finished and require less and less skill on site; The multiplicity of types of special purpose fixings; The development of push fit pipe jointing systems; The increased use of plastics; The increase in factory finishing or part finishing of units anodising, stove enamelling etc.; The development of high build stain systems in place of traditional paints which require no skill to apply; The development of lighter weight components, for example steel lintels instead of concrete; Growth in the use of curtain walling'.

7. Wilkinson David : '. . . development and use of new materials and components'.

Academics

1. Clark T. : '. . . a general shift into high-tech and traditional can be detected. Characteristic problems are the huge amount of new learning required to build high-tech well'.
2. Loring J. : '. . . low investment in construction craft or component manufacture; Some limited increase or continued rationalisation of building manufacturing capacity and construction capability.; Market led demand for commercial/retail accommodation. Rapid pre-contract/construction timetable: Focus on skeletal steel frame multi-storey construction. Factory made components; Professional/ Industrial response to new methods except in component design; High level of imported components.

c) Componentisation 'in the last 5 years': In this period 65% (10% less than the last 10 years) identified developments in component building as being the most influential in the gains in productivity.

Consultants

Sykes Michael.: '. . . we suppose the biggest changes which we have found beneficial over the last decade or two have been things concerning off-site fabrication, like roof trusses and door sets'.

contractors

1. Fawcett A. : '. . . Prefabrication: Steel buildings & cladding low rise industrial and storage; Steel skeleton , high rise commercial; Sectional buildings, including tube frame; Fewer wet trades: Lightweight building blocks; Growth of ready mixed concrete: Concrete pumping.'
2. Harmes RD. : '. . . fast-track building methods and a greater degree of pre-planning have contributed most to construction productivity'.
3. Morris Peter. : '. . . further prefabrication and fast-tracking'.
4. Whitson R. C. P. : '. . . a variety of labour saving devices are continually being introduced through improvement in plant, prefabrication and materials handling systems'.

Component manufacturers

1. Bonafont R L. : '. . . these more recent developments (new Ruberoid products) are

designed to improve quality and to save time on site.'

2. Harper Digby : '. . . from a building materials point of view I think the greatest impact has arisen from the development of lightweight construction techniques, both in housing (timber frame and steel stud frame systems) and industrial buildings (lightweight cladding and lining systems)'.
3. Jennings David A. : '. . . the increased use of non-traditional construction materials'.
4. Joshi. A. : '. . . on the actual style of organisations, it is the 'fast-track approach that has been the latest contribution to the construction output rates and we would have thought the latter would be more appropriate in your case.
5. Kelly B. T.: '. . . the most part buildings are still made from the same materials , steel , timber, brick, concrete etc. . . Such progress as we have made has been from development of how we use them and how we make them in a form where they are more intensively prepared than before'.
6. Wilkinson David : '. . . Development and use of new materials and components.

<u>Academics</u>

1. Charles Cockburn : '. . . improved component design procedures, supply and distribution.'
2. Loring John : '. . . rationalised expansion of the do-it-yourself component market. Industrial manufacture + retail interests; High value added financial return'.

6. Summary and conclusion

Methodology: The 'system approach' employed in this research involved the study of the background, development, current conditions, and environmental interactions of different parties involved in the Iranian building industry. To explore the relevant issues and reach conclusions, a combination of empirical evidence, theoretical perceptions and a number of methods of analysis have been used. It also involved a pilot survey in the context of the British building industry and the field study in Iran. The latter consists of the survey report and data analysis as well as primary and follow up interviews. The research also involved a detailed examination of the structure and organisation of the building industry.

Data collection methods used in this study were: a continuous literature survey during the course of the study, of English and Persian sources; a pilot questionnaire survey in the British context; a number of interviews in the Iranian context; a structured questionnaire survey in the Iranian context; and a number of follow up interviews. The author's 25 years professional experience and active participation in different professional institutions have contributed both in the provision of data and in their analysis.

Participant observation is often used by academics and professionals in human studies. It is viewed that this method is useful in the exploratory and descriptive stage of research. 'Qualitative descriptions generated by participant observation are used to formulate concepts for measurement, as well as generalisations and hypotheses that with further testing may be used to construct explanatory theories'[29]. However the author's participation and direct involvement in almost all sectors of the Iranian building industry is reflected in explaining the nature, structure, and organisation of the industry and its problems from different viewpoints.

The study of building traditions, combined with the author's personal experience, led to the recognition of the unique nature, structure and organisation of the local construction industry. These whilst having separate institutions and operating in different ways should not be considered as separate organisations, as they influence each others behaviour, standards of operation, and goals. All these led to the formulation of the first hypothesis.

The background reading about 'industrialisation' both general terms and in the non-western world in particular, led to the recognition of the importance of 'productivity' as a concept and its implications for economic development and the construction industry.

This concept, in turn helped in the analysis of data and the formulation of the theory leading to the conclusions. Apart from the use of well-established concepts such as 'productivity' the research also dealt with 'concept formulation'. The concept of 'componentisation' emerged in a tutorial session, while 'industrialisation' was being discussed along with the use of components and resulting effects on increasing productivity. 'Componentisation', as an appropriate method of industrialisation, became the basis of the the second hypothesis (first introduced in concluding section of the theoretical discussion in Chapter 4).

This study of the socio-economic environment of the construction industry has used statistical data as well as the identification of causal relationships between those factors which affect the development of the industry. In order to support the main arguments of this dissertation in addition to other methods of gathering data, it was felt necessary to carry out field work to provide empirical data. Prior to the field survey in Iran, an open questionnaire survey was carried out in the context of the British building industry. This survey was selected as an example with two goals in mind. Firstly, it was assumed that exploring the issues raised in this survey may help a better understanding as well as provide more opportunity to examine the issues which may apply in the case of Iran. Secondly, it was seen as a pilot study to assist us in the development of the questionnaire and the approach to be taken in conducting the field survey.

Findings of the pilot survey: In this summary we will highlight the points which the respondents made in reply to the questionnaire.

<u>Government policies</u>:

The construction industry, as one of the main regulators of the economy, often suffers from the governments' economic policies:

1. The unregulated national building programme 1968 - 74 for both public and private sector.
2. Political incentives from central government towards industrialisation and prefabrication to solve the housing problem and consequent social problems.
3. Unstable economic conditions and their adverse effect on investment in training and equipment.
4. Fluctuation in demand directly caused by the government (public construction), or indirectly as a result of mismanagement of the economy, which affects market confidence.

In the last 25 years, 'politics and the state of the economy most influenced building and

construction productivity '.

Looking to the future the respondents gave more weight to political environment and possible changes as a result of the EEC developments. Other issues which were raised were, for example, the imposition of VAT on commercial buildings which may affect the balance between new construction and refurbishment, and therefore methods of construction. Another example was government legislation for stabilising labour relations which directly affects labour productivity. Or 'the effect of increased legal activity on product and contractors liability which may induce changes in the structure and organisation of the industry'. Some believed that, 'if the economy were well regulated there would be a fairly constant demand for materials and skills, and therefore less waste of materials and training'.

Market conditions: Investment in training, equipment an development of the building component industry is considered to be crucial for the improvement in building productivity:

1. The private sector's decision to invest in construction depends upon the strength of industry and the profits made'.
2. Investment in the industry also needs a realistic consideration of future demands.
3. 'The Oil crisis leading to a rapid decline in building market' have had negative effects.

'change comes about by market forces, very often influenced by government and those changes are often perverse'.'The political will over the "last 10 years" has favoured commercial competition to the virtual exclusion of local authority projects. This increased the demand for smaller scale construction for which traditional methods, such as prefabricated timber framing, are more appropriate.

'In the last 5 years' (1984-89), the major influence on building is said to be 'the availability of cheap money and the growth of new (market led) initiatives in the private sector. leading to buildings for small businesses, light industry and leisure:

1. Growth in the housing sector, which led to rationalised expansion of the Do - It - Yourself component market.
2. 'The free market in goods from 1992 onwards may well affect prices of materials and labour in some EEC member states'.
3. EEC codes to more standardisation which will reduce the choice available to designers.
4. Competition will mean that 'at the end of the day cheapest building method

acceptable will prevail.

Organisational factors: procedures The increasing emergence of specialised sub-contractors and the subsequent effects of incentive (as a human factor) was highlighted in the importance of the organisational change for improvement in productivity:

1. Small sub-contractor, which in the main provide 90% of construction work on a project, have a greater incentive than the employed labour to increase productivity.
2. Sub-contractors who carry out the work for a fixed price reduce the contractors risk and transfer their commitment to employees.
3. Development of new client groups and community Co-operatives.
4. Changes in the methods of contract (management contracting, growth of design and built packages, and project management)
5. Improved information and contract document.
6. The fast track approach which has been the latest contribution to construction output.
7. The industry's training bodies need need to create recognised professional site management qualifications.'
8. The role of training bodies in both contractor and trades level
9. The importance of building durability and 'building life'.
10. The use of site operatives who have had a proper apprenticeship would help raise standards thus would improve buildings life.
11. The maintenance sector was mentioned as being under-funded and unco-ordinated.
12. Development of building codes along with quality control procedures.

Improved component design procedures, supply and distribution, all require necessary changes in both site organisation and the organisation of the industry as a whole.

Technological factors: For the most part buildings are still made from the same materials , steel , timber, brick, concrete etc. 'Progress have been made from development of how we use them and how we make them in a form where they are more intensively prepared than before.' Improvements of productivity is also attributed to a number of technological changes as well as the introduction of new building materials and components. The major points raised were:

1. Mechanisation; prefabrication; rationalisation of traditional building.
2. Steel buildings & cladding; sectional buildings including tube frame.
3. Growth of ready mixed concrete.
4. The multiplicity of types of special purpose fixings; the development of push fit pipe jointing systems.

5. The increased use of plastics.
6. The increase in factory finishing or part finishing of units.
7. The development of lighter weight components particularly lightweight building blocks.
8. The development of lightweight construction techniques, both in housing (timber frame and steel stud frame systems), and industrial buildings (lightweight cladding and lining systems.

In the future there will be more emphasis on lightness and simplicity of structures. Further automation of factory processes will cut unit costs. Introduction of more computerisation, use of information technology for greater co-ordination between design and construction, improved control of plant and equipment via computer controlled monitoring, lasers, sophisticated instruments etc. will further reduce the labour content and probably lead to better quality. A point worth noting is the importance of training to enable site-personnel to take maximum benefit from the introduction of emerging technologies.

Productivity on site: labour productivity: The rapidly increasing **cost of labour** in the mid sixties was the force towards industrialised building. Another point mentioned was the fact that less and less people want to work outside in all weathers. As a result the materials industry has been giving most of its time and energy to making products which are more and more finished and require less and less labour as well as skill on site. A few factors were mentioned as adversely affecting site productivity such as the deterioration in standards of site workmanship and the use of more unskilled persons on traditionally skilled work. This again refers to the importance of training. Other major factors mentioned were:

1. Better site equipment the growth in use and availability of 'go anywhere ' power tools both fixed and hand held.
2. The development of winter building methods (Use of 'envelopes' to protect sites/buildings).
3. The adoption of off site production associated with high tech. or fast track building methods.

There have been various forms of prefabrication in elements of construction until recently, when fast track building methods and a greater degree of pre-planning **(management)** have contributed most to productivity on site. The problem is that a huge amount of new learning (**training**) is required to build high-tech well. It is ironic that respondents often point to the importance of management and training only indirectly.

Component building:

In the last 25 years component building has changed both in its meaning from a more closed system to open and versatile 'loose fit' componentisation, and from the more simple technologies to high tech. However, the opinions demonstrated here show that developments in component building and their share in the improvement of productivity have been steadily increasing between the last 15 to 25 years. A total of 9 respondents (comprising 2 consultants, 3 contractors, and 3 component manufacturers) referred to the effects of prefabricated building components as an influential factor in the improvement of building productivity. A total number of 15 respondents (comprising 3 consultants, 3 contractors, 7 component manufactures and 2 academics) referred to development of component building and product development as being significant in the last 10 - 15 years.

In the last 5 - 10 years the trend towards component building has continued. But the opinions show a slight sign of decline in the share of the concept. A total of 13 respondents, 1 consultant 4 contractors 6 component manufactures and 2 academics, referred to the role of various building components as being influential in productivity gains. But at the same time other new ideas which have increasingly reduced the number of operations, and thus the non-productive time on site, are encouraged through the availability of more components replacing site operations. The share of other industries and institutions in the development of new components have been significant. However, this shows that developments have been evolutionary and gradual. This may have been as a result of the slower pace of necessary changes in the organisation of the building industry, related institutions , and the building component industry.

The survey as a pilot study: lessons learnt: This survey was also seen as a pilot study to assist in the development of the questionnaire and the approach to be selected for conducting the main survey. It was believed that exploring the issues raised in this study provides necessary information to determine the extent of questionnaire coverage in the main field survey.

Considering the British context, the fairly homogeneous sample, and the characteristics of the respondents, a 50% to 60% response was expected. This was proved to be a distant expectation. The fact that 39 replied, only 21 had actually answered the

questions, and some misinterpreted the questions, may be attributed both to the questionnaire design and the method of conduct.

Although 'postal surveys are a favoured way of seeking to acquire data from a large number of respondents'[30] they are associated with a number of problems. 'The biggest problem with the postal questionnaire is that it is only somewhat tenuously a primary data gathering method. The investigator may have no direct contact with his respondents who may interpret his questions very differently from his intention'[31]. This pilot survey served to prove that a postal questionnaire must be excluded in the survey in Iran. A direct contact with the respondent can serve two main functions. Firstly, to encourage the respondents to answer the questions, and secondly to eliminate misinterpretations.

Interviews seemed to fulfil those criteria but they had to be excluded for a number of reasons, among them the large size of the sample, difficulty to making appointment with *memars* and other professionals (due to the difficulties of post war situation), difficulties in finding and training appropriate interviewers, and so on. The questionnaire had to be designed for self-completion, leaving problem of contact with the respondents to be solved. How? The solution is explained in detail in Chapter 6.

7. End notes

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[1]Lawrence J. R.; Operational Research and the Social Sciences; 1966; p 77

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[5] Krausz E. and Miller S. H. ; Social Research Design ;1974, p4

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[7] Howard K. and Sharp J. A.; The Management of a Student Research Project; 1983;p 106

[8] Op. cit.Krausz E. et al.1974, p4

[9] Ibid p1

[10] Op. Cit Howard K. et al ; 1983 p100

[11] Jorgensen Danny L.; Participant Observation;: A Methodology for Human Studies 1989 p27.

[12] Op. cit Krausz E. and Miller S. H; 1974 p2

[13] Op. cit. Howard K. et al_1983p110

[14] Ibid p70

[15] Ibid p 71

[16] Ibid

[17] Ibid p 123

[18] Peattie, 1983; quoted as in Barakat S.; Reviving War - Damaged Settlements: Towards an International Charter for Reconstruction After War' D. Phil dissertation in Architecture; University of York 1993 .p 166

[19] Mitchell M. and Bevan A.; Culture, Cash and Housing: Community and Tradition in Low-income Building; 1992 p 119

[20] Jorgensen D. L. Participant Observation: A Methodology for Human Studies ; 1989 p7

[21] Op. cit. Jorgensen P. p 22

[22] As a result of constant devaluation of Iranian currency in this period, the equivalent worth in Pounds is hardly to calculate.

23 Maclennan. Duncan, Housing Economics. Longman 1982

[24] Op. cit. Mitchell M. and Bevan A.;1992; pp 62-65

[25] Gardner G. Social Surveys for Social Planners 1978 p 111

[26] Op cit. Howard K.et al; 1983 p 124

[27] OP. cit. Howard K. et al p 107

[28] Social and community planning research; Questionnaire Design Manual 1972; p 59

[29] Op. cit Jorgensen D. L. p 7

[30] Ibid p138

[31] Ibid

CHAPTER 6
The survey and the implications of the findings

1. Introduction

This Chapter is an account of the field study in Iran comprising structured questionnaire survey and open interviews. Open interviews were carried out prior to the survey in order to help design the questionnaire and identification of possible problems to find an appropriate method of conduct. Follow up interviews were carried out to complement the information provided by the questionnaire survey. This involved professionals working in both the modern and the traditional/ conventional sector of the building industry in the Fars Province of Iran during Jan. - Feb. 1990[1]. The intention was to provide more empirical data about the main themes of this study, i.e. factors affecting productivity, and the problems of production and marketing of building components. The data will be used in the final assessment of the hypothesis 2 in the conclusive Chapter. It will also provide more information on the organisation of the industry to be used in examining hypothesis one.

Firstly, a brief account will be given of the reasons for conducting the survey, and its relevance to the objectives of the research. An account of the methodology will be given followed by identification of the sample, the method of conducting the survey, and the design of the questionnaire. Finally survey results and findings will be presented. The results of the prior and follow up questionnaire will be given where appropriate in conjunction with results of the structured questionnaire .

The main objectives of the survey are: 1) to identify the factors affecting productivity on site; 2) to study the use of building components in the conventional building process; 3) to identify the problems of the establishment and production of building components as a continuation to increased productivity.

2. Methodology.

One of the most common methods used in social research is the questionnaire survey. It is well known that social scientists often gather their data by open or closed structured or less structured questionnaires.

A combination of methods have been used; participant observation when visiting sites and factories, in addition to open interviews with various practitioners, as well of a pre-designed questionnaire. In addition, the authors' 25 years of experience in the building industry in a variety of roles has been employed, particularly in designing and conducting the survey and in arriving at the conclusions. The author coming from a family of *memar*s, have been closely involved in both modern and the T/ C sector. In the modern sector both as a contractor and as a consultant. As a contractors in different positions of responsibility have been involved with factors affecting productivity on the site and company level, and also the establishment of factories to produce building components. As a consultant have concerned with the problems of the design and the use of building components. In addition to variety of positions in the modern sector the author have always had a private practice involved in the design of residential and commercial buildings in the T/ C sector dealing with memars and private clients as well as materials and component producers and distributors. However it was considered appropriate to find out the opinion of the 'professionals' as first hand 'expert knowledge' against the author's views based on experience and research findings.

Here architects, civil and mechanical engineers, *memars*, and technicians are all referred to as professionals. Their positions or involvement were in: design / consultancy and contract management; whilst a number of them were also involved in material and component production. The author has sought the opinions of these professionals on those issues with which they have been either directly involved in their profession, such as factors affecting productivity, or indirectly, such as the clients' response to new building component products.

Although the purpose of this Chapter is not to further expand the already existing literature on research methodology, it will be helpful to introduce the research techniques employed in this study. There were three stages in the preparation of the questionnaire: 1) Identification of sample; 2) The method of conducting the survey; 3) Design of the questionnaire.

The relatively easy method of computer analysis may tempt the researcher to ask too many questions, many of them not precisely relevant to the research. In designing the questionnaire and formulating the questions, the researcher also runs the danger of manipulating data according to his or her own interests and views. In order to mitigate these problems, the questions were mainly those which were raised during the interviews

and discussions with a randomly selected pilot group of professionals involved in the building industry in the province of Fars. Moreover, in order to provide a platform to reflect the respondents' views, an 'open' option question was provided at the end of each question.

The questionnaire design was not aimed at the collection of all the data to provide empirical evidence in support of all the views expressed by the author in this dissertation, as some relevant data was more appropriately collected by open interviews from the author's own knowledge. Rather it was designed to collect information to clarify different aspects of the main themes of this research, i.e.: factors affecting site productivity, usage and pattern of acceptance of different building components, and problems encountered when establishing factories for the production of building components.

3.1. Identification of the sample:

The survey sample comprised architects, engineers, technicians, and *memars* who were involved in the T/C and modern sectors of the building industry in Shiraz, the capital of Fars province.

The reason for choosing Shiraz was two fold. The first was that Shiraz could be considered as a typical large Iranian city, while Tehran or Mashhad, for example, could not. Tehran because of a large difference in scale and type of buildings, and Mashhad because of the situation of land ownership. In Mashhad traditionally almost all the land belongs to the Shrine of Imam Reza, an *Aughaf* foundation (an Islamic type of charitable organisation). Although climatic conditions do not have major implications in this survey, except for the weather effects on site productivity, Shiraz with cold winters and hot summers can be also considered, to certain extent, as having a typical climate. Shiraz and most of other cities of Fars province are located in 'arid' zone except for southern cities of the region which are located in hot and humid zone. Temperature in arid zone varies between 35-40 degrees in summer and 0 to -5 in winter. See appendix 1 for more information.

However, the second reason was that the author had already worked in Shiraz since 1966, whilst previously working in Mashhad between 1963 - 66. This meant that more help and support was expected from the professionals both in the CI and T/ C sector in

conducting the survey. There is more on this later in 'the method of conducting the survey'.

The rationale behind choosing the professionals rather than the contractors and consultants was the belief that a survey of contracting and consulting companies would exclude professionals involved in the conventional sector, particularly the *memar*s. Whereas a survey of professionals would include both sectors.

A survey of the companies, as attempted by Ghanbarai Parsa[2], would not only miss *memar*s, whose role and views constitute an important contribution to the building industry as a whole, but also the role of the modern sector professionals. Increasingly, as a result of *Ghanoon-e Nezam-e Memari va Sakthemani* (The Law of Architecture and Construction Order), a considerable proportion of the architects and engineers are involved in the two sectors at the same time. For example, a civil engineer may have a government job in the local office of MHUD, or any other government sector office - or private contracting company, and at the same time run a private office involved in private sector housing design.

Architects and engineers, although to some extent involved within the T/C sector, consider themselves as representing the modern sector; as their main source of work usually lies there. The *memar*s, however are almost exclusively representative of the traditional/ conventional sector. Most of the architects and engineers questioned were members of the Society of Architects and Engineers of Fars province (SAEF), whilst the *memar*s and technicians were members of the *Memar*s and Technicians Union (MTU). All of them have been involved in the building industry for over five years and in some cases much longer. It must be noted that while members of SAEF represented the majority (nearly all) of the architects and engineers involved in private sector residential building in Shiraz, the number of the *memar*s who were members of MTU did not form the majority. However, the *memar*s who are members of MTU are from the higher strata of the profession and all of them have a degree of formal education in addition to a great deal of experience.

At the time the survey was conducted the total number of SAEF members were 195, of whom 30 were architects, 149 engineers, and 16 mechanical engineers. The total number of MTU members was 102, of which 73 were *memar*s and 29 technicians. But as to the matter of 'proportional representation', it must be noted that there are no official statistics on the total number of *memar*s in Shiraz. According to the authors

estimate there are around 750 *memar*s working in the city of Shiraz[3]. Thus the MTU represents 10% of *memar*s as a whole.

After the revolution in 1980 in a national policy of coalition, an institution named '*Ettehadiehe mohandesin memaran va teknesianhaye sakhtemani va taasisati*' (Association of Architects-and -Engineers, *memars*, and technicians of Fars) was registered in Shiraz. Four years later in 1984 *memar*s and technicians were separated to form the MTU. The architects and engineers changed their associations' name and constitution to become SAEF.

The main aim of SAEF as declared in its constitution is: 'With the aim of improvement of building construction in the cities (of the Fars province) from the architectural, technical and constructional points of view; as well as collaboration with the local authorities (Municipality, governor general office, regional offices of MHUD, etc.) ; the prevention of the waste of national capital (in the form of housing investment); as well as preservation of the members' rights. From the beginning the majority of those architects and engineers who became members of the Association, were involved in private sector residential building. Since its establishment in 1980 the SAEF was aware of the need for an improvement in the technical knowledge for the *memar*s and of continuing education for all professionals. This policy was carried out through sessions of 'educational programmes' held on average twice every month. The SAEF also gained a good reputation by holding two seminars at the national level. The author took part in six of these occasions between 1980 and 1986 as a tutor.

The author has been intensively involved in the establishment and activities of all these institutions since 1980 and was later elected as the vice chairman of SAEF for a period of two years in 1986. The establishment of the Fars Province Building Contractors Association FBCA in 1980 was also initiated by the author, who was later elected as the chairman serving the Association between 1983-84. Friendship and good relations with professionals has been extremely helpful to the author, both in the conduct of the survey and in the earlier stage of questionnaire design.

3.2. The method of conducting the survey.

The survey was conducted at a single session of one of the educational programmes. This method was chosen with the help and advice of the Board of Directors of the

SAEF. The gathering was arranged by them with the University of Shiraz kindly providing the venue.

In the prevalent circumstances of post-war reconstruction[4], with its intense difficulties resulting from material shortages, as well as other problems, these colleagues had other priorities with little time to spend on filling in questionnaires. Besides, the typical Iranian professional, particularly the *memar*, are not accustomed to giving interviews or filling in questionnaires. Arranging individual interviews was very difficult, particularly with the *memar*s who usually operate without an office. The interviews were certainly extremely time consuming. The author was quite convinced that a posted questionnaire would be neglected. Moreover the experience of the earlier pilot survey[5] was consistent with that idea.

Distribution and completion of the questionnaire in a single session had some other advantages over doing it by mail. Many *memar*s operate from *Ghahva Khanah* (coffee house) and they could be directly contacted only in person or through their union (MTU). At the meeting however, there was an opportunity for the author to clarify the purpose of the questionnaire and the meaning of questions. It was an opportunity to answer any queries.

If they had been invited to come specifically to fill in a questionnaire, a good response could not be expected. However, it was decided to follow the familiar pattern of an educational programme and as a result of the SAEF's reputation a reasonable response was expected. So there were two tasks involved in that session. First was to give a talk on the subject: 'An approach to increase productivity in the context of the building industry', and second the participants' were asked to complete the questionnaire.

There was a discussion concerning which stage should go first. The SAEF directors wanted the author to talk first and then ask the audience to fill in the form at the end of session. It seemed to the author that in this way there was a risk of manipulation of ideas. When the talk was directly in relation to the survey, it could affect the audience and bias their ideas. The other worry was that at the end of session the audience were more tired and some may choose not to fill in the questionnaire. On the other hand, it was the first time that the issue of 'productivity' was brought under discussion and scrutiny. Many, although quite familiar with its implications, did not have a clear definition and idea about productivity. This was evident in the pilot survey that some respondents did not distinguish between profitability and productivity. In the event it was decided that the

questionnaire be completed first after a brief introduction to the issues by the author.

The venue was the *Talar-e* Amir Kabir (Amir Kabir Auditorium) Faculty of Engineering University of Shiraz on Saturday 3d June 1989 (Friday is the weekly day off in Iran), almost a year after the war ended. The task of invitations had to be left to the SAEF. As a usual procedure an invitation letter[6] was sent to all architect and engineer members of the SAEF, as well as a letter to the *Memar*s and Technicians Union (MTU) asking them to invite *memar*s and technicians. In addition to that a brief invitation was published twice in *Khabar*, the local paper, the second was two days before the event as a reminder.

3.3. The design of the questionnaire

The questionnaire was designed to cover the questions which needed to be asked on the one hand whilst considering the respondents knowledge and ability to answer on the other. The diversity of the level of formal education of the respondents was among the factors that made this particularly difficult. Despite the author's awareness of the subject - and the language which *memars*, architects, and engineers use in discussing their problems, the questionnaire, as an instrument of communication, had to be tested. 'Piloting or pre-testing of a questionnaire is essential if its weaknesses are to be eliminated prior to the start of the main survey.'[7]

This was done by asking a small group of respondents to fill in the questionnaire followed by a discussion to hear their criticisms. The discussion was necessary because 'examination of the answers obtained can only indicate gross misunderstandings of questions and, if the questionnaire is mainly pre-coded, may not even show these.'[8] In the course of these tests it was apparent that some words, although having been carefully chosen for by both architects and *memar*s, still required further definition. However each group of questions was accompanied by one to four lines of explanation. The wording was carefully chosen to reduce confusion to a minimum, with due consideration for the diversity of the respondents knowledge. For example in the seventh option on the use of concrete blocks it was decided that the phrase 'bad quality of blocks' be changed to 'the blocks are not made properly', a phrase that memars use in their conversation and are more familiar.

The layout and presentation of the questionnaire was designed to match the method of

the survey's conduct. As it was to be filled in a single session of more that a hundred respondents, it was decided that the questionnaire must not be lengthy and preferably be limited to two pages of A4 paper. Questions were grouped and each group were framed separately so to allow separate treatment and provide intervals of thinking, filling, checking of each group and probably a minute of rest before starting another group. For questionnaire layout and more details on the design and the type of questions see appendix 4

The survey was designed using pre-coded questions to allow for the data to be computer processed. But was considered that some open ended questions would enhance the survey results. Open ended questions 'would naturally defeat the object of a structured questionnaire if most of the questions were not pre-coded, but equally it would defeat the object of detailed attitude research if there were not a few questions which encouraged respondents to use their own words and phrases to describe their own feeling or preoccupation.'[9] All groups of questions were designed with an optional open question at the end.

If the number of options equals the number for choice, and the respondents choose all options, the result of frequency test would be equal for all factors. In questions 4 to 8 the number of choices were given to be less than the whole options in each group of questions. For example in group 4 (factors affecting productivity) there were eight boxes to tick and the respondents were asked to choose and tick five more important factors. (See questionnaire in Appendix 4). This allows to determine the relative importance of various factors by frequency test, as some of the factors would not be chosen by some and some others by the others the number of response count on each question would be different. The respondents were also asked to mark their response with a value, for example between 1 and 4 so that the most important factor gets the highest value. This method of scoring helped to highlight the significance of each factor with greater contrast and accuracy.

4. Survey results and findings

The questionnaire was analysed by the use of the SPSS-x computer software package, and the open option comments were extracted manually. To test the computer analysis procedure, a random check of some of the computer results were carried out and proved satisfactory. As to the comparison of the results with other surveys or data which could

be considered as 'norm', unfortunately such a norm or similar survey, to the knowledge of the author, does not exist. Previous research on the Iranian construction industry did not include the T/C sector, and even in the case of the modern sector they lack detailed data resulting from actual surveys.

The most recent survey on the construction industry is by Ghanbari Parsa which exclusively deals with the contractors in the modern sector. Parsa's field survey is different from ours both in context and nature. However in his Question 6, categorised as 'problems and solutions' he finds out that: 'In considering the problems and some solutions which were listed, the respondents were asked to mark their response with a value between 1 and 5. In section A of Question 6 the main problems were listed as: materials, equipment, workers, credit facilities, and shortage of government investment. This question is to a certain extent comparable with the Question 4 'factors affecting productivity'. The results of the survey, consistent with Ghanbari's, indicated that: 1)material, 2)equipment, and 3) labour ranked in descending order as 'the most serious problems facing the contractors' in his case; and as 'factors adversely affecting productivity in this case'. However the results did not contradict either the views of the author or the other findings from various interviews and from intensive research on available literature presented in the previous chapters.

5. Composition of the sample.

The first group of questions solicited factual information about the respondents title and the type of job they were involved, in order to be able to classify the sample into its sub-groups. These questions were designed to identify the title and position of respondents as well as the type of projects with which they were involved. Another aim was to find out to what extent architects and engineers were involved in private, single-owner built projects, which in turn was an indication of the involvement of these professionals with the T/ C sector, and also to determine to what extent *memar*s were involved with the modern sector.

More than 180 attended the session and received the questionnaires, of which 151 returned the filled in questionnaire. Of the total respondents there were: 30 *memar*s; 65 engineers; 21 architects; 11 service engineers; and 20 technicians. If a few non-member respondents (of SAEF or MTU) who may have attended as a result of the paper advertisement are ignored (probably those who did not return the questionnaires), it

would be safe to assume that from 195 members of the SAEF, 97 (nearly 50%) answered the questions. This was considered by the SAEF colleagues as a good return. Of the 102 total MTU members, 50 of them filled in the questionnaire, again nearly 50%. Of the 73 *memar* members of the MTU 30 of them, about 41%, filled in the questionnaire.

Figure 6: 1.

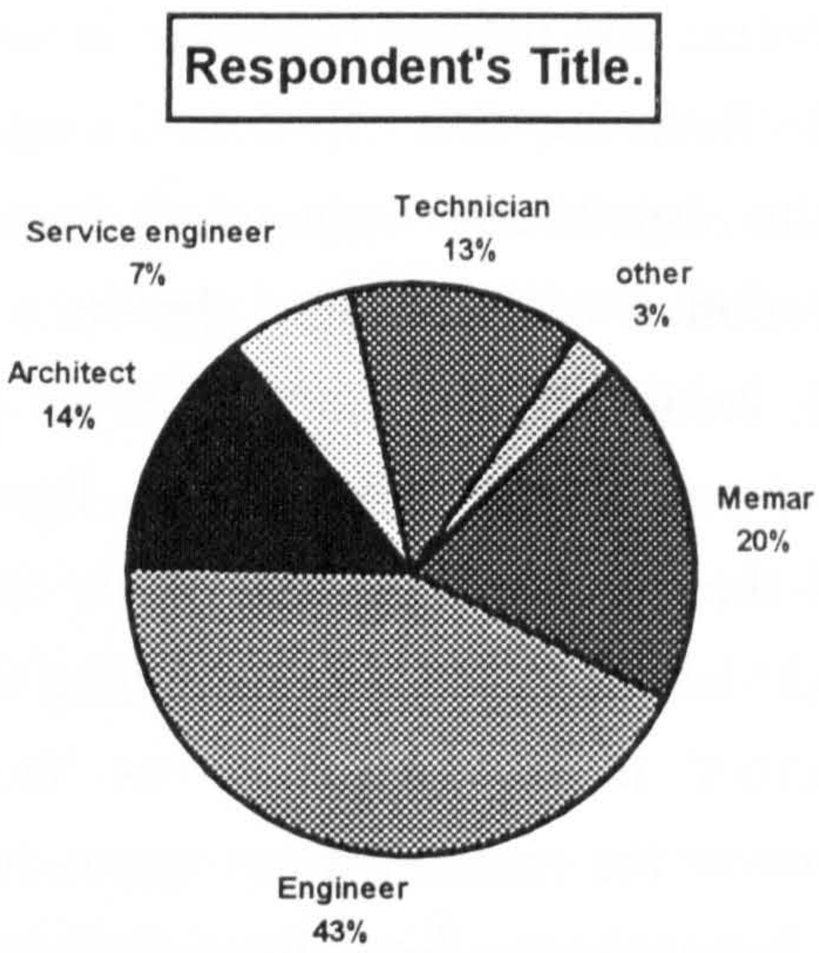


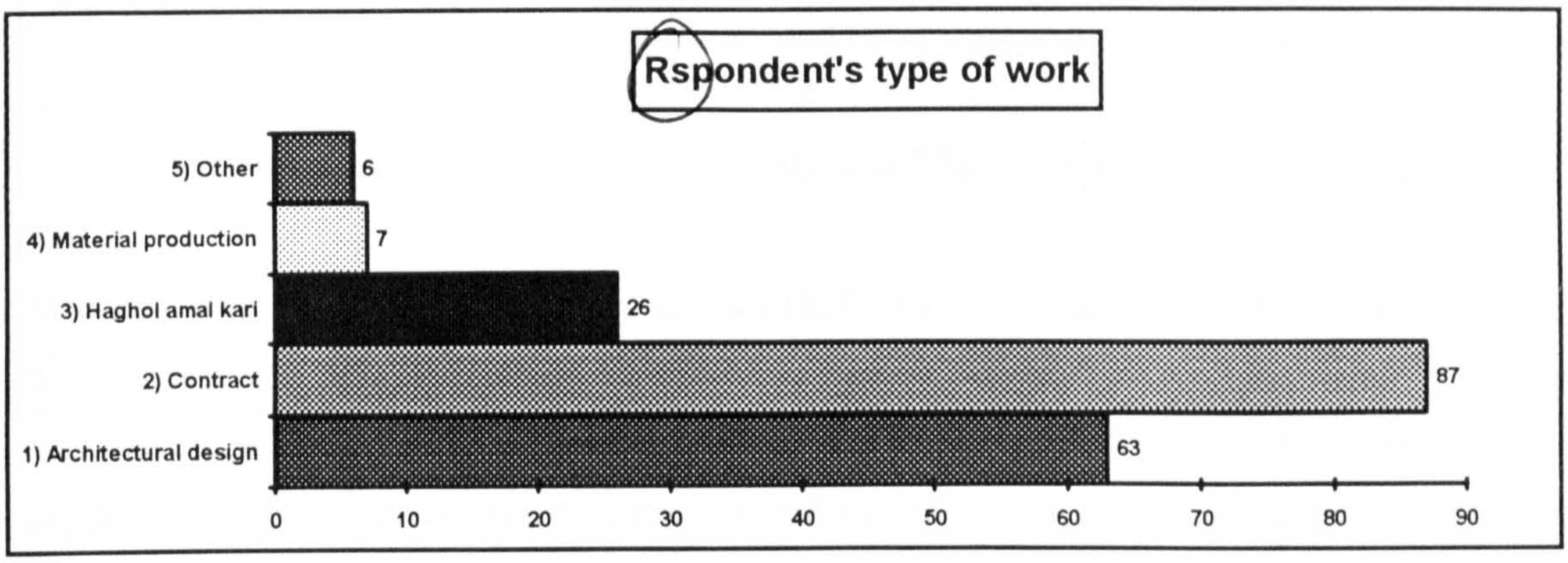
Figure 6: 1 shows the structure of the sample in terms of their title. The figure clearly shows the overwhelming majority of engineers in the sample, which is consistent with the proportion of engineers in the SAEF and the professionals in the construction industry as a whole.

5.1. Respondents type of work.

Figure 6: 2 shows the structure of the respondents in terms of the type of work in which they were involved. Comparing figures 6: 1 and 6:2 it is clear that architectural design is not exclusively the architects' domain but it is shared by engineers and to some extent technicians and *memar*s as well. But the converse is not so common. Table 6: 1 further shows the roles each group of professionals take in the building industry. At the time of the questionnaire design the need to distinguish between 'labour-only contract' (the common *memar*s type in T/ C sector) and the usual contract for a whole project was not envisaged. The term 'contract' in the following cross tabulation (Table 6: 1) has two meanings, that is; labour-only for *memar*s and the usual 'whole contract' for engineers,

architects and to a great extent technicians. It is shown that only 3 *memar*s were involved in architectural design and a shift from *haghol amal kari,* once almost the sole type of working arrangement with the client is shifting to a less traditional method of labour-only contract arrangement.

Figure 6: 2.



Haghol amal kari is the traditional type of contract see Chapter 4.

Contrary to the common practice in the West, engineers are considerably involved in architectural design in the T/C sector, while their role in design in the modern sector is confined to structural design. The other important finding is that all the 6 respondents who were involved in material production were engineers. This is partly due to the fact that engineers tend to be better equipped with the technical knowledge needed in this field and partly because they are more active in executive and management occupations.

Table 6: 1. Cross tabulation: Positions by title

position title	Design	Contract	*Haghol-amal - kari*	Material production	Other	Row total/ percent.
Memar	3	20	17	0	0	29 (20.7%)
Engineer	29	28	2	6	3	63 (45%)
Architect	16	3	1	0	1	19 (13.6%)
Service Eng.	7	6	0	0	0	11 (7.9%)
Technician	6	9	6	0	1	18 (2.9%)
Column total/ percent	61 43.6%	66 47.1%	26 18.6%	6 4.3	5 3.6%	140 100%

It is obvious that while architects concentrate on design, their share in other positions is negligible. This may be attributed to a number of factors, one of which is that those architects who are mainly serving the middle and upper middle class are paid very well. Another reason is that design by architects costs more. This is due to the fact that

architects are trained according to the *Beaux Art* tradition and have very little ability for structural designs themselves and so need to pay a structural engineer for that purpose. Engineers undertake both architectural and structural design and are thus more competitive. The other reason is that the number of graduates in architecture is considerably lower than engineers, due to the relatively few schools of architecture. Until very recently, there were only two schools of architecture, both based in Tehran. Now there are three schools of architecture in Tehran and one in Yazd.

8:5.2. Respondents' projects 1984 -1989.

Table 6: 2 shows that 28 out of 30 (93.3%) *memar*s who responded to this question were involved in single unit housing. When it comes to more than one unit their share sharply declines. Their rate of involvement in commercial buildings, that is shops and shopping complexes in the private sector although seemingly reasonably high in terms of the number, does not amount to a considerable share of the workload. For example, in five years one *memar* may have been involved in only one commercial building.

According to planning permission records in three successive years 1985-1987, the average number of urban buildings in the province of Fars was 9,209 new buildings of which 8,711 were residential, 286 'commercial', 230 'residential with commercial', and 13 health and education.[10] The corresponding numbers for Shiraz would be approximately one third of these figures. However the proportion of residential to commercial -and-commercial with residential buildings is 8,711 : (286 + 230) = 16. 88. In other words, for about 17 residential buildings one commercial or commercial with residential building were built.

The *memar*s' share of commercial buildings will inevitably decrease as a result of the rapid increase in the price of land in commercial areas and a tendency for multi-storey commercial complexes. When it comes to the government sector, that is government offices, schools, clinics, and hospitals, the *memar*'s share sharply declines. It is fair to conclude here that **the existence of the *memar*s system is very much reliant upon single unit owner built housing**. This is consistent with that part of the arguments against government's mass housing policies.

Table 6: 2. Cross tabulation: Projects between 1984-1989 by title

\Title Projects	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total/ (percent.)
Single house	28	33	12	6	12	91 (64.5)
Housing 2 - 10	5	11	5	2	2	25 (17.7)
Housing 11 - 30	5	12	2	2	0	21 (14.9)
Housing 31-over	2	15	2	1	0	20 (14.2)
Factories	2	24	6	2	6	40 (28.4)
Warehouses	10	19	2	3	3	37 (26.2)
Commercial	17	16	6	4	1	44 (31.2)
Offices (Gov.)	3	29	7	3	5	47 (33.3)
Schools	6	12	1	1	2	22 (15.6)
Clinics	2	8	1	1	3	15 (10.6)
Hospitals	4	8	0	2	2	16 (11.3)
Others	0	2	1	01	1	4 (2.8)
Column total percent	30 21.3	65 46.1	19 13.5	10 7.1	17 12.1	141 100

Almost 51% (33 out of 65) of the engineer respondents were involved in private single unit housing, 63% of architects, 60% of service engineers, and 70% of technicians. Another interesting finding is the low level of involvement of Shirazi architects in the designs of schools, clinics, and hospitals. The reason is that these government projects are usually designed in Tehran, where almost 95 percent of registered consultants are based. This has been a matter of criticism by those who advocate regionalism, but so far with no result. However, with an already high involvement of modern professionals, and the increasing trend of their involvement as a result of the implementation of *Ghanoon-e Nezam-e Memari va Sakthemani* (The Law of Architecture and Construction Order), **the political pressure behind mass housing and high rise development comes from larger contractors mainly based in Tehran.**

6. Factors affecting productivity.

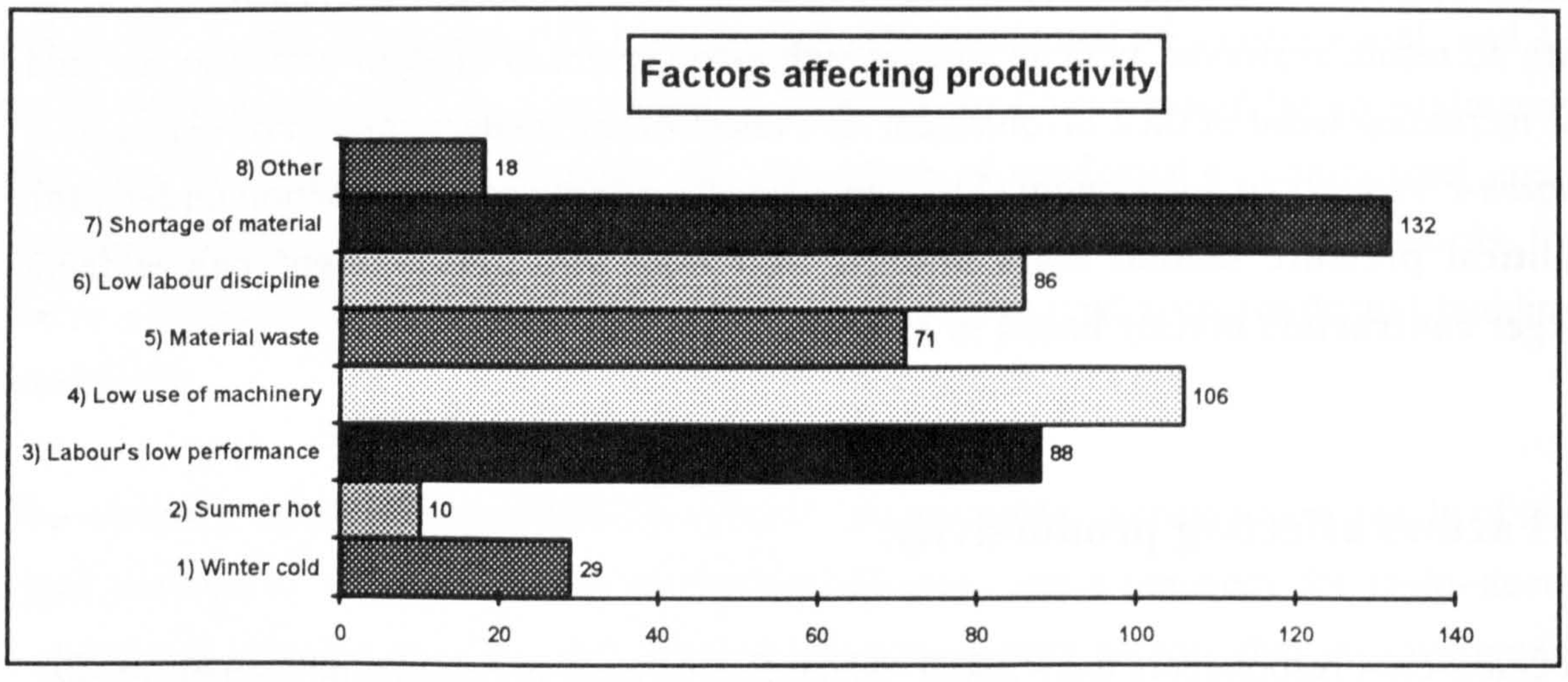
In Question 4 respondents were asked: which factors have been most influential for the decrease in site productivity in building projects in which you have been involved during the last 5 years. There were 6 options and they were asked to tick the four most significant factors and then give values from 4 to 1 to those chosen options. This was to be according to their degree of importance in descending order.(the most important factor gets 4 and the less important 1). There was also a seventh option which was an open one, in which respondents were able to use their own words to express their views.

The first two options were on the effect of weather. It must be noted that most of the populated areas and big cities have more or less the same climatic conditions as Shiraz and northern part of Fars[11]. the temperature varies between 35-40 degrees in summer and 0 to minus 5C, in winter. [12]

Option 3 was on labour performance; option 4 on the use of machinery; option 5 on material waste; option 6 on labours' discipline; option 7 on the effect of materials shortage: and option 8 was the open ended one. Options 3, 4, 6, and 7 are based on Donald Bishop's theoretical view of non-productive time on site, which has already benn discussed in detail in theoretical discussion in Chapter 4 under 'site management'.

The effect of site management were not included, partly because of the fact mentioned by Donald Bishop: 'High non-productive time does not necessarily indicate that a site is badly managed: sometimes tasks are so intertwined that high non-productive time is inevitable'. Secondly it was believed that one could not get an 'impartial' response when asking the managers themselves about the adverse effects of their own operations.

Figure 6: 3. frequency histogram



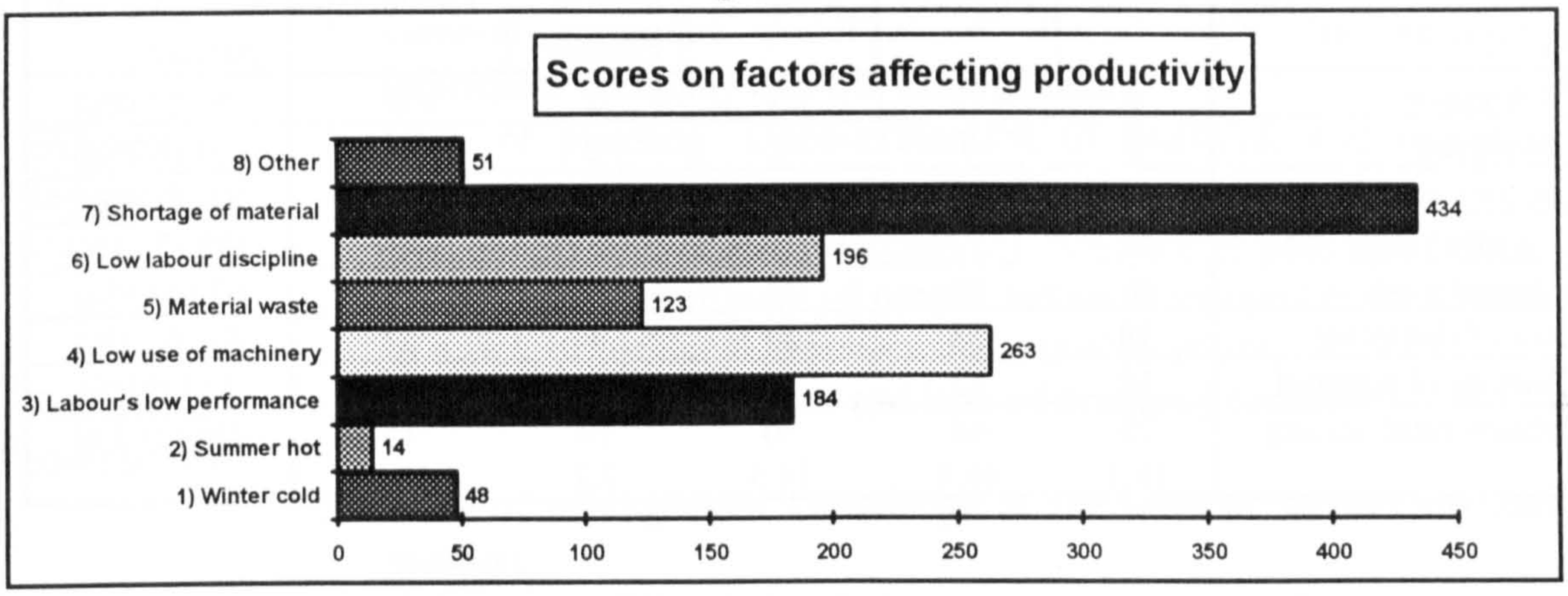
Source: author

Figure 6: 3, which is the response frequency on each factor without considering values given to them, is consistent with Figure 6: 4 which shows the aggregate score or value sums. There is only a small difference on labour performance and labour discipline. This can be taken as evidence of the respondents' accuracy and also as evidence of accuracy of analysis. However, it is clear that the main problem on site is shortage of material and delays in their delivery. This was also one of the main complaints of contractors when

considering problems of the industry (discussed in Chapter 8). Shortage of materials is not a new problem in Iran, although it has been exacerbated, as a result of 8 years of war. Even in the affluent years of 1970s, as were discussed in the study of the development of the modern sector during the Fifth Plan, shortages of materials were the major problem facing the construction industry and the Development Plan.

Insufficient use of machinery ranks as the second factor. The importance that the respondents have given to the use of machinery can be attributed to two factors, the first being the managers' common wish[13], and the second is a 'universal' aspiration for the elimimination of hard physical labour.

Figure 6: 4.



The issue of labour productivity is reflected in two options. One is the performance which is related to skills and training, while the second is discipline which is a socio-political, cultural, and to some extent economic question. But although discipline to a certain extent can be improved through training, usually the other factors prevail. Korean contractors' achievements were attributed to their high discipline. In the author's experience before the 1970s and according to the *memar*s, building workers have always maintained a good discipline and a high respect for *memar*s and senior tradesmen. They were proud to state that 'their word was better than a written agreement'. Two main factors have affected discipline structure, the first being the economical situation of 1970s (the oil revenue boom), drastic increase in government expenditure on developmrnt projects, and thus an acute shortage of labour, and the second is the effects of the events after the revolution and anarchic propaganda by irresponsible political groups. However permanent workers show a higher level of discipline than temporary workers.

Material waste ranks fifth, but the author believes that this matter merits closer attention.

Perhaps the professionals do not have a point of reference. Waste of building materials is a common feature of every building site in the country, particularly with regard to sand, gravel and bricks. This must be tackled through raising awareness and the use of better techniques and equipment for the storage and handling of building materials.

The last option is related to the effect of weather. Although summers are very hot, but cold weather and rain have been considered as more crippling. One of the advantages of industrialised prefabricated building, and factory production is argued to be eliminating the effect of weather. In this case weather effect does not seem to be a major factor.

Table 6: 3. Cross tabulation: Site Productivity by Title

\Title Factors	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total and/ (percent.)
Cold season	8	12	5	2	2	29 (21.0%)
Hot season	2	4	2	2	0	10 (7.2%)
Labour's performance	**18**	**41**	**8**	**7**	**8**	82 (59.4%)
Low machinery use	15	52	16	6	16	105 (76.1%)
Material waste	9	32	11	4	11	67 (48.6%)
Lack of discipline	**18**	**33**	**14**	**4**	**14**	83 (60.1%)
Shortage of material	18	62	19	9	19	127 (92%)
Column total percent	25 18.1	64 46.4	20 14.5	10 7.2	19 13.8	138 (100.0)

Relative proportion of response to each factor by different professionals indicates that relative importance of these factors is agreed by all groups of professionals, except for the labours performance and discipline. The civil and service engineers put more emphasis on labour performance than labour discipline, *memar*s consider it of equal importance, while architects and technicians believe that discipline is more important. See Table 6: 3

Respondents' comments under the open-end option are demonstrated in Table 6: 4. Responses on the open option were not overwhelming. 10 out of the total 18 statements relates to the shortcomings of the government. The others, with the exception of a few who were self-critical are also 'external' factors.

Table 6: 4. Respondents' comments under 'other' option on factors affecting productivity

Title. Position	Comments.
Architect Designer. Engineer contractors.	• Discontinuity of employment, lack of harmony between manager and other workers. 1. Lack of management in client (government) organisations. 2. Lack of skilled and dedicated management at government (client) organisations. 3. Lack of proper technical manpower. 4. State of Building Technology(4), and lack of competence of those involved(1). 5. General economic condition of the country and resulting impossible company and site management.
Engineer designers.	1. Lack of planning. Unco-ordination of financial, and technical resources and related criteria. 2. Bad quality of building materials (3). Absence of time scheduling. 3. Problems in recruitment of proper technical manpower as a result of a lack of technical experience and qualifications.
Technician contractors.	1. Low capital of contractor and lack of financing facilities.. 2. Lack of management knowledge at the level of technicians and *memars*. 3. Delay in payment to the contractor.
Technician designers.	• Intervention of incompetent persons in government (client) organisations.
Memars .	1. Inaccurate estimate at the beginning and financial problems and discontinuity of work later on. 2. Contractor's lack of capital. 3. Client's financial problems.
Mech. Eng. contractor.	• Delay in payment (to the contractor). Incomplete drawings and inadequate site supervision.
Mech. Eng. designers	• Lack of proper management at all levels. No clear government policy on issues of production and industry.

7. Usage of prefabricated components.

Questions five to seven were designed to identify the pattern and problems of the acceptance of three major building components. These were standard doorsets, concrete blocks used for wall construction (not concrete roof/ floor blocks or partition blocks), and roofing membranes.

7.1. The use of prefabricated standard doorsets.

The most appropriate components to standardise and semi-mass produce are doors and windows. 'There is no justification for a range of 50 to 100 types of doors and windows in a (developing) country. Logic calls for production to be limited to a small number of models which are easily obtainable on the building materials market and can be mass-produced.'[14] What is more is that they account for a large share of housing costs and offer a ready opportunity for local research and saving of foreign currency.

Despite all the benefits of prefabricated doors and frames the use of ready made doors is not yet common in the country. There are a few large factories in Tehran, and two others in Gilan and Mazandaran, where the forests provide the necessary timber. These factories are mainly government owned or under government appointed management,[15] producing door sets and distributing them nationally through their agents in the big cities. These are mostly flush doors, complete with frame, ironmongery, and ready varnished. Although these products come to the market at less than half the price of a similar tailor made door, demand is still limited. These products come from factories that were established in the late 1970s. Here the results of the survey concerning problems of marketing and the usage of these products are examined.

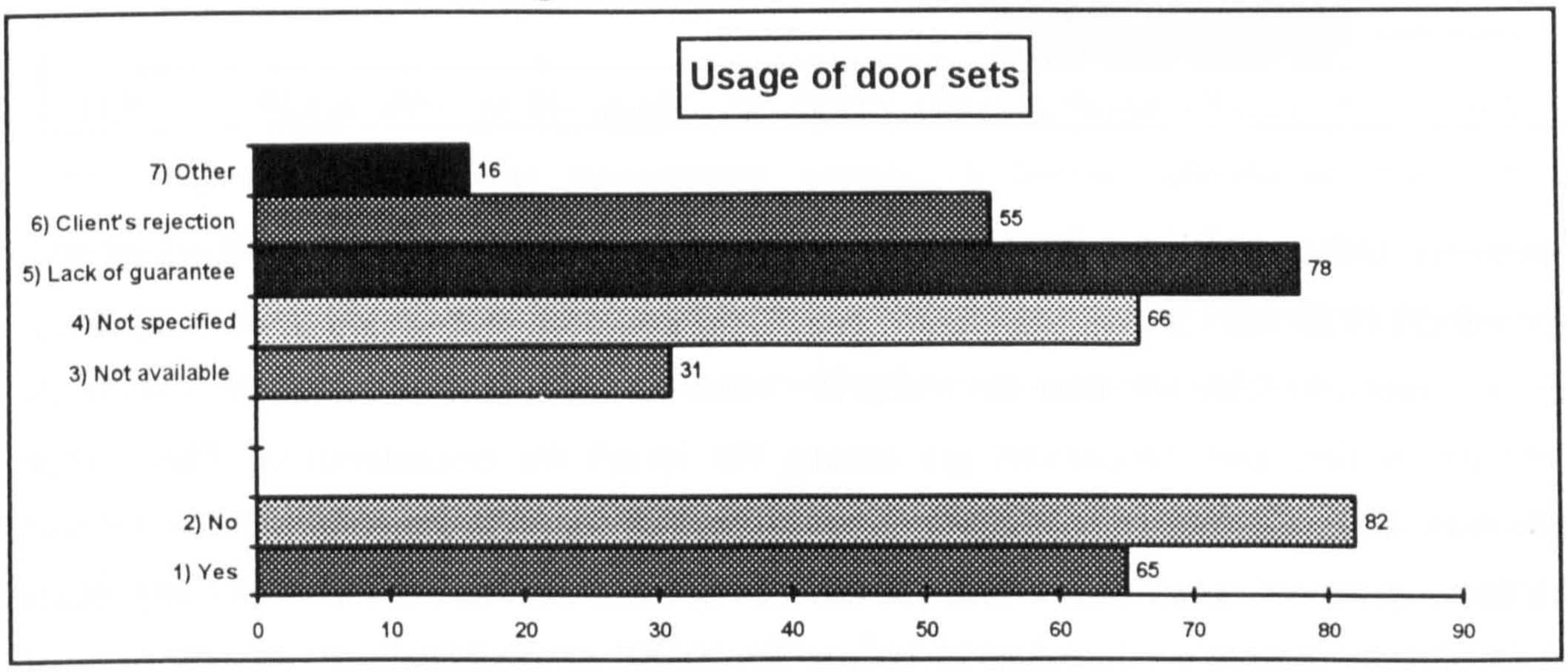
In answer to Question 5; 'Have you used or specified Prefabricated Doors?'; 82 (56%) replied no, and 65 (44%) replied yes. *Memar*s, engineers and architects gave completely different responses to this question. Cross tabulation of use by title (Table 6: 5) shows that *memar*s and architects are in total disagreement with each other on the use of prefabricated doorsets. While almost 87 percent of *memar*s do not agree with the use of prefab doorsets, 70% of modern architects agree with their use. Engineers showed a 50-50 response. The level of agreement among architects was not expected by the author. Architects often seem to disagree with standardisation and its companion process modular- co-ordination, which is, unwelcome to the architect-designer or artist-designer.

'It restricts his freedom of design, although this is only apparently the case, and so it always finds opponents.'[16] Apparently architects have considered other issues related to housing more important and have chosen to sacrifice their instinctive dislike of standardisation. In fact in a session held in the Architects Association of Fars (AAF) at the author's request to discuss the issue, one of the architects in reply to one of the young architect opponents, stated that: "Although I understand my colleague's respect for artistic values, and sincerely hope he has success in expressing them . . . . , we would like to remind our colleagues that it must not cost more particularly to relatively poor clients"[17].

One of the main reasons for the reluctance to use factory produced doorsets is the non-traditional design of these products. Instead of wooden grid they use cardboard cores inside to assist rigidity. Factory agents can demonstrate a variety of test results indicating the sound quality of the product. But these are not apparently satisfactory, particularly to *memar*s and their customers. As respondent No. 61 states 'If wooden grids were used instead of cardboard, prefabricated doors would be recommended'. The core is invisible or as respondent No. 53 states 'prefabricated doors are closed goods', pointing to an old saying that says never trust *gense dar basteh* (a product in a closed package) before you open it.

In such conditions a valid guarantee can make a difference. Many contractors in discussions prior to the questionnaire's design stated that if the product were specified we would use them without objection. However, the reasons for rejection of prefabricated doors, as tested by the response count is: 1) Lack of guarantee. 2) designers reluctance to specify the product 3) Client's rejection. 4) Not being available.

Figure 6: 5. Response frequency:



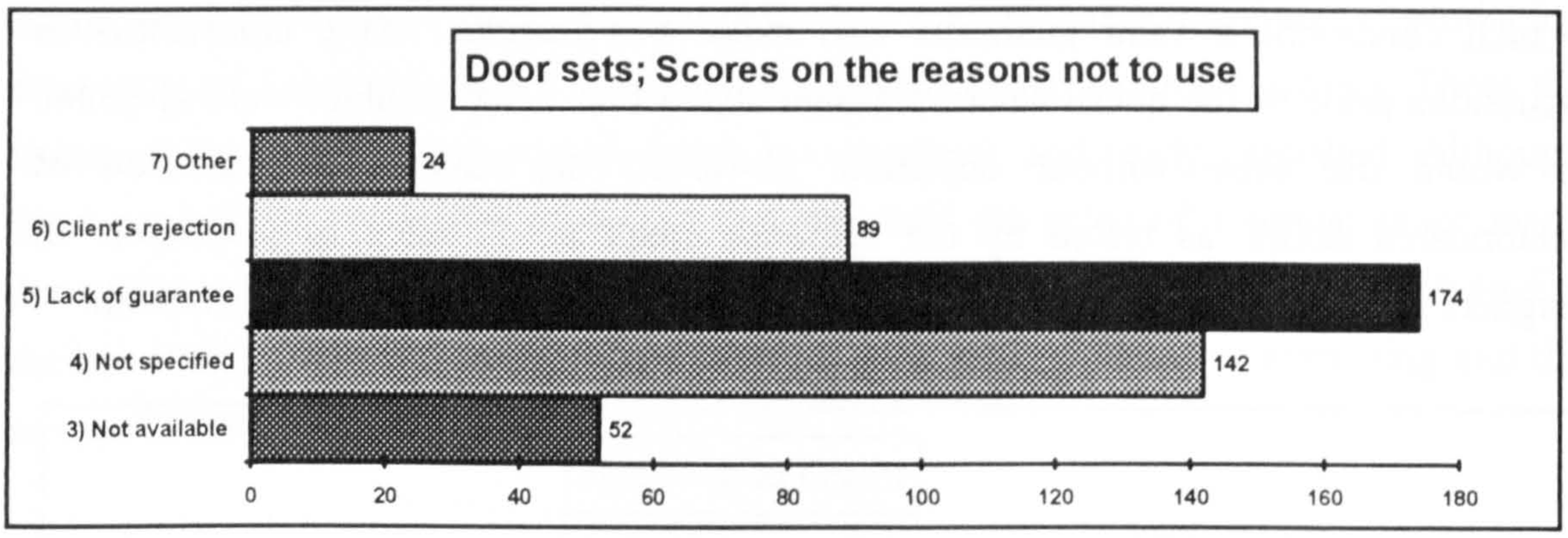
The question of availability sounds strange when a product does not sell well, but that is what is happening due to the peculiar method of marketing and distribution the government managers have chosen. The stagnant sales of the under-capacity operation of the factory, the sole agent's lack of storage facilities etc. can lead to a situation where even if you want the product you have to order and wait for an unknown period of time for delivery. It sometimes happens that an urgent government project, enjoying the privilege of priority put in a large order, which means that all other deliveries are delayed.

Table 6: 5. Cross tabulation: Use of door set / by Title

\Title Door set use	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total/ (percent.)
Do not use	26	33	6	5	11	81 (57)
Agree to use	4	29	14	6	8	61 (43)
column total percent	30 21.1	62 43.7	20 14.1	11 7.7	19 13.4	142 100

The results of the sum of values on each factor in Figure 6: 6 show the same ranks as the frequency test. Here the considerable difference in values also indicates the significance of the difference between the importance of each factor.

Figure 6: 6.



Comments under the option seven are demonstrated in Table 6: 6. One of the respondents comments about 'the lack of standards' could be interpreted in various ways. The first question is surely these door sets are made to some sort of standard? Standards in design, quality and dimensions are among the issues for consideration. The author made another journey to Iran to carry out a number of supplementary interviews to deal with these questions arising as a result of the survey analysis. Here some of the important points of two interviews in relation to the problems of manufacture and the use of doorsets will be presented.[18].

a) The first interview[19]

1. 'When these doors came to the market in Shiraz they were nothing like the doors which were made by the local joiners. I mean they had lots of problems from the kind of odd hinges which they used, they didn't look strong enough. The thickness of stiles was 2.5 cm., where the local joiners usually use 3.5 and so on. The very fact that they were lighter was taken against them. We tried hard to convince the factory to change those features which concerned people.'

2. 'Although they changed some of these, for example the hinge, the lock and the handle, more fundamental changes were very difficult for them because of the inflexibility of their machinery and the production line as a whole. For example, the machinery which made the sheet metal profiles for door frames was designed for a the door thickness of 2.5 cm. apparently to standards of some European countries. Making them one centimetre thicker meant that they had to alter the machinery which made the cardboard cores. Moreover, they could not change the door thickness because of the metal frame.'

3. 'Expensive alterations and the scarcity of foreign exchange meant that they could not respond to our requests for change. After more than two years of struggling they agreed to abandon their frame-making section and make the doors with a 3.5 cm. thickness and send them without a frame. Here we buy ordinary frame profiles from the black market and make frames in a small workshop.'

b) the second interview[20]

- 'The relationship between the joiner entrepreneur and the *memar* works to the benefit of the joiner and not the government factory. A hostile attitude on the part of *memar*s towards these products was another important factor. The *memars* rejected the new product and used their influence to change the minds of the building owners despite the competitive price (50 percent cheaper than custom made doors).'

- '*Memar*s still have a great influence amongst the people. For example, if the architect who has designed the house recommends ready made doors and the *memar* rejects them, the client would reject them. These factories failed to communicate and to establish the necessary links with *memar*s and customers. Government managers and

factory agents were not sufficiently interested in public relations and/ or had not the necessary knowledge of marketing. Instead they kept lowering the price to attract customers, which as we mentioned earlier, had an adverse effect both on the product and consequently on the acceptance of the concept at a micro level, and on its adoption by private workshops.'

Table 6: 6. Respondents' comments under 'other' option on the reasons why they disagree with the use of prefabricated doors.

Title / Position	Comments
Architect Contractor.	Majority of prefabricated doors are non standard.
Memar Contractor	Prefabricated doors are 'closed goods'.
Memar Contractor/ *Haghol Amalkar*.	The inside of the doors are not made properly.
Memar Contractor/ *Haghol Amalkar*.	Materials used inside the door, covered by plywood, are of bad quality.
Memar *Haghol Amalkar*.	Because it is more imperative to buy from conventional (traditional) carpenter.
Technician Contractor.	Lack of wooden grids inside.
Technician Contractor/ *Haghol Amalkar*.	Many of the doors are twisted and the type and quality of butt is poor.
Technician Contractor/ Designer.	If wooden grids were used instead of cardboard prefabricated doors would be recommended.
Mechanical. Engineer Contractor	Cheap price of prefabricated doors are is their only positive feature.
Engineer Contractor.	Lack of standard.
Engineer Contractor.	Low quality of primary materials used.
Engineer Contractor.	Poor quality.
Engineer Designer	Lack of standard
Engineer Designer	Absence of quality and responsibility for quality control.
Engineer Designer.	Lack of standard is one of the most important factors.
Engineer. Designer.	Lack of standard and low quality.

After finding out these fundamental problems associated with large scale, centralised, high-tech mass production, the author decided to examine the potential of local joiners. In fact one of the factory agents who had revealed his intention to establish a small scale

workshop stated that; "People come here for ready made doors (with standard overall dimensions) but with specification close to those with which they are already familiar i.e. 3.5 cm. thickness and more importantly with wooden grid core or a wooden skeleton. I am personally in the process to obtaining an 'establishment permission' for meeting that demand." There are already hundreds of small and medium scale joiners in Shiraz and other medium and small cities dealing with customers' orders. How can they benefit from the idea of standard dimensions and use their own style, techniques, and machinery for small scale 'mass production', instead of 'bespoke' production?

Before presenting the points stated by one of these workshop owners, it is necessary to point out that metal door frames and metal windows have become common practice in urban areas all over the country. Wooden windows and door frames, mainly because of the scarcity of timber and termite problems, have been totally abandoned. However, the measurement and production of door frames (out of typical sheet metal profiles) is a job for welding shops run by small scale entrepreneurs.

- 'If we receive a large order it is obvious that we can give large discounts between 25 to 30 percent, because it costs less. It is quite different to make one individual door or tens of the same size, particularly when producing a series with similar details. In answer to your question why do we not opt for the production of standard size ready made doors. First of all people come to us after the door frame is installed and flooring is finished. The final aperture determining the size of the door is between the designer, the *memar*, and the welder. Suppose that there were some arrangement that they could provide a standard aperture, possibilities would arise for us to go for mass production. Considering that joinery is today carried out by machine work even in small shops, we think we can compete with factories hundreds of miles from Shiraz with less overhead, transportation, and middleman (agent) costs.

Table 6: 7. Cross tabulation: Reasons why door sets were not used / by Title

Title \ position	Not available	Not specified	lack of guarantee	Client's rejection	Other	Row total/ (percent.)
Memar	11	22	24	14	2	27; 31.0
Engineer	11	31	33	23	3	36; 41.4
Architect	2	4	8	7	2	8; 9.2
Service Eng.	3	4	6	3	1	6; 6.9
Technician	3	6	9	7	0	10; 11.5
Column total/ percent	30 34.5	67 77.0	80 92.0	54 62.1	8 9.2	87; 100.0

The main reasons for the rejection of door sets presently available in the market can be summed up as:

1. Lack of provision of guarantee by the producer and an atmosphere of uncertainty about the quality of the product.
2. The reason why *memars* and contractors do not use these products is that they are not specified by architects and designers.
3. Architects and designers do not specify these products because they are uncertain about the quality
4. Clients reject then because they are new and they do not know much about their durability, function, and quality.

On the other hand, quality control is considered to be much easier in the case of factory production and the price is considerably cheaper. A lack of standard and absence of both proper marketing and links between the producers and building professionals are all important factors. These can all be attributed to a lack of initiative on the part of factory management and their distance from the region and clients. The other problem clearly demonstrated in relation to door thickness and frame profile-making machines is the inappropriate choice of machinery and the problem of importing a large scale factory lock, stock and barrel. There is however a potential for small and medium scale regional workshops which can produce cheaper doors for clients, whilst preserving and developing local joiner/ entrepreneurs.

7.2. The use of concrete wall blocks

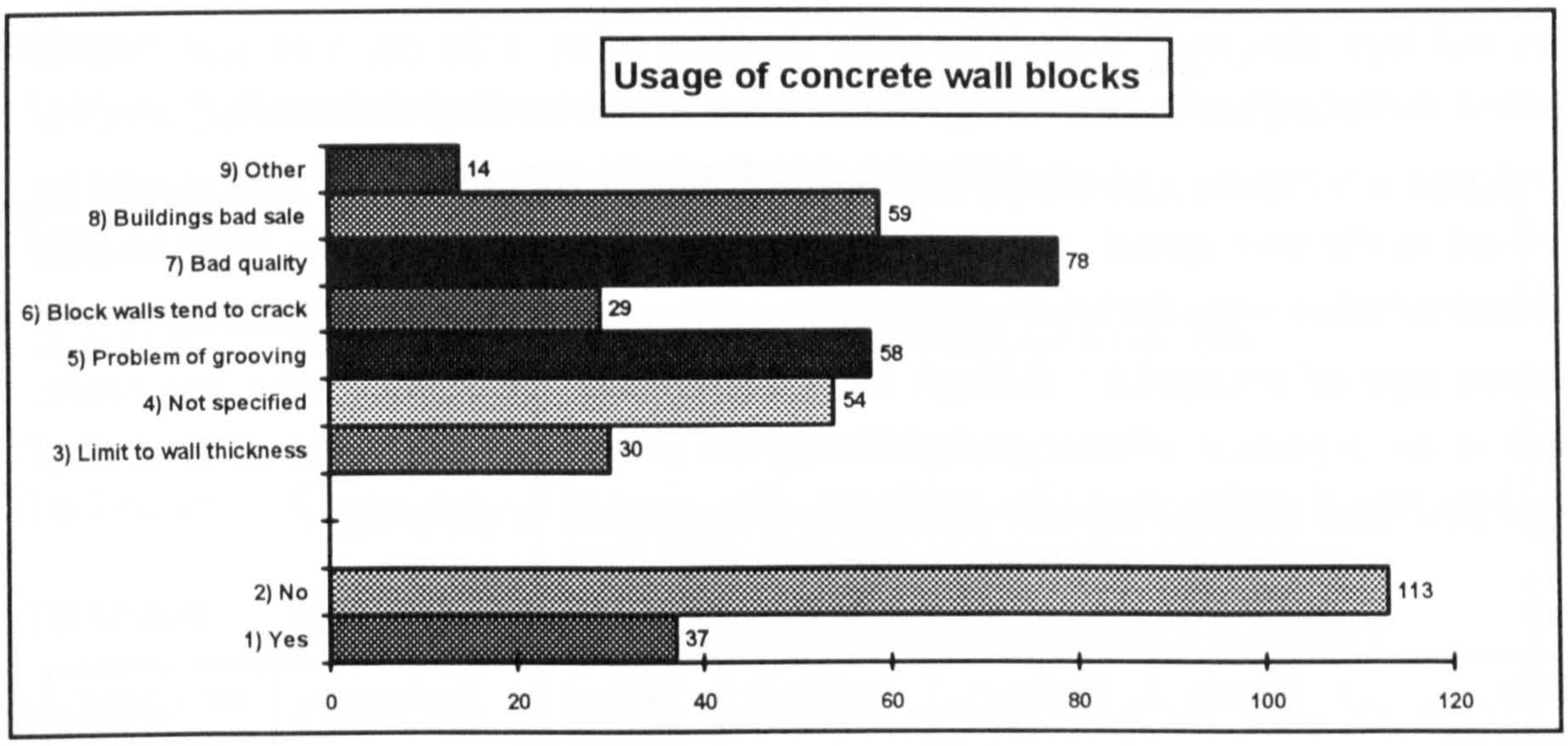
Concrete blocks are among the most produced prefabricated building components on the housing sites in a number of developing countries.[21] It is more than three decades since concrete block walls were introduced. Despite their long history, and despite their value in improving productivity,[22,23] concrete block walls are still not properly used. Though they are used for outside compound walls and as partitions they are not used for inner load bearing walls.

In answer to the question: 'Have you used or specified concrete blocks for load bearing walls ?' Only 37 (25%) replied yes, and 113 (75%) replied no. As to the reasons for not using concrete blocks for load bearing walls, they were asked to tick and then give a values to the three reasons of their choice, out of the six options. The ascending order for rejection are shown in Figure 6: 7: 1) Bad quality of available blocks on the market.

2) The adverse effect on the price of the building. 3) The problem of cutting grooves for plumbing and wiring conduits. 4) Not specified by the architect or consultant. 5) Limit to wall thickness 6) The tendency for block walls to crack. 7) Other reasons see Table 6: 9.

The results on the value sums shown in Figure 6: 8 are consistent with the frequency test, except for the problem of grooving. The problem of cutting grooves for plumbing and wiring conduits is probably one of the main reasons that makes the use of block walls difficult, even for non-bearing partition walls. According to regulations wiring should be executed through steel or plastic conduits the minimum thickness being about 10 mm and increasing with the number of wires inside. Two layers of plaster are applied directly on the brick or block wall with a maximum thickness of only 6-7 millimetres. Thus it is necessary to cut grooves into the bricks or blocks for embedding these pipes. It is much easier to cut through bricks, as our clay brick is much softer to cut through than a concrete block.

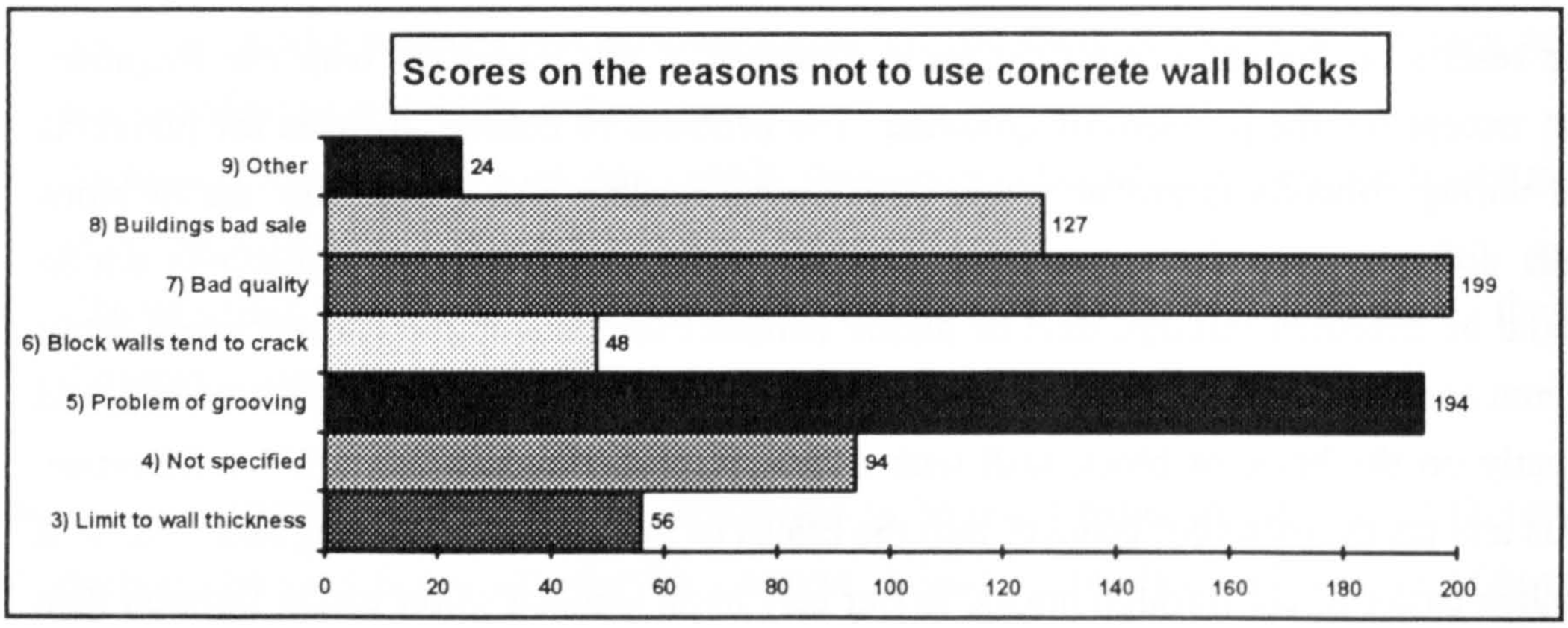
Figure 6: 7. Usage and response frequency on the reasons not to use concrete blocks for load bearing walls.



The main complaint, however, is again the quality of the product. Concrete blocks can be made with a wide range of compressive strengths through the appropriate choice of mix proportions and the degree of compaction. 'Solid blocks can be made to carry more load than hollow blocks and concentrated loads should be supported on solid blocks or hollow blocks filled with mortar. A wall can be made to carry higher stresses by using stronger blocks, with an appropriate bedding mortar, or by increasing the thickness of the wall'[24]. Concrete blocks are commonly made hollow, with the dimensions of 20 x 20 x 40 centimetres. The use of other sizes of block is not common. In Shiraz, even a large factory imported from the USA, with expensive machinery able to produce very high

quality blocks in different shapes and sizes, had to abandon the production of other sizes and currently produces the common 20 x 20 x 40 blocks.[25]

Figure 6: 8. Sum of values for each 'reason not to use' concrete blocks.



The problem of the limit to wall thickness means that there is no choice between 20 cm. thick wall and 40 cm. wall. As a result of the bad quality of blocks as well as the heavy I beam and Jack arch roof/ floors (the most common type), a 20 cm. wall with hollow blocks is not strong and stable enough. Either blocks must be filled with mortar, which is a very time consuming and expensive process indeed, or the wall thickness should be increased to the next option, 40 cm, both operations reduce productivity. The standard thickness of brick walls for load bearing elements in one or two storey buildings (most common type of residential buildings) is 34 centimetres. Brick walls take less space, which is an important advantage considering the very expensive price of land, that constitutes more than half the cost of housing in many parts of the country.

Table 6: 8. Cross tabulation: Use of concrete wall blocks / by Title

\Title Block use	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total/ (percent.)
Do not use	28	45	13	7	18	111 76.6
Agree to use	2	20	7	3	2	34 23.4
column total percent	30 20.7	65 44.8	20 13.8	10 6.9	20 13.8	145 100.0

Another factor is the bad reputation that has grown up concerning the tendency for block walls to crack. This is largely due to a lack of quality control. Blocks of poor quality are sold on the market and it is difficult for the customer to actually assess their strength and sometimes poor quality blocks are bought simply because they are cheaper. However,

the 'cracking of walls is a complex problem governed primarily by the quality of the blocks and mortar used. By restraints imposed on a wall by an adjoining structure and by the changing temperature and humidity of the atmosphere. It is not affected greatly by the thickness of the wall.'[26]

Table 6: 8 shows that 28 out of 30 *memar*s (93%), 18 out of 20 technicians (90%), 45 out of 65 engineers (69%), and 13 out of 20 architects(65%) disagree with the use of concrete blocks for load bearing walls. *Memar*s and technicians are the worst enemies of concrete blocks, while architects and engineers share more optimistic views of the possible use of concrete blocks. This can be attributed to the fact that *memar*s' and technicians' information is based on the local practice, while architects and engineers enjoy a wider perspective, including technical knowledge and an awareness of the practice elsewhere. The other important conclusion, which may be indirectly drawn, is that *memar*s' views are closer to the public. This is clear when, despite the enthusiasm on the part of some modern sector professionals, practically, the share of the use of concrete block walls, according to the information from the Municipality Planning Permission[27], is negligible.

Table 6: 9. Respondents' comments under 'other' option on why they did not use concrete blocks for load bearing walls

Title/ Position		COMMENTS
Memar.	Hagh. Amal.	Lack of sufficient knowledge about them.
Technician.	Hagh. Amal.	**Wrong method of laying**.
Technician.	Contractor	In high walls the speed of block laying is low and there is the problem of expensive scaffolding
Technician.	Designer.	Non standardised quality.
Engineer.	Contractor.	Blocks are heavy to work with and more prone to distraction in earthquakes.
Engineer	Contractor	Block walls don't have enough adherence for load bearing walls.
Engineer.	Designer.	**Practice principles are not yet developed.**
Engineer.	Designer.	Blocks are heavy and laying them is not quite practicable.
Engineer.	Designer.	**Lack of quality control and bad workmanship**.
Engineer.	Designer.	Need to be reinforced (reinforced masonry).
Engineer.	-	Wrong laying methods.

For detailed reasons why each of these professional do not agree to use concrete blocks

for load bearing walls see Appendix 4

There are other problems with the use of concrete blocks indicated by the respondents under the 'other' option as shown in Table 6: 9. On four occasions the wrong method of block laying is mentioned (shown in bold). The study suggests that this is the main problem in the adoption and the use of concrete blocks by the industry. In the component production industry the main problem is the poor quality and low strength of the blocks. The author's view on the relative problems of bricklaying and block laying were given in Chapter 4, in the discussion on the question concerning conventional technology about wall masonry.

The effect of hollow vertical joints in block work is more critical than in brickwork. In brickwork when spreading mortar horizontally between 30 to 50 percent of the length of the slots will be filled, while in block work this is less than 10 percent. Here the author agrees with the view that: 'If concrete block work is to be successfully applied, many members of the building team must understand its potentialities and weaknesses and treat them in their own right rather than as an alternative to other materials. Skills need to be exercised at every stage of the manufacture and use of blocks if their value is to be exploited.'[28]

Problems in the use of concrete blocks should be responsibly addressed and efforts made for the correct use of this product. The reasons concernign the correct use of concrete blocks is not only because of their possible higher productivity effects, but also environmental concerns about the excessive use of soil, which is a precious and scarce asset necessary for agriculture and food production. Despite the views of geographers, such as those cited in Appendix 4, everywhere in the county brick kilns can be seen surrounded by large areas of barren, scarce agricultural land. (also see 'Geography' in Appendix 1.) Having abundant natural sand and natural gas accessible almost all over the country, concrete blocks seem to have less environmental impact in Iran and are more appropriate than mud bricks, contrary to conventional wisdom elsewhere.

7.3. The use of prefabricated roofing membranes

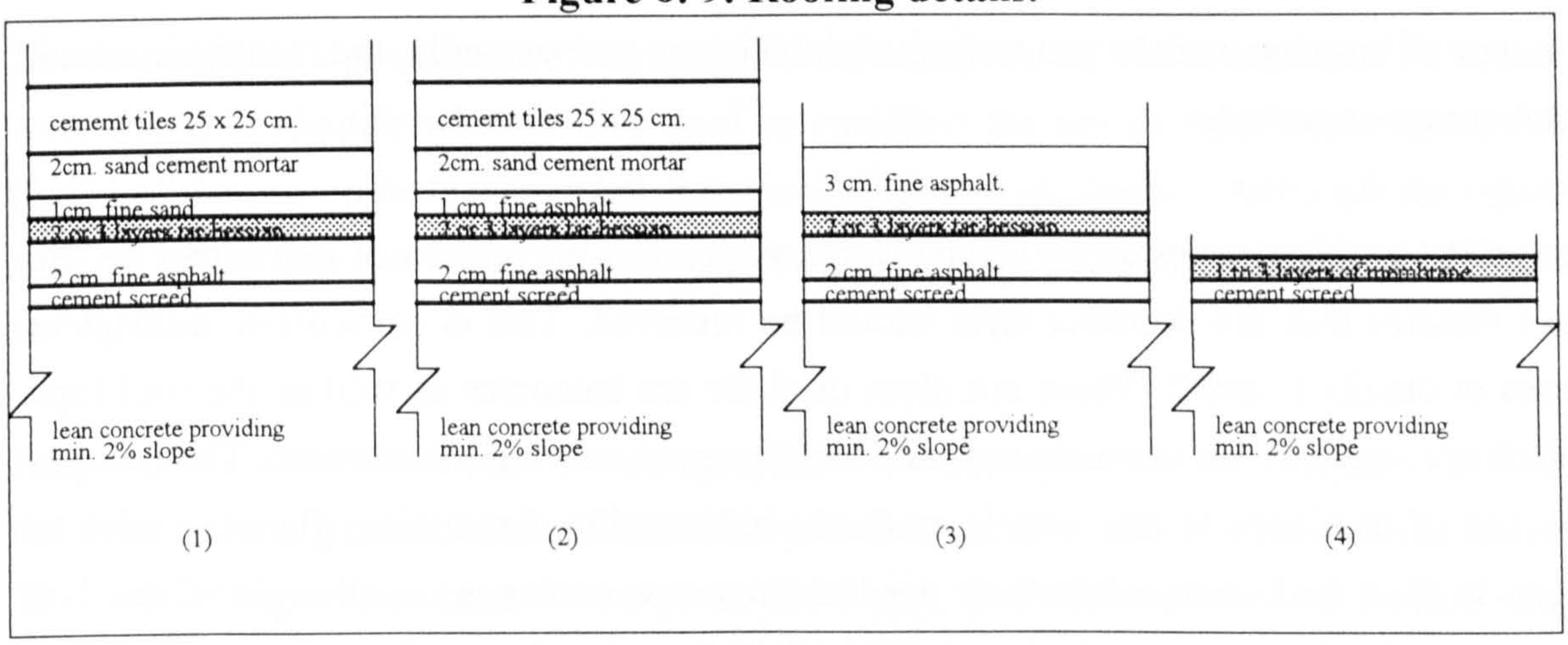
The flat roof is a common feature of the built environment and at the same time the most vulnerable part of the building. There is an old saying which remarks how water is the enemy of the building. Rainfall is seasonal, with quite heavy showers and snow in many

parts of the country.

The use of bitumen for water proofing boats and construction works dates back to around 2000 BC, and in fact the root of the word 'naphtha'[29] is from the Persian word 'naptu'. However, traditional methods of waterproofing usually did not use bituminous compounds. A variety of methods were used in different regions of the country, according to the locally available materials. In a large part of the country, including Fars Province, a combination of techniques using straw, clay and salty soil were used. This needed yearly maintenance and compaction by the use of stone rollers. Abandonment of mud roofs, and the common use of 'I beam-jack arch' flat roofs, along with the abundant availability of bitumen obtained from the distillation residues in petroleum refining, a new technology of water proofing emerged to become the tradition. Apart from certain details developed in different regions they all follow the same basic principles.

There are three common methods of roof structure I beam-jack arch, Joist-block, and in situ concrete flat roofs. There is a layer of light weight screed on the flat structure for the provision of a minimum 2% slope. For water proofing purpose usually one of the details 1, 2, or 3 shown is Figure 6: 9 are common practice. Detail (4) is usually used when a prefabricated roofing membrane is applied. In the first three examples the water proof membrane is not only built up on the job but asphalt is also prepared on nearby land, or the courtyard. This disturbs neighbours, pollutes the air and damages surrounding plants. Moreover the result is frequently unsatisfactory, as the practice requires considerable knowledge and skill.

Figure 6: 9. Roofing details.



Rolls of Jute fabric (Hessian), and usually two types of bitumen having different softening points, are brought on site in separate containers. These are then melted in

their metal barrels, and not in a proper smelter preferably fitted with stirrers. The bitumen temperature should be between 200 - 220° C and should not exceed 220°. There is no method of gauging the temperature and the shape of the container and lack of proper stirring means that the bitumen all to often partially or totally exceeds the temperature limit and is burnt.

The melted bitumen is carried in buckets to the roof-top and an even layer of bitumen, using around 1.5 Kg bitumen per sq. m., is first spread in a bond about 1.1 m. wide. While the bitumen is still hot the small roll of hessian (cut to length to suit the row) is slowly unrolled in place. Later another layer of bitumen is spread on top of the hessian. There are usually two layers of hessian, so while the second layer of bitumen is still hot the second layer of hessian is added, and then the top coat of bitumen finishes the operation. The work is carried out by a gang usually working together as roofing sub-contractors. They maintain a reasonably high level of workmanship, but they lack technical knowledge concerning the material's properties and behaviour, and are not enough aware of the importance of the correct melting temperature. This, with a lack of proper melting facilities means that the job is often not properly done.

This brief description of the operation was given in order to show how unsafe, and environmentally damaging this craft is. In fact, the result is not always successful, and on many occasions after 2 to 3 years the whole operation must be repeated. The method of application involving even layers of bitumen and carefully overlapping the direction of laying and so on, is usually inspected by *memar*s and observed and willingly followed by these sub-contractors. However, the main problems are attributed to two factors: first the type of bitumen and the proportion of the mixture and secondly, the manner in which the bitumen is melted.

An added problem arises at the maintenance stage. The prevention of extra load on the roof dictates that the previous layer should be removed. This is particularly difficult in cases of details 1, and 2. These are often used for the balconies as well as the roof tops which are intended for use as living and sleeping spaces during the summer. The trend in the use of roof tops in this way is gradually but steadily diminishing. People prefer to sleep in their bedrooms while their mechanical water cooler is on all night. Case 3 is becoming the dominant method and although lighter it still has all the same problems, added to which the amount of asphalt needed is larger. The method of preparation and the spread of site-made asphalt does not need definition, only to mention that it has got similar problems, but on a larger scale.

It may be a distant expectation but nevertheless a much needed one, that roofing components become available to the *memar*'s with definite specifications:

> 'The small contribution that we have made towards the simplification of roofing/ waterproofing work on site has been mainly in the development and progressive introduction of high quality membranes, such as two layers which can perform better than three traditional layers, or one instead of two. Self adhesive roofings are also coming along, and these make site work certainly safer and more convenient. Our 'Heat seal' roofing system is composed entirely of factory made components and requires no separate bonding adhesive. Your attention is also drawn to the 'Rubertherm' product, which combines thermal insulation with a layer of quality roofing. These more recent developments are designed to improve quality and to save time on site'.[30]

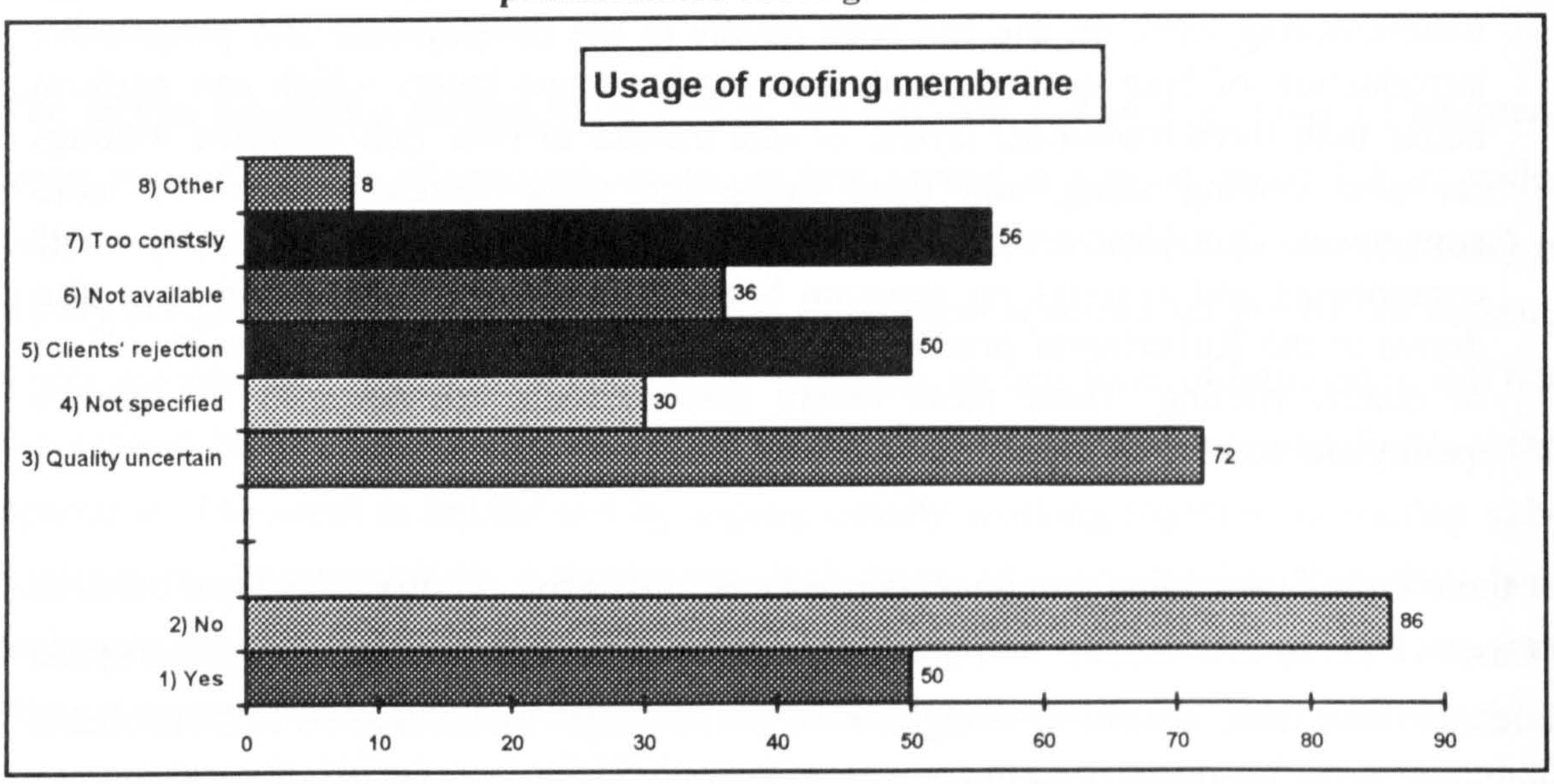
But there are a few roofing components produced inside the country which are used, as in Case 4. These are usually bitumen felts manufactured to tropical and sub-tropical grades. If these felts, instead of being crafted on site were manufactured in controllable conditions, many mistakes would be avoided and problems lessened. Blistering following entrapment of construction water, tearing at cracks or screed bay joints in the substrata, and rotting, the formerly prevalent problems in the performance of bitumen felts in the tropics, are now avoidable. The first two problems are avoided by the use of perforated first layer felt, and the third is avoided by the use of glass fibber felts for all layers. Bitumen felts are manufactured to-day in tropical grades by employing blown bitumen with a softening temperature of 104 - 116° C.[31]

The respondents' opinions about the use of these components were examined. First they were asked to identify whether they used or specified the use of these components. 86 (63%) of the respondents were against the use of these components. Although the figure is much better than the 75% in the case of concrete blocks, the question remains why still so high?

Respondents were asked that if their answer to the first question was negative, to tick the three most important reasons, and then give them grades 3 to 1 in descending order. The rank of importance from the response frequency, and the value sums are consistent, only the value they gave to the client's rejection slightly emphasised the client's opinion. This indicates that some of them even if they decided to use the product, faced the clients opposition. One point worth noting here is that in a situation where clients are actively involved in design and decision-making, as they are in the owner-contractor situation of

housing, the marketing of new products needs public propaganda in addition to the usual methods of informing or convincing professionals.

Figure 6: 10. The usage and the response frequency on the reasons for rejection of prefabricated roofing membrane



The most important reason declared was the uncertainty about the quality of products. Here no option were provided for 'lack of guarantee', the reason for this being that these companies actually issue a letter of guarantee.[32] Still, their lack of dedication and general attitude when things go wrong, remains a matter for complaint. One colleague a member of the SAEF, stated that: 'In most cases the company takes the matter to dispute and succeeds in blaming previous work, such as structural instability, lack of proper slope, or destruction of the job by the following trades.'[33] The follow up job particularly refers to the tiled finishing. However, the terms of their guarantee with the help of these excuses, and the time and costs involved in court proceedings, means that the company usually succeeds in escaping compensation.

The second most important reason is the question of cost. The cost of brand names is between 20 to 25 percent higher than the traditional sandwich type (detail 3 Figure 6: 9). There are also un-branded products marketed by trade sub-contractors at a rate of 10 percent plus the cost of the traditional detail. However, as the process seems more simple to apply - customers expect a cheaper price, particularly as by this late stage customers are usually financially in a tighter position. 'We are doing better in the maintenance sector than in new jobs, that is when *ghir-o-gooni* (traditional tar-hessian) has failed them and they are financially in a better position'[34]. Apparently customers are

not in a position to calculate the 'cost in use' or the cost of maintenance at the time of building.

Figure 6: 11.

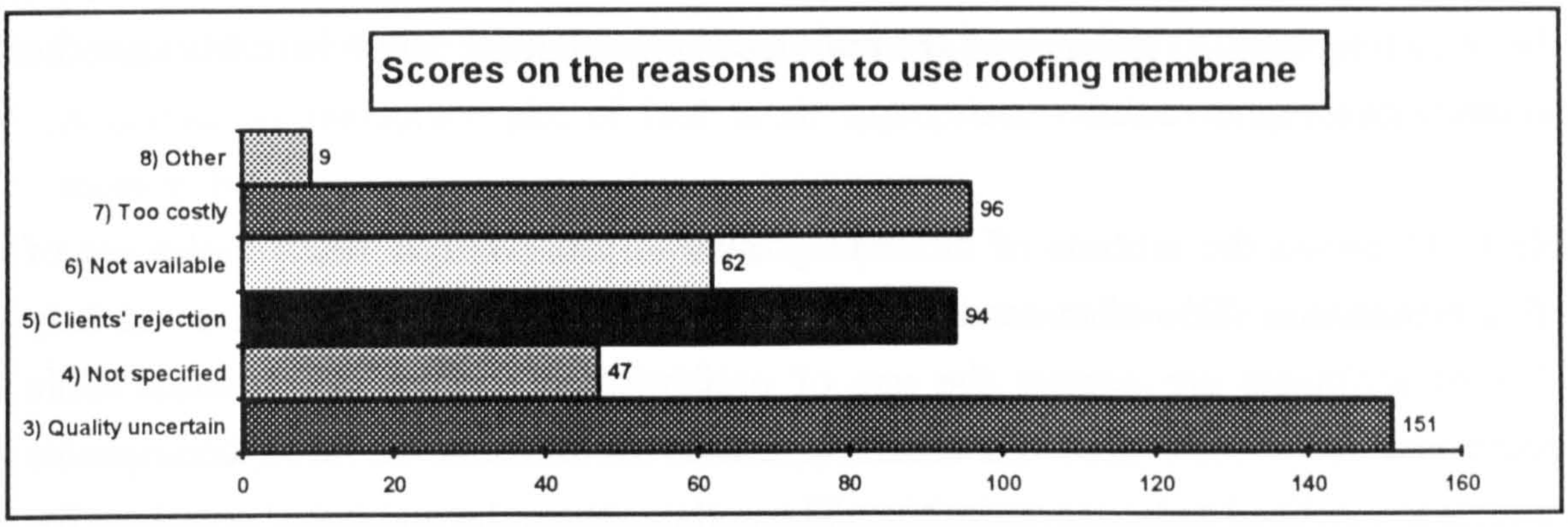


Table 6: 10 Respondents' comments under 'other' option on why they did not use prefabricated roofing membranes

Title	Position	Comments
Engineer.	Contractor.	Unskilled workers spoil the result.
Engineer.	Contractor.	Lack of proper practice (no code of practice)
Engineer.	Contractor.	Lack of standard is the main problem because some of them actually provide you with a guarantee but in many cases after one year the roof starts leaking.
Engineer.	Designer.	Roofing components come to the market with various unknown names and qualities with no standard.
Engineer.	Designer.	The main problem is that 'ISIRI'[35]is not active in controlling prefabricated building components.
Engineer.	Designer.	It is not yet absorbed and accepted by people's technological culture.
Engineer.	Designer.	Lack of protection against heat and sunshine is one of their weak points.
Technician.	Designer.	It is not yet recommendable because of lack of standard practice.

As with the case of prefabricated doors, there is a certain amount of irony associated with the unavailability of roofing membranes. The scarcity of suppliers which causes delays in supplies, in a situation which exists side by side with the availability of traditional tar-hessian sub-contractors. There is always a waiting time for the start of the job for these products, while traditional sub-contractors are readily available to offer traditional tar-hessian. Another reason which makes the waiting time a critical factor is

the lack of planning as a result of the general state of material shortages.

Respondent's views on the other reasons for rejecting these components are shown in Table 6: 10. The lack of a code of practice, or standard, the lack of initiative on the part of the regulating bodies (ISIRI), and the notion of 'technological culture' are amongst the most interesting points raised.

Table 6: 11 shows the attitude of different groups of professionals towards the use of roofing membranes. 72% of *memar*s, 72% of technicians, 60.6% of engineers, and only 47.3% of architects are against the use of prefabricated roofing membranes. While *memar*s and technicians are staunchest opponents of the use of these components architects are inclined to be more positive. The author shares the architects' optimism for reasons already stated and believe that it is crucial that the problems are solved and the improved use of these membranes becomes common practice.

Table 6: 11 Cross tabulation: Use of roofing membrane (R.M.) / by Title

\Title R.M. use	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total/ (percent.)
Do not use	21	37	9	5	13	85 63.0
Agree to use	8	24	10	3	5	50 37.0
column total percent	29 21.5	61 45.2	19 14.1	8 5.9	18 13.3	135 100.0

To see the details of why each group of professionals are opposed to the use of prefabricated roofing felts see Appendix 5.

8. Difficulties in the establishment of a factory to produce building materials and components

The establishment of an enterprise for the private investor has never been easy in the country. In the past it was not only a matter of having the capital, knowledge, or initiative, but also the connections. A Shirazi *memar* mentioned an old saying in this respect: '*Hezar gaz dom peida kardam hich kari pish narafi; yek shakh peydakardam hameh chiz roo be rah shod.*' (If I have a thousand metres of tail but nothing can be done; If I've got one horn then everything turns out fine.)

After the Revolution, the imposed war and the resulting economic conditions there are a number of severe obstacles for entrepreneurs to overcome before they can better contribute to the economic revival. However, as a result of several interviews with a number of concrete component producers in Shiraz the following problems were determined as the major obstacles for the establishment of new enterprises to produce building components. These were:

- Acquiring an appropriate plot of land in an appropriate location in agreement with the municipality
- Government 'principal permission' for establishment
- Obtaining a bank loan and financing the high price of the machinery to be imported
- The import permission
- Long waiting time for the delivery of machinery made in the country
- The shortage of primary materials such as cement and reinforcing steel.

In this group of questions, the respondents were first asked if they had been involved in the establishment of a new enterprise for the production of building materials or components in the last 5 years? 40 replies were positive. Among these were 4 *memars*, 1 architect, 2 service engineers, and 4 technicians. The greatest number were engineers; 25 out of 65 that is 38.5% were involved in the establishment of a factory for the production of building materials or components. The high degree of involvement of these engineers expressed their interest in diverting or expanding their activities from contract and design to materials production.

Table 6: 12 Cross tabulation: Those involved in the establishment of factories / by Title

\Title Establishment	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total/ (percent.)
Not involved	26	40	20	9	16	111 75.5
Involved	4	25	1	2	4	36 24.5
column total percent	30 20.4	65 44.2	21 14.3	11 7.5	20 13.6	147 100.0

For further information and views of different groups of professionals on difficulties involved in the establishment of factories, see cross tabulation in Appendix 4.

Then those who were involved in the establishment of a factory were asked; which problems were most difficult to solve? There were 10 defined options and one open (other) option. They were asked to tick the five most difficult factors and then give them grades 5 to 1 in descending order.(the most difficult factor getting 5 and the less difficult 1). Figure 6: 12 shows the simple frequency test on the respondents choice. The ranking

of the important factors in descending order was:

1) Shortage of primary materials

2 &3) Government permission and loan and finance(with equal response frequency

4) High cost of and permission for Imported machinery

5) Marketing problems

6) Problems in acquiring appropriate plot of land in agreement with the municipality

7) Ordering, purchase and delivery of locally made machinery

8) Recruitment of experienced technical manpower

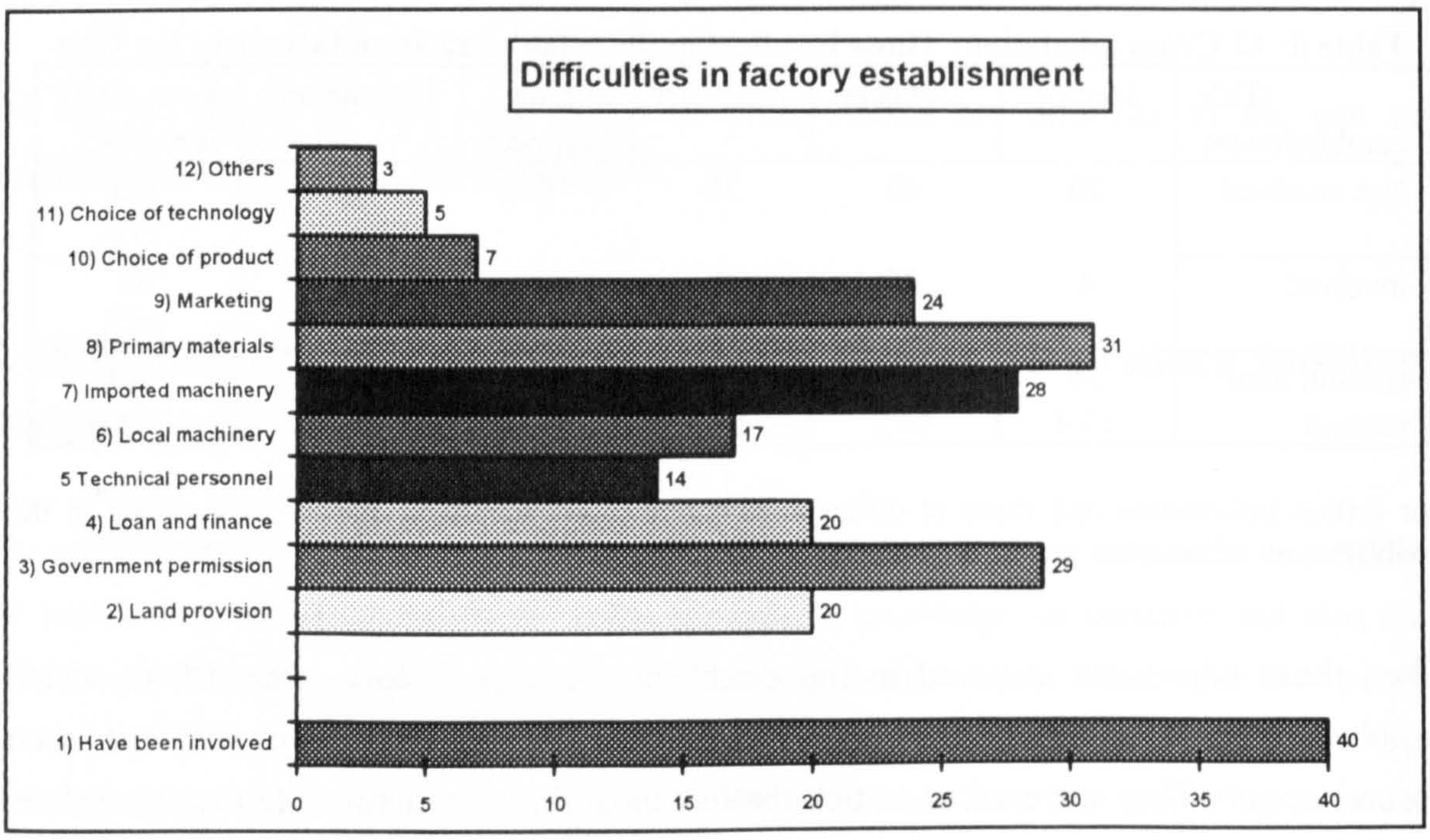
9) Choice of product

10) Choice of technology

11) Other problems.

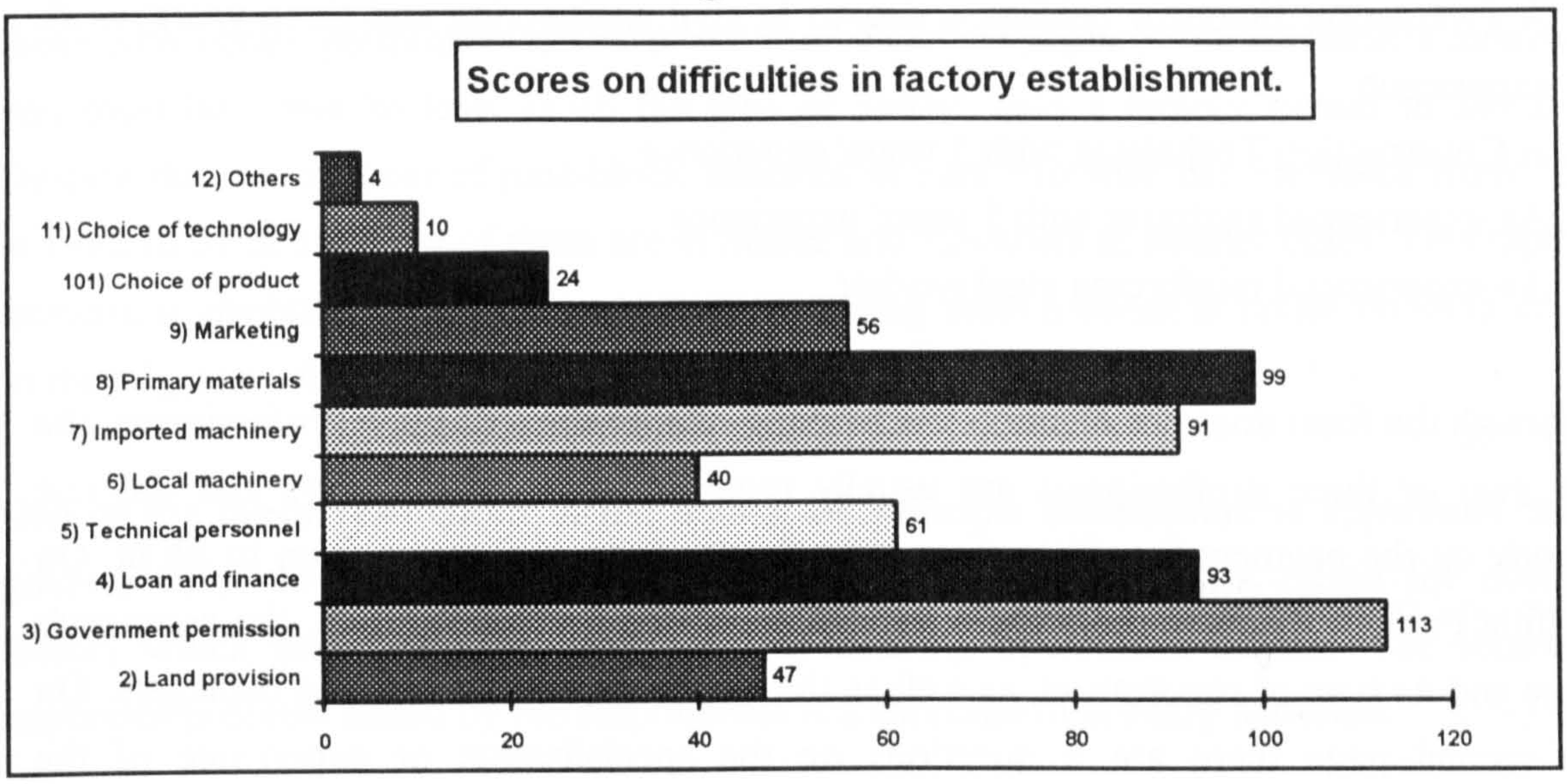
The difference between successive factors in the frequency test (Figure 6: 12) is small and insignificant but the difference in terms of values given by the respondents (Figure 6: 13) was considerable and the ranking order was more clear. Although the overall pattern in the frequency test and score sums are similar, there are minor differences. For example, respondents have given higher values to the problem of government permission which appears on top of the list.

Figure 6: 12. Difficulties in the establishment of a factory to produce building materials and components.



According to the values given by the respondents their ranking of the important factors in descending order were: 1) government permission; 2) shortage of primary materials; 3) loan and finance; 4) High cost of and permission for Imported machinery; 5) Recruitment of experienced technical manpower; 6) Marketing problems; 7) problems in acquiring appropriate plot of land in agreement with the municipality; 8) Ordering, purchase and delivery of locally made machinery; 9) choice of product; 10) choice of technology; 11) other problems.

Figure 6: 13.



A few respondents filled in the open 'other' option but the points they made are important and merit attention. See Table 6: 13.

Table 6: 13 Respondents' comments under 'other' option on the problems of establishment of factories to produce building components and materials

Title	Position	Comments
Engineer.	Designer.	Lack of government support; they make the factory extremely dependent and then totally neglect it.
Architect.	Designer and Contractor.	After one year struggling I couldn't get government permission to establish a factory to produce prefabricated concrete load bearing and cladding components in 1984.
Engineer.	Not declared	I was working in a government owned firm in Isfahan, We did not face any of these problems mentioned here (in the questionnaire) because we enjoyed government support and the privilege of priority.

There have always been procedures to get 'principle agreement' for the establishment of a

factory or a production unit. For example, to establish a factory to produce joists and blocks for joist-block floor/ roofs in a remote place in the south of the country, where there is no other similar product, you still need permission. Conditions for accreditation of a joist-block company are as follows:

- A Registered company.
- A General Manager holding a degree in civil engineering with three years' experience in the production of concrete components.
- A Production Engineer holding a degree in civil engineering and three years' work experience.
- A Construction Technician with 5 years' experience.
- An experienced shutterer with 5 years' experience.
- An experienced reinforcing steel worker.

Although the form does not mention the working relationships of these professionals, the first two or three professionals are usually required to be shareholders and the rest already on the payment list. Then there is an 8 page long application form to fill in. On the first page of the form there are questions about the applicant's name, the company's name and its type of registration, as well as the names of shareholders and managers. On the second page there are 8 questions on the specialisation or experience of the applicant, the scale and type of activities and production, the projected date of the establishment of the factory, and the city in which it is to be located. Capital investment also required with details both of its source and where it is to be spent. This includes capital needed for imported machinery and those sums needed for locally made machinery. This is followed by a complete feasibility study. The last page concerns liabilities and obligations of the entrepreneur as follows:

1. The exact location of the factory must be approved by the local municipality.
2. Any order or purchase of machinery from abroad must be undertaken after the approval of the Ministry of Mines and Industry.
3. Foreign nationals should not be employed without obtaining the necessary agreement of the Ministry of Mines and Industry.
4. Safety rules and regulations must be planned and provided for, according to the regulations of the Ministry of Works.
5. On all products or packaging issues the specification of the products and the phrase 'Made In Iran' (in Farsi) must be written.
6. The manufacture of the product must be in accordance with the existing (available)

standards.

7. The holder of the permission must obtain a licence for production after the instalment of the machinery and before the start of production.

Although all these regulations have a certain logic and purpose, in practice they, according to colleagues who were interviewed, resemble '*Haft khane Rostam*' (The Seven Adventures of Rustam)[36]. However, obtaining government permission is considered one of the most difficult stages in the establishment of factories. There are those who obtain permission and later sell it at a very high price. 'To establish a factory you must be either 'in love' (with the job) or 'crazy', said a factory owner in Shiraz. Despite this, the number of joist-block factories in Fars Province has increased from 12 in 1982 to 51 in 1989. 39 of these are in Shiraz and 12 others in smaller cities. This rapid increase is attributed to a number of factors, among them a boom in house building due to the migration from Abadan to Shiraz as a result of the war.[37]

One of the major restrictions in the issuing of 'principle permissions' is apparently the government's obligation to provide the necessary cement and steel ration for every factory which gains the permission and the resulting operational licence. The second important problem stated by the respondents is a shortage of primary materials.

In an interview, the director of *Ehdase Sanaat* stated that the company is a State enterprise responsible for increasing the capacity of the cement production in the country[38]. He mentioned that:

> 'The reason for the existence of this company is that the Islamic government is determined to solve the problem of the cement shortage in the country by almost doubling the production capacity during the First 5 Year Plan of the Islamic Republic. One of the reasons why the government has taken the initiative in this respect is that 'per capita' cement production in Iran at present is 218 Kg. This is very low compared to the figure in our neighbours, for example; Iraq 840 kg; Turkey 1000 kg; Persian Gulf Emirates, including Bahrain, is 1200 kg. Our figure of reaching under 500 kg per person is not over ambitious but a pragmatic goal and a necessity. The other reason is the high capital needed which means that the private sector in its present condition is reluctant to involve itself in large scale investment. The execution and supervision of 10 out of 22 principle agreements for the establishment of cement factories is our responsibility. Of these, 6 are to be established by the private sector and the rest by the government. However these

are all to be gradually transferred to the private sector (privatised) after completion and the start of production.'

In a recent interview with a contractor[39], he stated that the rationing system for cement has been abolished since mid 1993. "This is partly due to the lower workload and partly as a result of the increase in production". He further mentioned that: "While there is no shortage of cement at present, reinforcing steel is still being rationed for government projects and private housing, as well as factories producing building components. Although the 'free market' or black market price is still 1.5 fold, the black market price was several times higher three years earlier."

The problem of finance is still a major constraint. While there is a relatively high record of failures and bankruptcies among the companies active in manufacturing and production there is an easy and rapid profit for middlemen as a result of the general economic conditions. Despite the willingness of the government and the Bank Markazi, the banks are very cautious in approving loans for long term investment. There is a tendency at present towards investment in short-term economic activities such as import - export. This selling and re-selling of different consumer commodities, is called a Bazaar economy rather than a production economy.

The problem of imported machinery was quite understandable with the drastic decrease, then 30 folds and currently almost 45 times devaluation of the Iranian currency. It seemed necessary to make an inquiry into the situation of engineering firms who were involved in the production of building machinery and plant in the country. To this end the author held an interview with the Director of Mamiran Co., one of the leading firms in this area.[40] He revealed that there are about 50 firms involved in this field. Of those 50 only 12 hold government establishment 'agreement in principal' *(Movafeghat-e osooly* and *parvaneh-e Kar)*, and are members of the Co-operative of Construction Machinery Manufactures (C.C.M.M.). The main job of the co-operative is the purchase and distribution of primary materials to their members. The C.C.M.M. is recognised by the government and is eligible for a ration of primary material, particularly crucial are steel sheets, and spare parts from government, all at subsidised prices.

The other 38 firms, deprived of membership of C.C.M.M., are unable to acquire primary materials, and are in a difficult situation. Their main problem is having to purchase primary materials at black market prices which are several times higher. Most of them had almost abandoned production and were in the business of buying and selling second-

hand plant and machinery. The Mamiran Company director believed that most of those 38 firms, if supplied with the crucial primary materials, were technically capable of the design and production of most machinery and plant needed in both the building industry and the building materials and component industry.

There is still a high enthusiasm and enterprise initiative amongst engineers, and a willingness on the part of contractors to invest in building component industries. This could solve most of the problems one may expect in the way of any new establishment. But there are factors out of the control and ability of these professionals which must be solved. To do this the 'minimum necessary environment' must be created so that the available knowledge and technical know-how can be canalised into increasing production capacity and launching new components onto the market.

Table 6: 14. Cross tabulation: Difficulties involved in the establishment of factories / by Title

\Title Problems	*Memar*	Engineer	Architect	Service Engineer	Technician	Total %
Land provision	2	12	0	0	1	15 36.6
Government permission	2	19	1	2	3	27 65.9
Loan and financial	3	19	0	3	2	27 65.9
Technical manpower	2	10	1	0	1	14 34.1
Local machinery	2	11	1	0	2	16 39.0
Imported machinery	1	18	1	1	3	24 58.5
Primary material	1	21	2	1	4	29 70.7
Marketing	1	17	0	1	4	23 56.1
Choice of product	1	4	1	0	0	6 14.6
Choice of technology	1	3	0	0	0	4 9.8
Other	0	2	1	0	0	3 7.3
Column total /percent	4 9.8	28 68.3	2 4.9	3 7.3	4 9.8	41 100.0

9. The use of the 'Joist-block'.

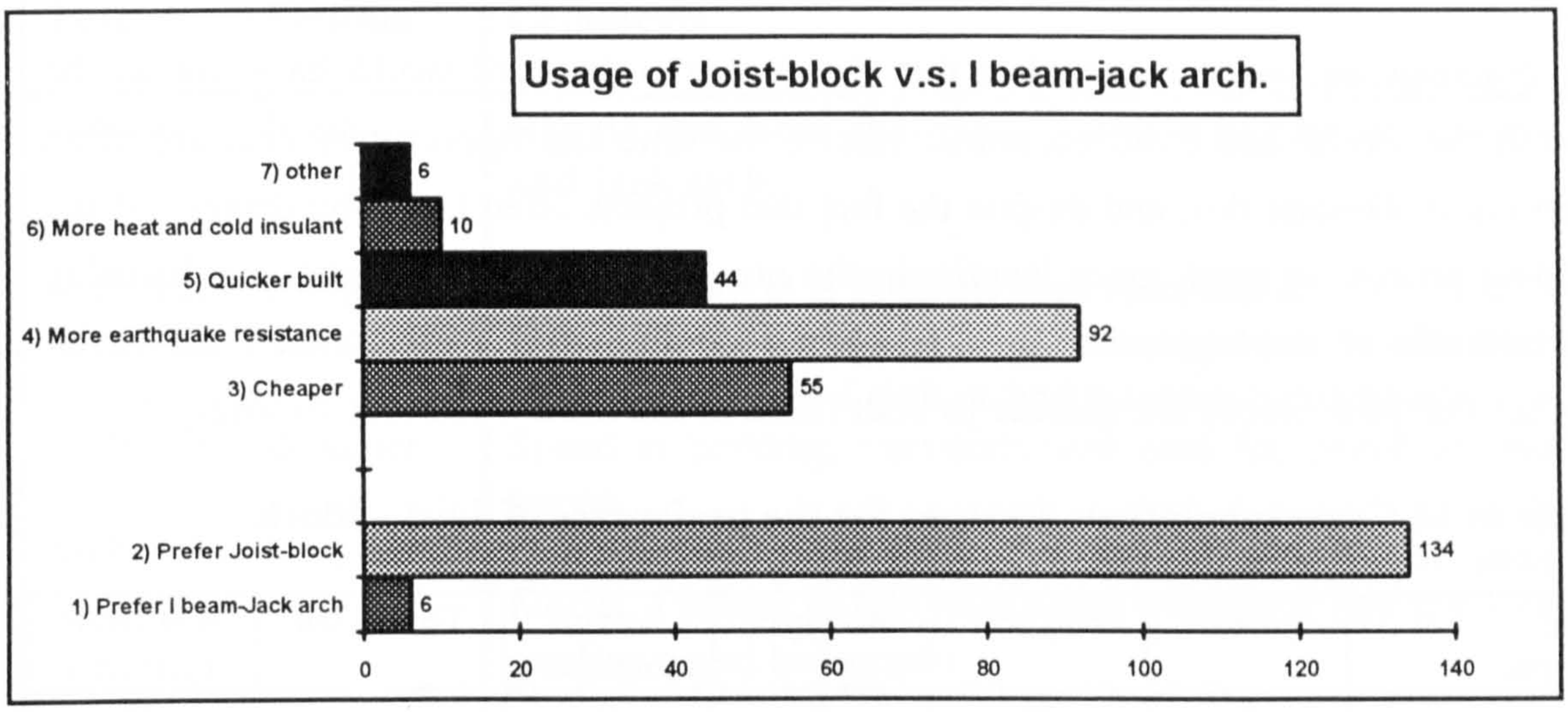
This method is used all over the country with the prospect of replacing the I beam and jack arch method (see Chapter 7). It was a successful example of launching a new product both into the modern and the T/C sector. Joist-block or as it is more commonly called *Saghf Sabok* (lightweight roof/ floor) may be considered as a floor/ roof system and is usually executed by specialised sub-contractors. Also refereed to as joist and block building components as they are directly bought by private owner contractor and assembled by *memar*s on site and completed with a 5 cm. in-situ concrete on top. It does not need shuttering or reinforcing steel work as the reinforcing still is already placed in joists. (there is only a net of 'temperature still' reinforcement of Ø6 at 30 cm. distance). While ready mixed concrete is available in Tehran and large cities the operation needs less skill.

It is two decades since the introduction of the first joist-block component/ system in Shiraz. The opinions of professionals involved in the industry were asked about its use, advantages and problems. As the author was aware of the general consensus and opinions of colleagues concerning the product it seemed that a post-coding approach would be possible and appropriate. Possible in the sense that categorisation of the answers was thought to be practical, and appropriate because by providing different types of questions alleviating the potential boredom of the respondents in the final group of questions.

The respondents were asked which type of roofing did they prefer to use or specify; 1) I beam and jack arch or 2) Joist - Block. Then they were asked to state one or two of the most important reasons.

95.7% of the respondents preferred to use joist-block over I beam and jack arch . With the exception of service engineers, Table 6:18 shows that there is no major difference between *memar*s, architects engineers and technicians in their opinion about the advantage of Joist-block over I beam and jack arch.

Figure 6: 14.



Almost all comments on this question have been categorised and 'post-coded' according to; 1) Cheaper to use, no shuttering less reinforcing steel work; 2) stronger; and more monolithic - and more earthquake resistant; 3) quicker to build with; 4) better heat and sound insulation. Some comments (shown in Table 6:17) did not exactly match the categorisation. Respondents had made a particularly interesting point worth attention. These are shown in Table 6: 14. However, technical advantages concerning the product have been the paramount reason for their use. Here there are lessons to be learnt when choosing new components to be introduced into the building market. This concerns the earthquake factor.

Table 6: 15 The use of joist-block

\Title Prefer J.B.	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total/ (percent.)
No	4	3	4	3	2	16 11.3
Yes	25	59	17	6	18	125 88.7
column total percent	29 20.6	62 44.0	21 14.9	9 6.4	20 14.2	141 100.0

The second reason for the choice is the relative cost of the technology or product. Customers do not usually have the ability to calculate the 'cost in use' as a result of better heat insulation properties of the joist-block for example, which uses hollow blocks, compared with the more solid I beam and Jack arch method. They may also not know that during the plastering of the ceiling, less operations and materials will be used in the

case of joist-block. These points are major strengths for marketing the product to it where the product becomes well known to both professionals and clients.

The conventional wisdom considers that the people in the third world 'have got all the time in the world' and basic economic values, the time and opportunity cost are often overlooked. Despite this, and despite the fact that projects often face long delays and the building process is much more lengthy in the prevailing situation of economic hardship and all kinds of shortages, the speed of operations remains a great concern. However, the fact that joist blocks are quicker to built ranks as the third reason for choosing it.

Table 6: 16 Cross tabulation: Reasons for the preference of Joist - Block

\Title Reasons	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total/ (percent.)
Cheaper	9	22	7	0	5	43 37.4
Earthquake resistant	18	47	12	6	16	99 86.1
Quicker to build with	8	24	9	5	8	54 47.0
More heat insulant	1	7	0	1	2	11 9.6
column total percent	23 20.0	54 47.0	14 12.2	6 5.2	18 14.7	115 100

Table 6: 17 Some of the respondents' comments on the use of I beam - and jack arch, and Joist -block.

Title	Position	Comments
Memar.	Hagh. Amal.	**Repair and later alteration is easier in case of I beam and jack arch.**
Architect.	Designer.	**Quality control is difficult with joist block.**
Architect.	Designer.	**It is easier to construct an 'I beam and jack arch' than other types of roof slab in bad weather conditions.**
Architect.	Designer.	Speed in building, versatility and ease for plumbing and wiring.
Architect.	Designer.	**Considering these days the fall in quality of joist blocks, I prefer to use steel beam because I can trust its quality and behaviour.**
Engineer.	Designer.	The advantages of joist block are that it is monolithic, and easy and fast to build.
Engineer.	Designer.	From the safety point of view I give the priority to joist block provided it is made under quality control and standard.
Engineer.	Designer.	For the sake of heat and sound insulation I prefer to use joist block. Steel should mainly be used for industrial purposes.
Engineer.	Contractor.	**I beam is more reliable.**
Engineer.	Contractor.	Joist block uses less steel and is advisable considering the low steel production of the country and the abundance of natural sand and gravel.
Engineer.	Contractor.	**I beam is easier to work with. It is also difficult to produce concrete joists of a good standard.**
Engineer.	Contractor.	Less material is used while plastering in case of joist block.
Engineer.	Material Producer.	I prefer joist block, because of its higher technical standard
Engineer.	_	Because of ease of use, its light weight, its provision of holes pipes in blocks, joist block is very much more economical for larger spans,

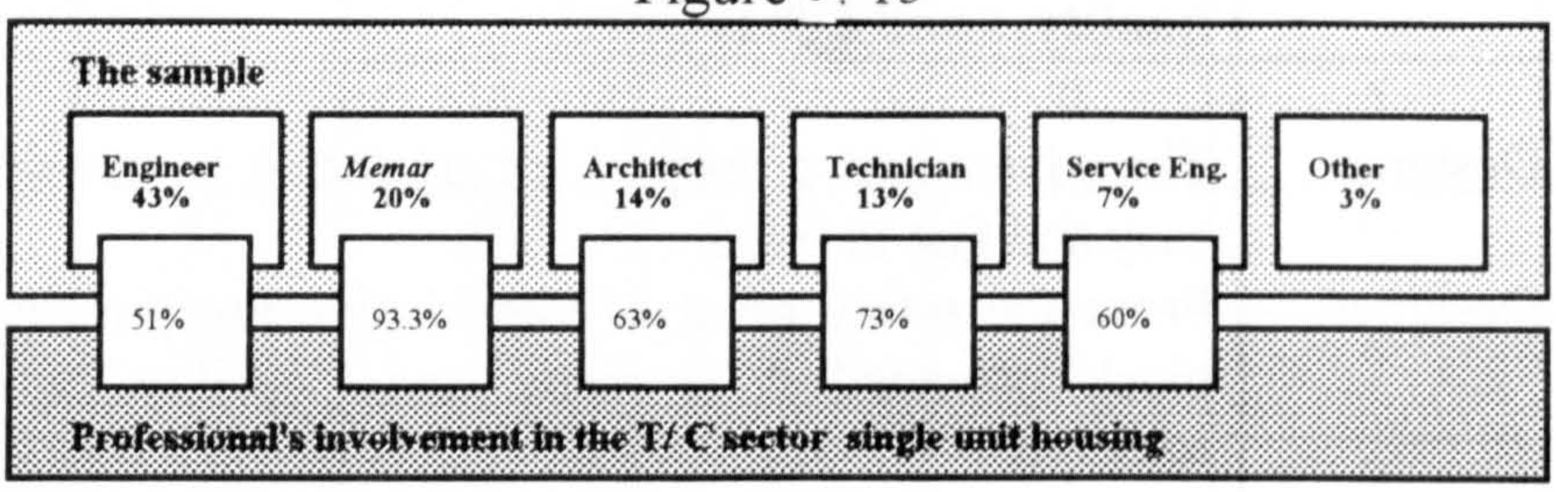
Those comments (the 6 in bold) against the use of Joist-block were counted as 'other' in the frequency test (figure 6: 14)

10. Summary and conclusion.

Summary and conclusion to this Chapter will be presented in association with the final assessment in Chapter 9. Here a brief summary of the major points is presented.

Professional's involvement: Figure 6. 15 shows the involvement of professionals in the T/ C sector. Modern CI professionals wile maintaining positions of responsibility in government funded public sector projects, at the same time are involved in the T/ C sector designing private residential and commercial buildings. *Memars* are exclusively involved in the T/ C sector.

Figure 6: 15



Factors affecting site productivity: Major factors affecting site productivity as perceived by the respondents are shown in Figure6 : 16 in order of importance. The studu gives credence to the authors assumption that productivity can be greatly increased by improvement of skills and avoidance of the direct waste of materials.

Figure 6: 16

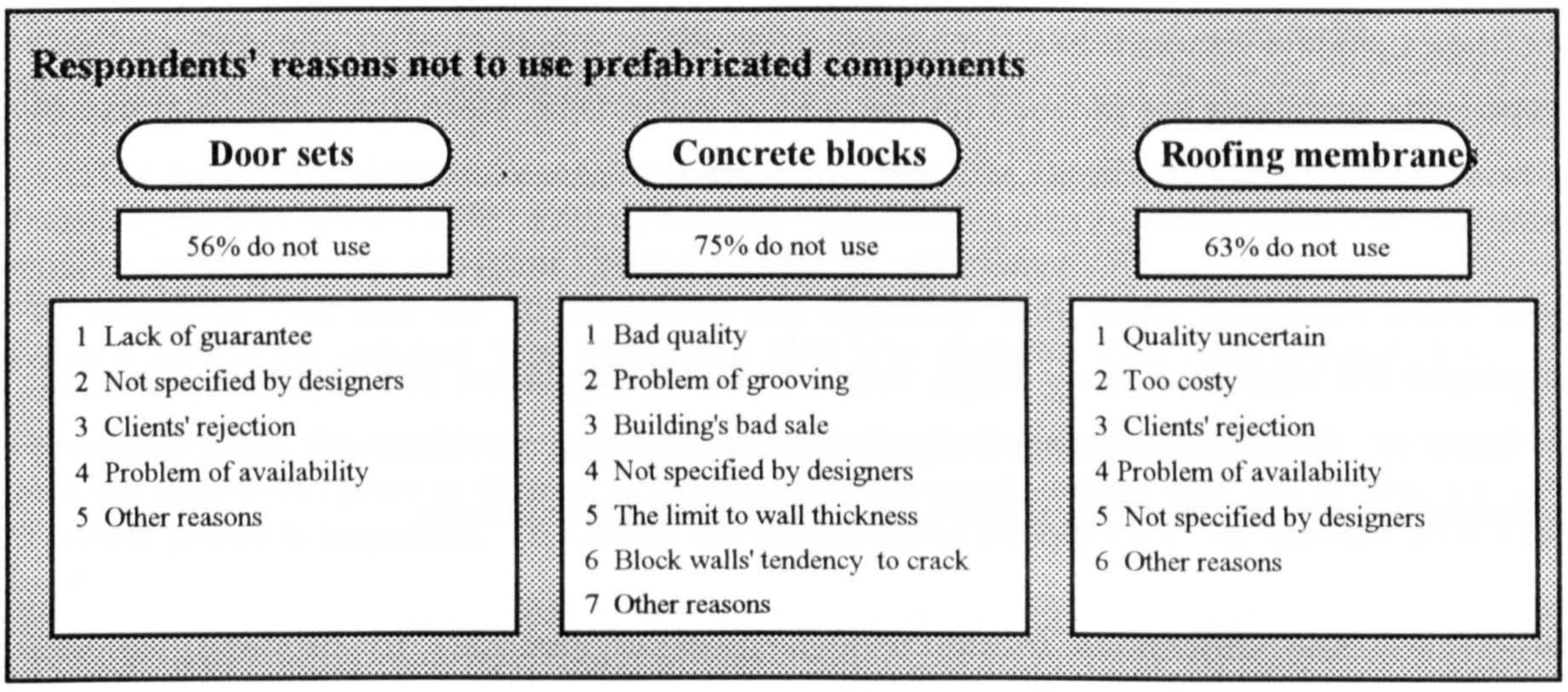
Major factors affecting site productivity in order of importance (management role excluded)

Respondents' view	Our view
1 Shortage of materials and components	1 Shortage of materials and components
2 Low use of machinery	2 Low labour skill and performance
3 Low labour skill and performance	3 Material waste
4 Labour's low discipline	4 Labour's low discipline
5 Material waste	5 Low use of machinery
6 Cold weather and rain	6 Cold weather and rain
7 Hot weather	7 Hot weather

The use of building components

Figure 6: 17 summarises the main reasons of rejection of three major components: a) doorsets, b) concrete blocks and c) roofing membranes.

Figure 6: 17



a) prefabricated mass produced door sets: 56% of the respondents were against the use of these doors. While almost 87 percent of *memar*s did not agree with their use, 70% of modern architects were agree; and engineers showed a 50-50 response. It can be interpreted as an evidence that in private sector housing **clients actually follow the *memar*s views.**

A major problem with high tech approach was clearly demonstrated in relation to door thickness and frame profile-making machinery. This was an example of the effect of inappropriate choice of machinery and the problem of importing a large scale factory lock stock and barrel. Having noticed the problems of centralised high tech mass production of doorsets the author found that there is a potential in small and medium scale regional workshops which can produce cheaper doors for clients and preserve and develop local joiner/ entrepreneurs.

b) The use of concrete wall blocks.

Despite more than three decades of the introduction and its long history, concrete block walls are rarely used. Only 25% of the respondents agreed with their use for residential buildings. %93 *memar*s, %90 technicians, %69 engineers, and %65 of architects disagree with the use of concrete blocks. *Memar*s and technicians are the worse enemies of

concrete blocks another indication that clients and *memar*s share the same view.

c) The use of roofing membrane. The most important reason declared was the uncertainty about the quality of products. Although these companies actually issue a letter of guarantee, still their dedication and attitude were a matter of complain. Guarantees must really mean guarantee! %72 of *memar*s, %72 of technicians, %60.6 of engineers, and only %47.3 of architects are against the use of prefabricated roofing membranes. While *memar*s and technicians are worst opponents of the use of these components architects are inclined on the side of agreement. Here again the total use of the product indicates that clients and *memar*s share the same view.

These three examples show that although the problems of the use and problems of acceptance are related in many ways, they can be distinguished and separately treated. Problems of the use is mainly related to training and problem of acceptance to organisational, institutional, legislative, and marketing inadequacies.

Prerequisites and difficulties in the establishment of factories to produce building components are summed up in Figure 6:18

Figure 6:18

Prerequisites and difficulties in the establishment of a factory to produce building components

Conditions for accreditation	Liabilities and obligations	Difficulties in order of importance
Conditions for concrete components producers 1 A registered company. 2 A General Manager holding an Engineering degree with three years experience. 3 A Production Engineer with three years' experience. 4 A Construction Technician with 5 years' experience. 5 A shutterer with 5 years' work experience. 6 An experienced reinforcing steel worker.	General liabilities and obligations 1 Approval of the exact location of the factory. 2 Approval of the muchinery to be purchased from abroad. 3 Approval of the employment of expatriates. 4 Complying with safety rules and regulations. 5 The phrase 'Made in Iran' must be written on the product or packaging issues along with its specification. 6 The manufacture of the product must be in accordance with the existing standards. 7 The holder of 'principle agreement' must obtain a licence for production after the installment of machinery and before starting production.	1 Government permission. 2 Shortage of primary materials. 3 Loan and finance. 4 High cost of and permission for imported machinery. 5 Recruitment of experienced technical manpower. 6 Marketing problems. 7 Problem of aquiring appropriate plot of land in agreement with the municipality. 8 Ordering, purchase and delivery of Iranian made machinery. 9 Choice of product. 10 Choice of technology. 11 Other problems

11. End notes

1 The relatively long time gap between the survey and writing up was due to a number of reasons. Among them were the financial and health problems of the author, and language problems. Another travel to was made to Iran in 1992 for the update of information and a number of interviews. However there has not been a significant change during the course of research as the structure and organisation of the construction industry is indeed very resistant to change.

2 Ghanbari Parsa. Ali, "The Interaction of Planning Policies and Construction Technology In Iran"; PhD Thesis. Department of Planning Policies; University of Newcastle Upon Tyne 1989

3 *Markaz Amar Iran,* (Iranian Centre for Statistics), *Salnamehe Amari Sale 1365 Keshvar* (Iranian statistical year book of 1987-1988) 1988 pp 518-519 . The estimate is based on the number of residential buildings in Shiraz and an average of 4 houses per year for each memar.

4 After 8 years of war with Iraq: Sept. 1980 - Aug. 1988 (*31st Shahrivar 1359 - 29th Mordad 1367*)

5 The survey of the factors which influenced productivity in the British building industry in the last 20 years was represented partly in Chapter 7. In that survey 100 questionnaires were sent by post, but only 25 percent positively responded.. This survey was carried out on January 1989. See appendix 4 for more detail.

6 Circular letter No 260 dated 28/2/1368 (18th May 1989)

7 Social and Community Planning Research, Questionnaire Design Manual 1972. p16

8 Ibid, 1972 p17

9 Ibid, 1972 p59

10 *Markaz Amar Iran,* (Iranian Centre for Statistics), *Salnamehe Amari Sale 1365 Keshvar* (Iranian statistical year book of 1987-1988) 1988 pp 518-519

11 See climatic map Appendix 1

12 Kasmaie Mortaza, *Eqlim va Memari* (Climate and Architecture), Tehran *1363* (1984) pp 165-175

13 Even in the context of the British Building Industry, with relatively high use of plant and machinery, not only did the respondents in the pilot survey show concern about the positive effect of the use of machinery, but also in the reports such as 'Capital & Counties Report on Japanese Construction Industry' and 'Building Britain 2001' cited earlier which speak enthusiastically of Robotics in the construction industry.

14 United Nations Department of Economic and social affairs, United Nations. The Prefabrication of Wooden Doors and Windows.; United Nations publication Sales No: E,72. IV 6 1973 p68

15 Since 1992 and the policy of privatisation by the Islamic Republic government these factories are expected to be or have been privatised.

16Op cit. UN Department of Economic and Social Affairs 1973 p69

17 Saami Djavid, an architect from Shiraz practising since 1968. In a three hour discussion involving 12

members of Architects Association of Fars (AAF) in 9th Feb. 1989

18 The author held two interviews in Shiraz in relation to mass produced door sets. The first was with Mr. Al-e Yasin local agent of *Sherkat-e Sanaye-e Choob-e Iran* (Iranian Wood Industries Company) and the second with Mr. Mizanshahi agent for Shahid Rajaee Factory. Mr. Mizanshahi had started a small production line locally producing doorsets with standard dimensions but with traditional technology. They were both interviewed on the same day on 12 Feb. 1992.

19 Ale Yasin op. cit. interview. 12 Feb. 1992.

20 Mizanshahi op. cit. interview. 12 Feb. 1990

21 Abu-Ghazzeh Towfiq M., 'Industrialisation of Building Systems in Jordan; The Investigation and Analysis of Housing Problems in Jordan and The Potential Role of Systems in Alleviating the Housing Shortage'. PhD thesis, The Catholic University of America 1985p422

22 McIntosh J.D., 'Improving concrete blocks for greater productivity'. Municipal Engineering, Vol. 143, No. 1 7th Jan. 1966 pp 21, 23

23 Kinniburgh W. A., 'A comparison of times required to build walls in building units of various sizes' BRE Current Paper 77/68 1973

24 MacIntosh J. D. The Manufacture and Use of Concrete Blocks for Walls. Overseas Building Notes No. 150, 1973 p 2

25 Interview with the Asre Iran Co. factory manager on 8th Feb. 1990. He also said that 'our blocks are slightly more expensive than our competitors which use very cheap machinery, but not at a level to justify the high initial investment. As far as we know most of our blocks are used for wall compounds inside the city and because of their fair face and accurate dimensions they do not need plastering so it costs less for the customer. The other important advantage of our blocks to those of other producers in the city, which is their high quality and strength, is ignored because there is a lack of the 'culture' of the use of concrete blocks.' This factory was built in 1976. The owner was a rich Dentist from Shiraz living in Tehran. He did not have any idea about blocks or building but he had links with the former regime and had managed to acquire free land for the factory and easy loans from the Banks. As a result of the flight abroad of the owner the factory, by the time of interview, was managed by a government appointed manager.

26 Op. cit. MacIntosh J. D., Note No. 150, 1973 p 2

27 MPB Iranian Centre for Statistics, *(Markaze Amare Iran)*, 'Information on planning permits issued by all municipalities in the country' *(Etelaate Parvanehhaye Sakhtemani Sadereh Tavasote Shahrdari haye kolle Keshvar)* 1986 p30-31

28 Op. cit. MacIntosh J. D., Note No. 150, 1973 p 8

29 Naphtha means 1 petroleum 2 any of various liquid hydrocarbon mixtures used chiefly as solvents. Also naphthalene, a hydrocarbon usually obtained by distillation of coal or tar and used specially in synthesis of organic chemicals. (source: Longman Family Dictionary) 1984 p452

30 Bonafont. R. L., Technical Director of the Ruberoid Building Products, Middlesex UK. In a letter to the author on 14th Feb. 1989 in response to the questionnaire survey see Appendix 4.

31 Kinniburgh William, Bitumen Coverings For Flat Roofs. Overseas building notes; Information on housing and construction in tropical and sub-tropical countries. BRE No. 180 June 1978

32 Two major producers of roofing membranes with brand names of 'Isoran', and 'Isogumme' were contacted by the author in March 1989. Both had been provided with a letter of guarantee for five years.

33 Danshjoo Habib, Engineer. Contractor, and a member of the Board of Directors of SAEF interviewed in April 1989.

34 Isogumme company agent in Shiraz, in a discussion with the author in April 1989

35 ISIRI, (Iranian Standards and Industrial Research Institute.)

36 Rustam is the epical hero created by Ferdowsi. Rustam had to succeed in passing through seven adventureous stages almost beyond the ability of ordinary mankind.

37 Izad Parast, Engineer, director of Iran Zand company, one of the pioneering companies producing Joist-block in Shiraz. Interview with the author 5th Feb. 1990

38 Ayatollahi Ali, Engineer director of the Ehdase Sanaat. in an interview in the company office in Tehran

39 Khosheh Chin Asadollah, General manager of Calendar Company in Arak. Interview with the author in Leeds April 1994.

40 M. Ferdowsi, Mamiran company director: No. 624 Azadi Avenue Tehran Iran. The interview was held at the company office on 6th of April 1989

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CHAPTER 7

Traditional/ conventional sector of the Iranian building industry: traditional roots and conventional practices

1. Introduction

This Chapter is an investigation into the organisation and management of the so called 'unorganised' building activities which this study considers it as the traditional/ conventional sector of the building industry. This 'unorganised building activities' is also referred to as 'informal' when comparing it to the formal status of the so called 'modern' sector. The most important features of the traditional/ conventional industry are its organisational framework and its role in the training of trades and skilled labour. The modern sector of the construction industry is still dependent on *memar*s for its skilled work force. Although training has been a problem area in the construction industry for quite sometime, no other method has yet been successful, other than the traditional apprenticeship system. One of the main problem areas for training is the introduction of more modern technologies.

1.1. Formal and informal

In most developing countries there is a modern sector of the economy in which the pattern of organisation, working and living is similar to those of the developed world. In nearly all there is also a *non*-modern sector, accounting for the needs of the vast majority of the total population. Here the patterns of living and working are different, if not profoundly unsatisfactory, and are deteriorating increasingly. Perhaps because the merits of these so called informal sectors and their genuine role in the overall economy is unknown, much concern has been increasingly shown by development economists over the general neglect of this important sector

> 'I am concerned here exclusively with the problem of helping the people in the non-modern sector. This does not imply the suggestion that the constructive work in the modern sector should be discontinued, and there can be no doubt that it will continue in any case. But it does imply the conviction that all successes in the modern sector are likely to be illusory unless there is also a healthy growth - or at least a healthy condition of stability - .(in the non-modern sector).' [1,2]

What Schumacher states, considering the whole economy in the Third World, is true, and it applies to the condition pertaining in the traditional/ conventional of the building industry. The scale of need, and the attention necessary to preserve the conventional/ traditional building industry is a matter of life or death for that sector as a whole.

The deep rooted traditional/ conventional sector of the building industry has gone through a period of neglect, disrespect and many difficulties. Although under-valued, and in a sense submissive, this sector still bears the responsibility for about 92 percent of residential building[3]. In fact 'in the twenty year period 1965-1985, out of all the investment in construction 90 percent was in residential buildings, while investment in construction formed a major part of gross fixed capital formation'[4]. Despite this, the traditional/ conventional sector is usually described as the 'unorganised' or 'informal' sector:

> 'Outside the 'organised' construction sector, there is a considerable 'unorganised' sector. In building the latter sector includes urban artisans engaged in building individual houses, usually with the prospective owner acting as his own 'contractor', and a large number of small, artisan-type, housing contractors throughout Iran. These are for the most part semi-literate or literate craftsmen, but together they probably account for around 80% of all housing construction.'[5]

It is true that the traditional/ conventional sector is informal or unorganised compared with the degree of formality and the type of organisation in the modern sector. Does this really mean that it has been operating all these years without any kind of organisation and is the government's negligence therefore of minimal importance?

1.2. The Importance of the traditional/ conventional sector.

One may ignore the fact that about 92 percent of housing construction is built by the traditional/ conventional sector in the form of single houses for users participating as self contractors; one may deny the deep roots of this sector in the history, close links with the people and all other merits which have been already studied in Chapter 2; one may deny the overall efficiency of this sector, its low overhead costs; and it's crucial role in the training of the various trades on which the modern sector is severely dependent. If all these factors are denied then there musst be a problem of judgement. But whose judgement: govenment officials, executives, professionals, or indeed all those people?

Conventional wisdom suggests that the state in the world has never been the expression of the people. Ever increasing rules and regulations are initiated and tailored by the body of 'formals' and they never consult the body of the society i.e. 'informals' . 'The state is whatever government happens to be in power-liberal or conservative, democratic or tyrannical- and the government usually acts in accordance with the mercantilist model'[6]. Hernando de Soto[7] defines mercantilism as a 'bureaucratised and law-ridden state that regards the redistribution of national wealth as more important than the production of wealth'. In practice, this redistribution does not mean equity, but tends rather to favour a small group that depends on the state and on which the state is itself dependent. Despite the best of intentions, governments in the third world tend to fall into the mercantilist trap.

'The 'informal economy' is usually thought of as a problem: clandestine, unregistered, illegal individuals, entrepreneurs, and industries that pay no taxes. These compete unfairly with companies and industries that obey the law and pay their taxes promptly'[8]. This is exactly what the director of Housing in the Ministry of Housing and Development complains about: 'The formal sector for the mass production of housing pays six types of taxes, about 18 percent of the price of the house, where in the traditional/ conventional sector, the owner-contractor, pays only 1/1000 of the price'[9]

In other words the 'formals' are not interested because they cannot manage or handle it, and there is nothing in it for them. There is a proverb in Farsi: *Digi ke baray-e man namijoosheh, begzar sare sag toosh bejoosheh.* 'It is OK for a dog's head to be boiled in a cooking pot, as long as someone else is eating it.' There is nothing in the informal sector for the 'formals' so they are quite happy to see it damaged. One can agree with Hernando de Soto[10] when he cites the Peruvian case: 'I was convinced that no serious research could be conducted on the basis of the prejudice, which no one had been able to substantiate fully and which instead reflected an inability to understand or appreciate Peruvians' true potentialities'. The author personally believes that the strategy statement by Akhundi (cited in Chapter 3), the Ministry of Housing and Urban Development, condemning the single owner built house and thus the traditional/ conventional sector is based on inadequate research, and less on prejudice.

1.3. Technological potential and problems.

The merits and potentialities of the traditional building industry and its continuity to the present day have already been studied in Chapter 2. There is however, the opinion of some professionals, who argue that bygones should be bygones and that new methods and technologies require new organisation and management. They deny the importance of the traditional yet contemporary role of this sector, and base their arguments on the need to employ new methods of modern organisation; industrialisation of building. Before tackling this specious argument, let us hear what Peter Stone[11] has to say:

> While the forms of traditional building tend to change over time, the underlying characteristics tend to remain the same. Traditional building usually uses a loose form of organisation in which the operations follow a recognised order and in which both the order and the work in each operation is well understood by the skilled craftsmen and is implied by the design without any need for detailed instruction. **This situation is not necessarily changed in any fundamental way by the introduction of prefabricated components, or by the standardisation of their measurements.**

What Stone is stating in general completely applies in the specific case of the Iranian traditional/ conventional Sector. In fact the reason why this author calls this sector traditional/ conventional (T/ C), and not traditional, is its potential for adopting new materials, and components perfectly, and to some extent even new technologies. It is true that the T/ C sector has some problems in the new technologies particularly concrete technology, but there are solutions to this problem through devising special training schemes. More on this later in this Chapter.

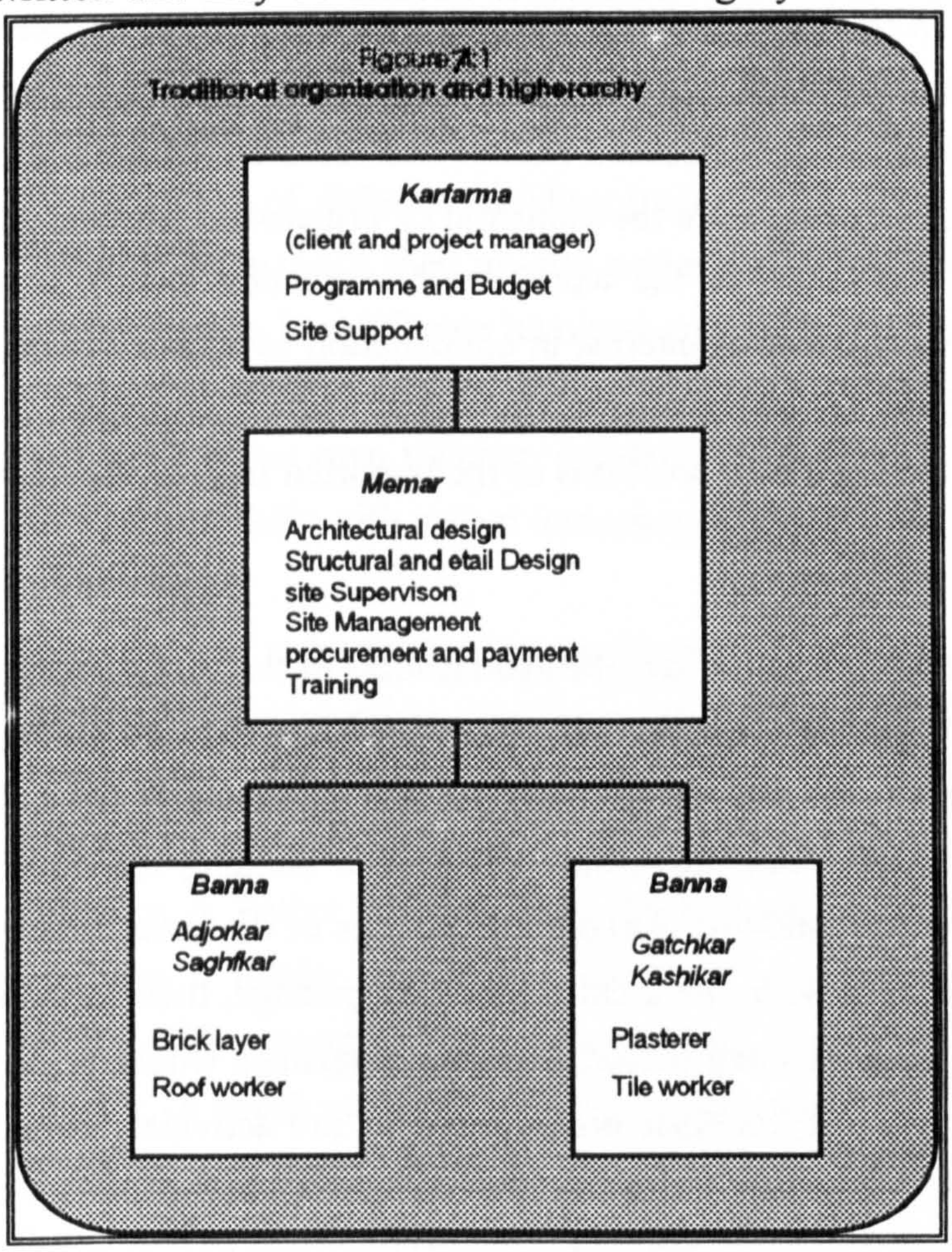
For those colleagues in developing countries who are very enthusiastic about industrialised building, perhaps it is interesting to know that even in Western industrialised countries 'in the first instance, and predominantly construction has been industrialised, not via the systematised prefabrication of buildings, but via the industrialised production of all materials and components, not by builders but by industrial manufacture and heavy industry.'[12] One do not need to go that far, and through a closer look at the developments of last 50 years there are lessons to be learnt.

Spillane. J.[13] in 1972 describes fourteen innovations in building in Iran all of which have been successfully used by the same traditional/ conventional industry and the owner built system. Almost all these new materials were introduced and first used by the modern sector. Most of these innovations were finally accepted and adopted by the *memars*.

Others are either in a transitional period of change and adaptation, or have been totally rejected for different reasons identified in the survey (Chapter 6). The survey showed that *memars* were most influential in the acceptance or rejection of these products in the construction industry as a whole.

2. The Structure and Organisation

It is true that the T./ C. Sector is informal, but how could an industry as important as this operate so efficiently without organisation? Over a long period this sector has developed a pattern of mutually acceptable agreements which hold the industry together and which have resulted in an organisational framework and proved to be suitable for the execution of building work throughout the country. Although in recent years some agreements, between *karfarma* (client) and *memar* have developed a more formal nature, like the written two or three page contract, many are informal in the sense that they are not written and may be difficult to enforce legally. The main element of this organisation however lies in the human relations established between the two parties concerned. The principles behind these relations are obviously cultural; principles like respect, trust, discipline and status. Traditionally, this relationship had only three principal sides: *Karfarma* (the client), *memar*, and the building.



The government, apparently, had no role to play. As Chardin [14] in his travel account describes, there were no government taxes or duties on the building or its sale. Instead the *memar bashi* or the chief of *memar*s was entitled to two percent of the price on each transaction. As

Chardin writes, the *memar bashi* did not usually claim the whole amount but only part of it depending upon the financial status of the owner. He was also entitled to five percent for all buildings built by the Government. If the building was built under his direct supervision the *memar* was entitled to 20 percent of the total cost. What Chardin observes is the picture of a strong professional body which also performed governmental duties. This organisation was based on trust, status, respect and discipline.

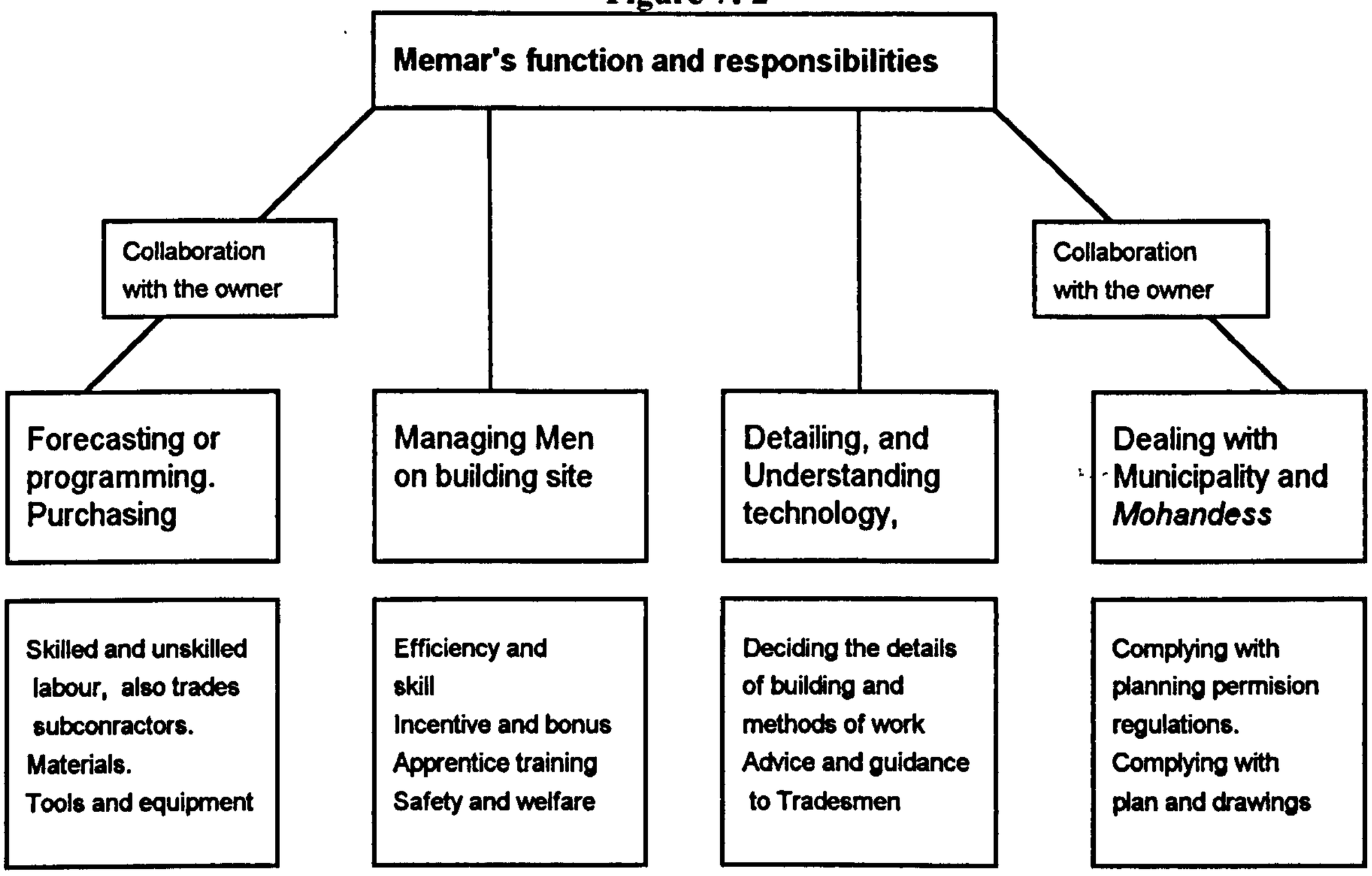
In the last 50 years the traditional building industry has gone through considerable modifications in response to the thorough-going changes in the social, political, technological, and business environment in the country. To the simple, almost three sided, relationship, new elements have been added which have created a virtually new form of organisation. Figure 7: 1 give a brief sketch of the organisation of this sector.

2.1. Management; *Memar as* Entrepreneur/ Site Manager

The importance of management in the context of the building industry can not be over emphasised. The construction industry itself has been seen basically as a management problem by academics and researchers. Many decision makers and research bodies in the Third World still 'do not approach building from the industrial or organisational point of view and the building research institutions of the world see construction mainly as a technical problem'[15]. It is probably the lack of interest in construction as a management problem which has led to the neglect of the management potential within the indigenous building industry and instead to the search for solutions in the imported high technology answer for mass housing.

Memars are the managers, entrepreneurs and in fact the main leaders of the T./ C. sector. Most of them are semi-literate or literate craftsmen who have gradually reduced and at some stage stopped manual work on site, and subsequently become increasingly involved in the managerial duties of a *memar*. They are mainly engaged in building individual houses and private sector commercial buildings. Although the duties of the *memar* have shrunk considerably and continue to do so in the architectural design stage, their role on site remains irreplaceable. Even in the modern sector, building companies would prefer to employ a *memar*, if they can afford it, for their management of site activities, rather than so called educated building technician whose wages are almost half a *memar*'s salary.

Figure 7: 2

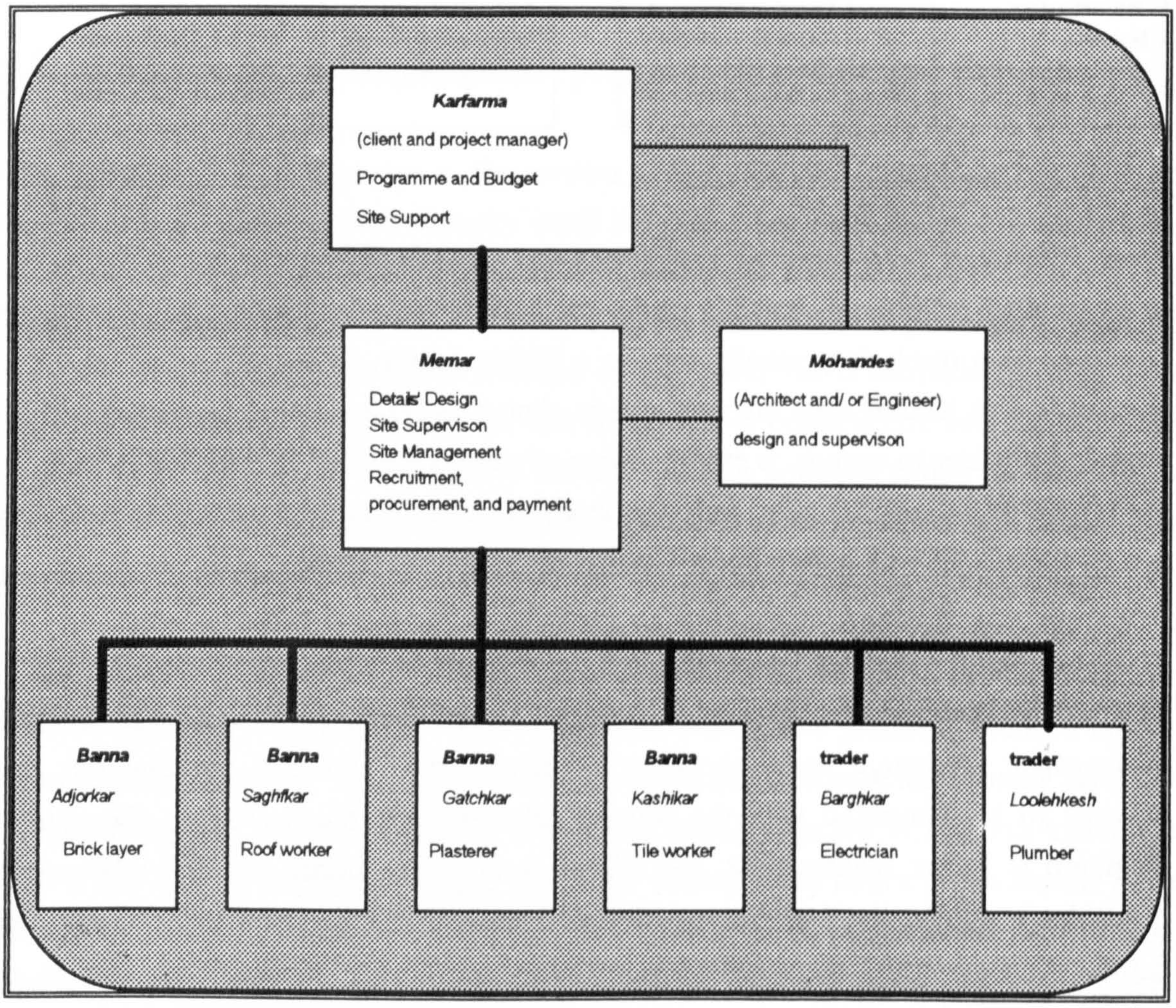


Their advantage over educated technicians lies in their management skill and deep understanding of different building trades, both in terms of technology and in human relations. As a result they usually achieve a higher degree of labour productivity. The *memar*, having himself been involved and in almost all trades during his progress from unskilled labourer to *memar*, is exactly aware of what is involved in every single task. In the course of his own training, and later in charge of training, the *memar* develops his management skills with a deep understanding of the 'human factor'.

Three types of management, as a reflection of 'government' style, have been described in Iran[16]: 1) Dictatorship management; 2) Father management; 3) Participation management. Although some elements of dictatorship, and also participation, are believed to be associated with the *memars'* management, the nearest to the correct definition is Father management: the *Memar* acts as the father and the relationship resembles a family; the *Memar*, ordering and caring, and the workers, obeying and faithful. This system of management seems more appropriate in a society -- and in an industry, in which professions are not institutionalised, working agreements are by word of mouth, and trade unions do not exist or are in their infancy. These factors can be interpreted as the advantage of traditional over modern training.

Within the T/C sector, *memar*s are the sole managers on site. However in the whole operation of a private owner built project, the *memar* shares the responsibilities of 'project management' with the *karfarma* ('owner' or 'owner contractor'). The process of design, and the manner of participation of the owner in the design process have been already studied in Chapter 2. With the ever increasing role of modern architects that pattern is rapidly changing. Despite the rigorous introduction of *mohandess* (architects and engineers) by law, their function in the management organisation of the building process is still an 'appendix' role. (compare Figures 7: 2 and 7: F3). Although by law and regulation the *Mohandess* is held responsible for supervision and quality control, the role of *mohandess* is practically finished by the time planning permission is obtained.

Figure 7: 3. Management organisation and hierarchy of traditional/ conventional building industry for a typical (one unit owner-built) house project.



The *memar*'s management skills depends on individual experience and personality. His 'natural' development of management skills could be enhanced by the study of simplified,

tailor made literature using the chief *memar*'s information and modern management knowledge. An excellent example of this type of tailor made management guide is the work of the BfD (Building for Development) prepared for local Nigerian building contractors[17].

2.2. Training and education: Traditional apprenticeship

One of the most significant features of the conventional building industry is that the formal and informal sectors of the industry are dependant upon the traditional apprenticeship system. Vocational education has generally failed to fulfil the needs of industry particularly in the case of the building industry, where it has failed to attract the interest of the young. Even the motives of those who choose vocational education are apparently not of interest but fear of failure in ordinary (non-vocational) education. They look for an easier way of getting a diploma and care less about making a career in the field they study. Research has shown that students who have lower grade point averages in primary education are more interested in vocational education.[18]

Unlike Britain building apprentices are not usually recruited by firms in the modern sector. This is because there are no formal regulations or any administrative institution to govern the system or the relationship between apprentice and employee. 'The building industry was the first one to have a National Apprenticeship scheme in Britain. In 1943, the Ministry of Works appointed a Building Apprenticeship and Training Council.'[19]

Apprentices are recruited directly by a *memar*; even if the *memar* himself is an employee of a company in the formal modern sector. The system is still an unmodified, ancient tradition based on non-standardised agreements, unpublished customs, tacit 'understandings' and unravelled procedures, which have been developed through the history of building activity in the country. This is why *memar*s and their 'father type' management and family organisation is so important and indispensable. Comparable with this system, the Western pattern appears far less desirable. In fact the strong point in the much admired Japanese Construction Industry is said to be its *Kankei* or human relations in management, . ' This *Kankei* is a form of social arrangement and web that binds relationships in everyday life and business.'[20] This literally means good human relations. It is also an answer to those who may argue, as usual, that in this case we are left behind, and we have to catch up with the West who have established sophisticated institutions and systems. The modern sector is confused in its understanding of the traditional system and so are the government authorities.

The formal education system has so far not been successful in contributing to the provision of bricklayers, plasterers, or any of the other skilled workers on a building site. Modern vocational schools (*honarestan-ha*) have been established since the 1930s, and teach all trades. With the exception of carpentry, which is practised in workshops beyond the building site, those who were educated in these schools in the field of building never considered manual jobs as a career. The reason for this is mainly a social one, a consequence of the modernisation period which have been already discussed in Chapter2.

The men who work with mud, mortar, brick, and stone have a complicated status. This situation is not peculiar to Iran. English youth, for example, were also reluctant to take up careers in the trowel trades. In the 1960s Kate Liepmann[21] states: 'The inherent skill and therefore the prestige of the trowel trades is lower than that of carpentry and of plumbing (painting comes last, both by the criterion of manual skill and by that of intelligence required); there is also some awareness of the long-term threat to security of employment in the traditional trowel trades by the growing competition of new building methods and materials'.

Despite the high wage differentials and a long period of relative job security in the last 25 years (with the exception of the last two years), town dwellers have become more and more reluctant to opt for careers as building craftsmen. Entering formal education is seen as a way of avoiding manual work and of embarking on a career in `white- collar' jobs. Working with machinery and plant has a stronger appeal. Certainly, the various craftsmen and artisans associated with the building industry do not have the prestige they had in the past, and are often regarded as inferior to `white- collar' workers. An office worker, in whatever capacity, would stand a better chance in the marriage stakes than his better paid but socially inferior brother, the bricklayer. The only hope for an enthusiastic building worker is the chance to be upgraded to the position of *memar*. This is a giant step in social status, but by the time it happens he is usually in his late 30s and married with several children.

Everyone in this sector, without exception, starts work on the building site as a *kargar-e-sadeh* (common labourer). A few, who may have finished primary school or who have come from a family already dealing with building, may be gradually upgraded to become *memar*s. The position of *memar-bashi* is more difficult to reach and very few accomplished *memar*s get this title. In the stages in between there are a number of crafts to learn and usually a *memar* masters only one or two of them.

'There is no clear distinction (at the beginning) in traditional Persian crafts between builder, mason, and bricklayer *(memar, banna)*. They all start as apprentices of a master builder *(memar-bashi)*. Those who were more talented than the average bricklayer made Persian architecture famous throughout the Islamic world.'[22]

As a *kargar-e-sadeh* (simple worker or unskilled labourer) the worker does all sorts of unskilled or less skilled jobs such as carrying loads, digging, or preparing mortar. If chosen for upgrading, and talent and family relations are usually important factors here, then the worker will be upgraded to *bar-dast* (mason's assistant, or apprentice). This is the most important promotion or selection, because it is possible to work all one's life as a common labourer and never get the chance to start as a skilled worker.

There are two types of masons *(banna)*; *seft-kar* (skeleton worker, mason for the building shell) and *nazok-kar* (finishing mason). After a period working as *bar-dast* it is crucial for the potential *memar* to be trained and then work as a *seft-kar*. At this stage the trainee mason mainly learns to build the walls and roofs of a building using traditional and conventional methods and materials.

The *bannay-e-seftkar's* (building shell mason) work is divided into a number of specialities: *adjor-kar* (brick layer); *sang-kar* (stone mason); *tagh-poosh* or *tagh-zan* (arching mason), and the recently added *beton-kar* (concrete mason), or *saghf-kar* (roof mason), the latter dealing with modern types of roofing, like the concrete joist-block flat roof method. As one may immediately recognise, **the training of the two latter trades does need some help and assistance.**

The *bannay-e nazok- kar*'s (finishing mason) work is divided into a number of specialities: *gatch-kar* (gypsum plasterer); *simankar* (cement-plasterer); *kashi-kar* or *kashi chasban* (tile worker); *sang chasban* (stone cladding worker); *Farsh-kar* (floor tile worker).

2.2.1. Adequacy of the system of training.

It is fair to claim that throughout its long history the apprenticeship system has properly served the building industry, and has adjusted itself in many ways to social, economic and technical changes, without any serious interruption or contradiction between the interests

of different parties. This is due to the simple, apprentice-*memar* relationship. As the conventional building industry, with its increasing involvement of architects, engineers and other modern professionals, moves towards sophistication this simple apprentice-*memar* system may be altered to a more sophisticated structure with the possible involvement of trade unions. It is worth noting that up until now, labour is still unorganised, and trade unions although emerging are not active and do not yet have any practical influence. In the case of sophisticated British apprenticeship system, Kate Liepmann[23] states:

> Apprenticeship is not just a form of training but is also used by both sides of industry in order to further their respective sectional interests. All the modifications made in adjustment of technical and other developments have been made in such a manner as to preserve the power of employers and trade unions to bend apprenticeship to their own ends. This has been brought about by way of accommodation between the former antagonists: employers and trade unions have come to terms on the issue of apprenticeship; but the outcome is in various respects at variance with the national interest.

There is no doubt that trade union movement will gain momentum sooner or later in the country; the outcome may be in variance with the interests of the employee, or with the national interest in the short term but will help human development goals and eventually national interest. Considering the national interest, the *Memar's* system of apprenticeship, without imposing any direct charges on formal education, has been an economic and efficient way of training . However there are a number of problems which must be addressed correctly and solved. the cost of training is only one criteria by which to judge an educational or training system. The question of adequacy remains to be examined. Liepmann suggests:

> From the point of view of the national interest the criteria by which to judge the apprenticeship system can be grouped under these headings: **1) Supply of sufficient workers with requisite skills; 2) Efficiency and economy of training; 3) Effects on productivity.**

Hereafter the *memar*s apprenticeship system will be examined under these three headings.

2.2.2. Supply of sufficient workers.

The building industry plays an important part in providing employment after general services, agriculture, and the mining-and manufacturing sectors. In 1987 the share of each industry was: **11% in building**; 13.5% in mining and manufacturing; 29% in agriculture; 42% in services. The apprentice system is the sole provider of skilled labour for the building industry but there are no direct data on the number of apprentices. As the apprentice is considered a part of the workforce on the site, he is called *bardast* or *komak* (assistant), and according to Iranian statistical convention, the apprentice is considered to be semi-skilled labour. Here the available statistics will be examined to test the ability of the *memar* apprentice system in terms of the number of required skilled workers.

The number of different types of residential building workers for 1987 were estimated to be:

A) 324,600 unskilled; **145,800** semi-skilled; **248,400** skilled workers.(derived from Table 7: 1)

The actual numbers of residential workers employed in 1988 were:

B) 389,000 unskilled; **132,000** semi-skilled; **239,000** skilled workers.(derived from Table 7: 2)

By comparing the above lists (A and B), certain conclusions can be drawn:

- Unskilled labourers increased more than the estimated figure. This means that there has not been a shortage of unskilled labour during that period. The number of semi-skilled and skilled labourers did not reach the expected target. The fact that the number of unskilled labourers exceeded the estimated figure can be taken as an indication that the job opportunities accorded with the forecast. Putting these two facts together one may come to the conclusion that the system failed to reach the expected target for providing skilled labour. Considering the fact that even the number of semi-skilled labourers, meaning the number of apprentices, did not reach the target suggests that the problem may be the difficulty in recruiting urban youth as new apprentices. This is in agreement with what have been already discussed concerning social status and the problem of the conventional building industry in recruiting and training sufficient apprentices.

- The figures for semi- skilled and skilled labour increase proportionate to each other; in other words the ratio of apprentices to skilled labour is almost constant. This may mean that the ability of the conventional industry to train skilled labourers cannot be increased beyond their 'natural' capacity.

Table 7: 1

Number of different types of labourers at work in 1983; and estimated for the housing programme of 1983-1987.(1000's)

Period	Labour type	Urban areas	Rural areas	Country total
1983	Unskilled	161.7	66.9	228.6
1983	Semi-skilled	69.9	22.7	92.6
1983	Skilled	120.0	41.2	161.2
1983	**TOTAL**	**351.6**	**130.8**	**482.4**
1987 estimate	Unskilled	169.3	155.3	324.6
1987 estimate	Semi-skilled	93.2	52.6	145.8
1987 estimate	Skilled	152.9	95.5	248.4
1987 estimate	**TOTAL**	**415.4**	**303.4**	**718.8**
New jobs	Unskilled	7.6	88.4	96.0
to be	Semi-skilled	23.3	29.9	53.2
created	Skilled	32.9	54.3	87.2
	TOTAL	**63.8**	**172.6**	**236.4**

Source: Ministry of Housing and Development 1983.

The study of Tables 7: 2 and 7: 3 also gives some insight into the proportion and the number of apprentices in the building industry.

1) In 1988 the number of semi-skilled labourers was 132,000 in residential and 13,000 in non-residential building. The ratio of non-residential to residential building workers is 10% (employment in civil engineering work is not included.).

2) The estimated increase to a total of 718,800 workers in 1987 from 482,400 in 1983, was achieved with the actual total employment of 835,000 workers in 1988.

This is contrary to the prediction of a few who argued that this goal could not be met.[24]

Table 7: 2 The number of different types of labour in 1988; an estimate for 1993 and employment opportunities in that period (1988-1993)in the First Development Plan of the Islamic Republic of Iran. (1000's)

PERIOD	LABOUR TYPE	RESIDENTIAL	NON-RESIDENTIAL	COUNTRY TOTAL
1988	Unskilled	389	38	427
	Semi-skilled	132	13	145
	Skilled	239	24	263
	TOTAL	760	75	835
1993	Unskilled	464	46	510
estimate	Semi-skilled	157	16	173
	skilled	286	28	314
	TOTAL	907	90	997
NEW JOBS	Unskilled	75	8	83
TO BE	Semi-skilled	25	3	28
CREATED	Skilled	47	4	51
	TOTAL	147	15	162

Source: Ministry of Planning and Budget: 'Housing And Building In The (First) Five Year Development Plan'; 1987 p88

From the two lists (C & D below) of residential workers in 1983 and 1988, the overall proportion of residential building workers is calculated in Table 7: 3. The Table clearly shows the high proportion of unskilled labour in the context of the conventional building industry. This, in addition to the overall low labour productivity, is the basis for those who argue the necessity of prefabrication and the industrialisation of building.

- -From every three workers who start a job as an unskilled labourer, one has a chance to be upgraded to a semi-skilled (apprentice) position.

C) Number of residential workers in 1983	
Unskilled	228,600
Semi-skilled	92,600
skilled	161,200
Total	**482,400**

D) Number of residential workers in 1988 (from Table: 7:2)	
Unskilled	389,000
Semi-skilled	132,000
skilled	239,000
Total	**760,000**

- - Further, for every two skilled labourers there is approximately one apprentice on site assisting the skilled labourers.

Table 7: 3

The overall proportion of residential workers for 1983 and 1988

Year	Unskilled	semi-skilled	skilled	total
1983	47%	19.6%	33.4%	100%
1988	51%	17.5%	31.5%	100%
Average proportion	**49%**	**18.25%**	**32.45%**	**100%**

Source: devised by the author based on information from the Ministry of Housing and Development (Table 7:1); and the Ministry of Planning and Budget (Table 7: 2)

2.2.3. Requisite skills.

Although in the periods of boom the need for a sudden increase in the number of skilled workers may result in shortage and disproportionate increases in wages; the problem of quality and the type of skills needed impose more important problems for the industry.

> 'So far as I remember we did not find any problem in recruiting masons and trowel trades in terms of numbers, but the level of their skill is the main concern of every *memar*, while there is a need to recruit new ones. S*hagerd*s (apprentices) of the old times were better than *Banna*s (masons) of today, this is because the whole scene of the workforce has changed. In the past we had the chance to recruit apprentices from citizens who already had a background and relation to the building work. Later, with the increasing reluctance of city youth, we had to recruit them from rural workers, and to-day the situation is worse because a large proportion of building workers (unskilled labourers) are Afghan refugees.'[25]

There is no doubt that the background knowledge and the culture of apprentice recruits are important. From the point of view of practical skills, the apprentice has the opportunity to upgrade himself to an acceptable level by virtue of `on the job' experience, but with the introduction of new technologies, the monolithic character of apprentice training does not seem to be adequate. In addition to practical skills it is necessary to have a thorough understanding of the job's technical aspects as well as a general education.

It would be helpful if more literate apprentices could be recruited. This depends on

an increase in literacy, particularly in rural areas. According to an estimate in 1990, 54% (male 64%, female 43%) age 15 and over can read and write. But as technical knowledge is taught by *memar*s, it is important to improve the *memar*s' knowledge in the field of new technologies, such as concrete work. To this end the author initiated and organised a series of free short courses held with the *memars* and Technicians Union of Shiraz in 1984. This work has been carried on by the Society of Architects and Engineers in Shiraz and continues still. These sort of efforts should be encouraged and somehow institutionalised.

Another problem is that the required skills in the conventional building industry are not limited to traditional trowel trades in which *memar*s have a thorough understanding. Notable among non-trowel trades is the welding trade. Although welders are usually trained in welding shops, certain aspects of their training on-site needs the *memar*'s control and supervision. Basic information by *memar*s can play a major role in improving the quality of both buildings and the welders skill.

2.2.4. Efficiency and economy of training.

> The concept of apprenticeship is characterised by the duality of its nature: the apprentice is both earning and learning, the employer is both training him and paying him for productive work. Apprenticeship thus forms part of the system of education and part of the economic system, and the adequacy of apprenticeship turns largely upon its success in harmonising the interests of education and of production'[26].

Apprenticeship is considered not only the most economical method of training for the building industry, but the only possible way. It is certainly economical for the trainee and also for the government in the sense that government does not spend one rial on it. It is efficient in the way that it can provide the required number of skilled workers, but under present circumstances there are unsatisfactory levels of skill and productivity. These problems, in addition to the question of the effects on the life cycle of the building, cast doubts on the overall economy of the system, and give ammunition to the argument for the employment of industrialised methods. Successful experience of close collaboration between the Society of Architects and Engineers of Fars and the Union of *Memar*s in arranging educational evening sessions leads the author to believe that these problems can be solved almost free. In contrast, the cost of employing industrial methods, including social costs, is so high it is beyond estimate.

2.2.5. Effects on Productivity

Another piece of ammunition used by those who level arguments against the traditional system is low labour productivity. In a report by the Planning and Budget Organisation the issue was described thus:

> 'One of the reasons for low labour productivity in this country is the existing difficult system of training based on experience, and the lack of an exact and planned training system for the preparation of a productive and appropriate workforce Devising a sound education system, and in accordance with housing plans and policies, is one of the necessities for solving the housing problem'[27]

Nice words, but the author believes that they are simply untrue. Even if true no one has come up with a practical research proposal for the evaluation of the present system. The above report neither elaborated on how the system is difficult nor did it discuss how building productivity is affected. Having called for a 'sound education system' the report also failed to come up with any plan for devising such a thing. The important issue of the way in which productivity can be affected by the inadequate training method, is directly related to this study. Ironically there is no previous study on this key issue. A careful study of each trade and the manner the tasks are carried out is the only way to diagnose the main problems and of finding a way for their solution. In fact the Iranian brick layer's labour productivity is considerably higher than their counterparts in Europe in terms of the number of bricks laid per man/ hour. However, their labour productivity per house unit or per square metre of building is considerably lower. **It is fair to conclude that the productivity of the labourers in this country is lower than their counterparts elsewhere, but it should be acknowledged that there are problems in the methods of work which result in lower overall productivity and lower building life.** This was examined in detail in relation to brick walls and conventional bricklaying practice earlier in Chapter 4.

2.3. Client *(Karfarma)*

Karfarma, or *sahabkar* does not exactly mean client. The Farsi word for client is actually *moshtari. Karfarma*, means `work-orderer' and *sahabkar* means the `work-owner.' *Karfarma* is a client with authority who contributes to and takes part in all stages of construction, from design to the final stages of building. Chardin[28] states that 'Iranians do not like inherited (already built) houses, and every individual likes to build his own

house. As the old saying goes: 'The difference is like the difference between a ready made garment and a cloth tailored specially for you'. After 350 years that statement is still true. In a ten year period between 1976 and 1986 an average of 87 percent of the houses built in this period were built for personal use, 10.16 percent built to be sold, and 2.84 percent to be rented. (Table 7: 4)

The Table also shows that the share of rented accommodation has sharply decreased since 1979. The cause of changes in rented accommodation lies with the 'Revolutionary' tenant protection laws and regulations which discouraged investment in housing for rent. The changes in the numbers of buildings for sale is a result of laws on urban land which made it particularly difficult for small *Besaz-o Befroosh* (Build and Sell) entrepreneurs to acquire building land. Some schemes were introduced by the Ministry of Housing and Development in 1983 to alleviate the latter problem of production of houses for sale, but these schemes favoured medium and larger scale companies in the formal sector. The Table shows that these schemes had little effect on the whole market.

Table 7: 4 Share of different categories of residential buildings according to the client 1976-1986

Year	Built as home	For sale	To rent
1976	75.7	19.3	5.0
1977	76.1	18.8	5.1
1978	82.1	13.6	4.2
1979	87.0	10.9	2.1
1980	92.8	4.9	2.3
1981	91.9	5.7	2.2
1982	-	-	-
1983	92.2	7.0	0.8
1984	92.6	6.0	1.4
1985	89.3	7.8	1.8
1986	90.7	6.8	1.9

Source: *Bank Markazi* Islamic Republic of Iran. Report on private sector building.

2.4. Nature and order of projects.

According to findings published by the Iranian Statistics Centre[29], 138,170 building permits for the construction of 144,241 buildings were issued by all the municipalities of the country in the year 1985-1986. The total net floor area was 31,438,058 square metres, which used a total land area of 46,501,104 sq. m. Of the total number of building permits issued in 1985-1986 Tehran Province still had the largest share despite a decline from 12.4% to 11.8% , followed by Isfahan and Khorasan with equal shares of 9.3%

each, and then Khuzestan with 8.7%.

The average building area for the building permits issued nationally was 218 square metres in 1986. The figure in 1985 was 188 sq. m., showing an increase of 15.9%. From the total building permits issued nationally in 1986, 58.5% were for single storey buildings, 29.6% for two storey buildings, and 11.9% for three or more storey buildings. The same figures for the previous year (1984) were: single storey 64.8%; two storey 27.7; three and more storey 7.5%. This shows a trend towards `vertical development'. The comparison of the data from different provinces shows the share of single storey buildings is larger in less populated provinces such as Booshehr, Sistan, Baluchestan, Kerman, and Kohkiloyeh and Bayer ahmad ; the share of two storey buildings is larger in Bakhtaran, Western Azarbyjan, and Hamadan; three and more storey buildings are mainly limited to Tehran, Central, and Hamadan. In other words it seems that increasing the storeys has a direct relation to an increase in population.

The survey of building permits also shows: 1) that 87.9% of nationally issued building permits were to be built with brick and steel as the main building materials(load bearing brick walls and I beam - and - jack-arch roof and floors); 2) 3% were to be of brick and wood- post; 3) 3.2% were to be of steel or reinforced concrete structure (frame); 4) 3% were to be mud brick and mud; 5) 5.6% were to be made from other materials.

The share of the dominant category (No. 1) in the previous year was 94.7%. Its decline to 87.9 is due to the relative increase in the use of joist- block components instead of I beams for the roof construction in cities and the relative increase in the use of wooden posts in rural areas.

Table 7: 5

Percent of public and private sector investment in building 1976-1986

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Public	%13	%14	%20	%9	%9	%12	%15	%8	%5	%4	%5
Private	%87	%86	%80	%91	%91	%88	%85	%92	%95	%96	%95

Source: Derived from Bank Markazi Iran economic reports. p25 Housing and Construction in the Fifth Development plan p25

Table 7: 5 shows the share of public and private sector investment in building in a ten year period. The private sector constitutes almost 90 percent of the total house building in the country.

Public sector building is almost exclusively carried out by the formal or modern sector of the construction industry whilst private sector buildings are built by the conventional industry. The fact that the public sector's share of housing is negligible means that modern (formal) sector's involvement in housing provision is very low shows clearly that the T./ C. Sector is still not far from being the sole supplier of residential building. In fact Table 7: 5 shows that the share of private sector buildings has actually been increasing, and with it the share of T./ C. Sector has increased.

Investment in public sector building was highest in 1978, one year before the Islamic Revolution. Since the Revolution it has declined because of the decrease in oil revenue, and since 1980, as a result of the Iran-Iraq war. Since the end of the war there has been an increasing tendency for government involvement in housing. The decision by the Ministry of Housing and Development to build 32 new cities with populations of between 200 and 500 thousand people,[30] in addition to government approval for the building of 100 new industrial cities,[31] indicates a definite trend. in conjunction with government discussions on the methods of contract this signifies a move towards decision making from above along the authoritarian path of land> works> people.

Perhaps the most important feature of the order of precedence within traditional building is its compatibility with the traditional housing process, **'land > people> works'**[32] , rather than the authoritarian **land> works> people.**

The most common authorised modern development procedures have reversed the traditional order of people before works: Commercial speculative developers and government housing agencies build first, usually before the buyers or tenants are known or selected. This was not a deliberate or even conscious change of policy but a change that has a long history. This is particularly so in England starting with the enclosures of common land in the Seventeenth Century, depriving peasants of freedom to build for themselves and making them dependent on their employers for their housing. The tradition was taken over by the Eighteenth century factory owners, then by the Nineteenth Century speculative landlords and later by the state[33].

In Iran neither Seventeenth nor Eighteenth century British-type developments happened. In the last 50 years, when land speculation appeared, the speculative land owners did not interrupt the pattern of Land > People > Works in a fundamental way. With few exceptions, after being divided into plots of land, agricultural land in the vicinity of the cities were usually sold directly to individuals to build their homes. This was done either

by the original land owner (landlord/farmer) or by the speculator who acquired the land from the original land owner. The small share of public housing did not affect this pattern as home ownership has always been very high in this country compared with many others.

According to a survey by the Planning and Budget Organisation in 1976 the rate of home ownership was 70.3%. In the same period it was 31.5% in France, 33.7% in Switzerland, 35.3% in West Germany, 36% in Sweden, 43.9% in the UK. 50.2% in Italy, and 62% in the USA To this comparison must be added that, in this case, almost 90 percent of the houses were owner built.

Before the Islamic Revolution, except during the Fifth Development Plan, the government did not fundamentally intervene in the housing sector. The drastic increase in oil revenues in 1973, the effects on Development Planning, the big push strategy and rapid urbanisation resulted in an increase in the housing deficit. In order to alleviate this acute shortage and also to improve the quality of housing in the main cities, particularly Tehran, a 'crash housing programme' was initiated in 1975 to build 200,000 housing units in three years. The idea was to import 150,000 units lock stock and barrel, and locally produce 50,000 units by imported housing factories. This programme was doomed to failure. This is discussed in Appendix 4 in detail, but the total neglect of the T./ C. Sector of the industry and the traditional mode of housing was astonishing.

Table 7: 6

Number and area of the buildings built by private sector in 1985

Building type	**Number**	**Building area** (1000 Sq. m.)
Residential	127373 **(88.4%)**	22012 **(85.4%)**
Residential & shops	9769 (6.8%)	2377 (9.2%)
Commercial	6387 (4.4%)	1012 (3.9%)
Industrial	249	138
Educational	4	15
Health	14	78
Religious	150	99
Sport and Leisure	0	0
Hotel, Bed & Breakfast	9	26
Others	95	13
Total	**144050 (100%)**	**25769 (100%)**

Derived by the author from: *Iran Dar Aynehe Amar* (Iran in Census Mirror) ; published by; Centre for Iranian Statistics Ministry of Budget and Planning; issue No. 6; 1987 p161

When the Islamic government gained control of urban land after the Islamic Revolution it started to provide 'sites and services' to individuals. However, the government increasingly introduced schemes which involved contractors in land >works> people; notably the decisions made by the Ministry of Housing and Development[34], on the methods of building 32 new cities. For this purpose *Sherkat-e towlide shahrhaye djadid dar Iran* (The New Cities Development Company in Iran N.C.D.C.) was established in 1992. These cities are to be built by a joint venture of the N.C.D.C. and different Iranian or foreign contractors. The Ministry of Housing and Development will provide cheap land and in return will receive a number of completed apartments. The details and terms of these contracts are out of the scope of this dissertation but it is worth noting that considerations of who will live in the buildings will come after `works', and the work will be carried out by big Iranian or foreign firms or joint-ventures between them.[35]

Past experiences in relation to the gap between planning goals and the actual implementation of Housing Plans, in addition to the growing shortage indicates that it is still safe to assume that for years to come private sector housing will continue to account for more than 70 percent of total housing. In Table 7: 6 the percentage of residential and other types of building built in 1985 is shown as an example. Both in terms of number (88.4 percent), and in terms of area (85.4 percent) the buildings are largely residential. Statistics show that this percentage has not changed fundamentally (see Table 7: 7).

Table 7: 7

Percentage of the number of residential buildings in total private sector building.

YEAR	1977	1978	1979	1980	1981	1982
RESIDENTIAL	92.7%	91.4%	86.8%	84.9%	85.0%	86.4%
OTHER	7.3%	8.6%	13.2%	15.1%	15%	13.6%

Derived by the author from: *Iran Dar Aynehe Amar* (Iran in Census Mirror) ; published by; Centre for Iranian Statistics Ministry of Budget and Planning; *1363* (1984) p102

The `natural' process of housing in the country has involved the traditional /conventional building industry in close collaboration and harmony with the people in a process of:

people >land >*memar*> works

Any effort by decision makers to disturb or undermine this system will have serious consequences and must be avoided. We must not allow new forms to overwhelm us in the way mass housing affected Europe[36].

> 'Our task is to try and understand what we are doing as clearly as possible, and not to explain and interpret it only after it is done. We must see what the future holds

> so that we may judge it, come to terms with it, or fight it. If new forms of human housing offer new opportunities, we must be able to say why they are preferable to old ones. To do that a clear insight is needed into what a dwelling really means. Once we agree that it is necessary to introduce the inhabitants as an active force into the housing process, we can face the future with confidence'.[37]

Habraken's comments are made very much in the light of Europe's post-war experiences with mass housing. Yet the professionals and politicians are worshipping its merits and craving for its implementation. It is ironic that we rarely seem to learn from the experience of others.

2.5. Contract Methods: *Haghol amal*[38]; 'Labour only'; Trade sub-contracts.

Haghol amal is the most common form practised since data-recording begun 350 years ago[39]. *Haghol- amal Kari*[40] is basically a type of cost plus contract. There is usually a very brief (two to five pages) written agreement which determines terms and conditions of the contract signed both by *Karfarma* and *memar*, which is called *Haghol- amal- kar* in the contract. The *Haghol- amal* (percentage) paid to the *memar* has traditionally varied between *memars* and has depended on circumstances. After asking Abul Qasem *Memar*ian[41] about the percentage usually agreed for *Haghol amal kari*, he stated that: 'In the years 1349-1350 (1960-1971), when I had about 10-12 buildings to construct concurrently, and this was not a difficult number in those circumstances, I used to charge between 1 to 2.5 percent of the total cost, and I was happy. These days it is impossible to run more than three jobs at the same time and the usual charge is 10 percent'. The payments to the labourers and the purchase of materials may be done directly by the owner or on his/ her behalf by the *memar*. In any case the percentage would not be affected.

This method of contract which is based on trust and good will is gradually decreasing as the structure of society is changing. In the past word of mouth seemed to have been enough because in most cases there were not even any written contracts. These days people suspect that the *memar*, as a *Haghol- amal Kar*, will not put much effort into controlling the cost of building, and indeed may even try to increase the cost to increase his own percentage (payment).[42]

With the increasing role of architects and engineers, and their influence on the industry as a whole, a type of unit price contract has been increasingly introduced. Labour only contracts are gradually replacing the *haghol amal kari* practice. In labour only contracts the *memar* and *karfarma* start by agreeing a unit price for the cost of labour for one square metre of building according to the design, specification, location, and other practical considerations. The *memar's* responsibility lies directly to the *Karfarma* and indirectly to the *mohandes* (architect or engineer) although it may seem to be the reverse, i.e. directly to the architect and indirectly to the *Karfarma*. The *memar*'s responsibility includes execution of works, site management, hiring (and firing) of labour, and quality control. Regular payment to the labourers is the responsibility of the *memar*, and the *karfarma* pays the *memar* by instalments at agreed stages and according to progress.

Sub contractors, who first appeared on site in conjunction with the foreign contractors in the early days of the modern sector, are increasingly becoming a common feature of the conventional building industry. There are two main differences in sub-contracting between the modern and the T./ C. Sectors. The first is that sub contracts in T./ C. Sector are usually labour only, whereas in the modern there are numerous cases of labour- and material contracts. The other difference is the informal nature of sub contracts in the T./ C. sector where there is often no written contract. This makes the settlement of disputes very difficult if it can not be resolved by the *memar*.

2. 6. Memars' role and method of design.

While *memar*s continue to be responsible for design in rural areas, smaller cities, and also for the lower budget building in towns, the *memar*s' share in the design is increasingly reducing and they are being replaced by architects and engineers. The introduction of *Ghanoon-e Nezam-e Memari va Sakthemani* (Architecture and Construction Order Act.) has forced this shift. This will be further discussed later. The continuing influence of the *memar* in the design stage does not seem to diminish even in the event of appointing an architect or an engineer for design. On many occasions the client approaches a *memar* whom he knows, and then together they decide which architect or engineer to choose. Even if the procedure is reversed the *memar* has his role as the client's advisor in different stages of design. Clients usually go together with *memar*s to appointments with the architect. There seems to be continuity of the influence of traditional principles and the procedures of design.

Traditionally and today when the design is prepared by the *memar* , the procedure is with close collaboration of the *karfarma* (Client). In Chapter 2 the five main traditional principles for design were discussed in detail. Understanding each of these principles took the *memar* years of experience, as well as the teaching and guidance of an *Ostad* or *memar bashi* (senior *memar*). These principles were:

- ***Mardomvari,*** the principle of function and human scale.
- ***Khod Basandegi;*** the principle of self sufficiency. In practice it meant the maximum use of existing facilities from *Boomavard* (local) components, that are locally produced from local materials.
- ***Ganj-0-Banar,*** the principle of avoiding the unnecessary work that not only wastes capital and labour but also can spoil aesthetic and artistic values. Even decorative elements should have a practical basis and a function.
- ***Niaresh-va-Peymoon,*** refers to all works and activities carried out for the stability and strength of the building.

In other words *niaresh* is a complex of statistics and structural calculations, with the addition of material science, used to work out dimensions and dictate the choice of appropriate methods and materials; ***daroongaraie*** ('inward looking'), a design philosophy. Our architects, like our philosophers and Gnostics, were taught to pay more attention to the inside than to the outside. The climate of the country, privacy, and 'the issue of *'hejab*', the preventing of the inside from being in view to the outside.

To-day these principles may not be thoroughly applicable to modern conditions, particularly with regard to technical and technological conditions. However, the same principles are used to simplify and codify design problems. For example, when I beams were introduced and used for Jack-arch flat roofs, it raised the problem of the assessment of the beam height of the beam. Structural calculations by engineers, involving modern mathematical methods, were out of the question for *memars* and were seen as being in the domain of engineers on whom they were reluctant to be dependant. Soon, all over the country, a *memars*' formula came out according to the old method of *niaresh-o-peymoon*; namely the same method in which the thickness of a wall was determined, using a proportion of the room span. The *memars'* formula for the I beam is:

BEAM HEIGHT (in centimetres) = ROOM SPAN (in metres) X 4

For example. for the span of 2.5 metres:
2.5x 4 =10 ; NP 10 (Normal Profile No. 10 is used with 100 millimetres height)[43]

For the span of 3 metres

3 x 4 =12 ; NP 12 (Normal Profile No. 12 is used with 120 millimetres height)

For the span of 3.5 metres:

3.5 x 4 =14 ; NP 14 (Normal Profile No. 14 is used with 140 centimetre height)

for 4 metres ; 4 x 4 =16 ; NP 16

for 4.5 metres ; 4.5 x 4 =18 ; NP 18

It should be noted that structural steel production and use in this country is taken from German Norm Standard which is different from the British BS4 part 1.

Between these numbers the closest beam number is chosen (usually the upper for the sake of safety) but the *memar* uses his judgement based on experience, the type of use, and the roof or floor details. This rule has proved reliable for the floors of residential buildings with spans of between 2 - 4.5 metres. In practice the spans are usually between 3-4 metres, where the formula is both safe and economical.

Another example is the replacement of the central courtyard with a large central hall in response to the new circumstances which have made the building of a courtyard house near impossible. See Figure 2: 2

It is worth noting that the *memar*'s designs are simpler and cheaper to build. Split levels in plan, split surface in the facade, numerous corridors, large spans and long cantilever balconies are all signs of an architect's designs. Most of these features are expensive to build. For the client, as an expression of status, the house must show that it is architect designed. The aim of the architect seems to be to build a sophisticated building expressing his skill. This is obviously in contradiction with the old principles of: *daroongaraie* (inward looking); *ganj-o-banar* (avoiding the unnecessary); and *mardomvari* (human scale and function).

2.5.1. Conventional design process.

The 'code of practice' for the design process in traditional building were introduced in Chapter 2. The five stages of: ***'gaz kardan'***, site measurement and investigation; ***'goftegoo'*** (discussion), determination of the number, and the type of each room *(Talar-*

o-badguir, Sedari, Panjdari, Urusi...) and other necessary spaces; ***'barzeh'***, the stage in which the *memar* prepares the arrangement of different rooms and spaces with the contours of rooms made of gypsum planks on the *barzeh*; ***'kast-afzood'*** (deduction-addition), discussions and decisions concerning the addition, subtraction and rearrangement of spaces until the full understanding and satisfaction of the *karfarma* (participant client); ***'arayesh'*** (decoration) is the final stage when the whole design is comprehensively discussed including the determination of the types and quality of materials used for the external facade, facing bricks, possible tiling and the style.

All traditional principles and procedures are to some extent still practised, except *barazeh* which has been replaced by designing on paper with possible modifications after setting out the plan on site. However this process is increasingly being interrupted by architects and engineers empowered by *Ghanoon-e Nezam-e Memari va Sakthemani* (Architecture and Construction Order Act.). In other words, still in the majority of cases the client does not choose to commission an architect for design, but as a necessity by law.

3. Legal Status; *Ghanoon-e Nezam-e Memari va Sakthemani* (Architecture and Construction Order Act.)

The T./ C. Sector has been termed unorganised or **informal,** but so far never **illegal.** *Ghanoon-e Nezam-e Memari va Sakthemani* (Architecture and Construction Order Act, ACOA), was passed through Parliament in *Khordad 52* (July 1973) by the Ministry of Housing and Development. For six years this Law was rarely implemented much, particularly with regard to private building. The reason was said to be the lack of necessary conditions for its implementation. The main practical reason was the number of architects and engineers necessary to take over the responsibilities from the *memar*s.

Before the implementation of ACOA, municipalities all over the country required a brief design comprising plans, a section through stairs, and an elevation viewed from the street. There was no concern about who should sign the design. The owner's signature was enough to make him responsible for building according to the approved plan. Many *memar*s whom the author knew had learnt to draw to the standard required by the municipality in Shiraz. Some of them had been to private schools to achieve higher skills in drafstmanship. *Memar*s were not restricted in continuing to serve the majority of

clients. They had managed to respond to the demand of 'modernised' clients in a changing society. Albeit at a slower pace this change was seen also in *memars*. They remained more traditional compared with government employees and other members of society and still have their roots in tradition. They have never had the desire or the ability to implement designs developed elsewhere, as have architects and engineers.

In 1976, municipalities, including Shiraz, required for all buildings higher than two storeys must be signed by an architect or engineer authorised by the Ministry of Housing and Development. This was in accordance with ACOA but it was the end of an era for *memar*s.

This new age, whereby the modern ('formal') sector professionals became increasingly involved in the conventional ('informal') sector, had already started in Tehran with other large and small cities following suit. The municipal authorities in Tehran, as in any other capital of the world, suddenly required an authorised signature for every single building, regardless of size and the number of storeys. Hence most architects and engineers, who were already involved in the modern sector, were now required to rubber stamp proposed designs in the private housing sector. Demand soon over-rode supply and a thriving business of selling signatures appeared. Many designs were prepared by *memar*s and were signed by a limited number of architects and engineers who were involved in private sector residential design. When municipalities set a quota for each *mohandes*, these architects and engineers working in the formal sector were asked to accept money for signing.

In Jan. 1989, Shiraz Municipality was instructed by the Governor of Fars Province to implement the new regulations as laid down in Article 6 of the same ACOA. This regulation further restricted *memar*s, not only in the design but also in the area of site management. According to these regulations a commission comprising the representatives of the Municipality, the Office of Housing and Urban Development (regional office of the Ministry of Housing and Urban Development), the Office of Governor, Culture and Higher Education, and the Society of Architects and Engineers of Fras (SAEF) was set up to supervise and inspect the implementation of building regulations and quality control[44].

First of all the *memars* representative body, the Union of *Memar*s and Technicians of Fars UMTF, was not invited to this commission; despite the fact that over 90 percent of residential buildings are still built under their direct control. Secondly, as an outcome of

the commission, *memar*s were further restricted in their supervision of residential buildings. For one story houses they were restrained to 200 square metres of building area, and in the two storey buildings the limit was determined as 300 square metres. The fact that houses are usually large, [45] (average of 140 square metres in 1977 [46], and 160 square metres in 1993 [47]) shows just how damaging to *memar*s is this restriction. Thirdly, the total quota for *memars*' projects was determined at 44 percent of the quota for *mohandes.* There is no apparent or declared reason for this decision, except the *memars*' suspicion expressed with grief in the Farsi proverb: '*Khodeshan boridand khodeshan ham dookhtand*' (They, themselves cut it and they themselves sew it), which literally means the professionals had decided for the benefit of themselves. This was despite the fact that most architects and engineers usually have their main job in the formal sector and that many of them are government officials totally occupied in their offices six days a week, with little time for site inspection or supervision.

After the Revolution, with its strong message concerning the value of tradition and the necessity for conservation and revitalisation of traditional architecture, hopes were raised. Every seminar or gathering, every academic paper or article on issues related to the built environment started with praise for traditional architecture and the need for its revitalisation. Ironically in none of these commendations were *memar*s and the traditional sector mentioned, let alone represented.

4. Technology; Traditional + modern/ Conventional

'It is surprising to see how many building materials and techniques are often applied even to a humble peasant house.' Hans E Wulff[48] gave a very interesting cross section of traditional building crafts and technology, as they had long-existed and were still being practised in 1937 when he was the Principal of the Technical College at Shiraz. What Wulff described in his book was the building technology in Iran of more than 50 years ago and, although it maintains many of its basic principles, it has undergone considerable changes. These changes in the traditional sector developed parallel with the more drastic changes in the formal sector of the industry. The issue of technology in relation to productivity have been dealt with in Chapter 4 and Appendix 4.

Table 7: 8: Distribution of different building technologies used in residential buildings in the years 1967 to 1975 (in percentage)*

YEAR	1: STEEL/ R.C. FRAME	2: BRICK & I BEAM	3; BRICK & WOOD	4: MUD BRICK & WOOD	5: TENT OR HUT
Before 1967	0.2	16	18	65	1.
1967 to 1971	0.7	28	22	47	3
1972	2	33	23	36	5
1973	2	39	23	32	5
1974	3	41	23	29	5
1975	4	45	22	24	5

* Figures are rounded by the author.
Source: Translated and devised by the author from: *Tahlili pyramoon-e Bakhsh-e Maskan* (An analysis around the Housing sector) Technical consultancy and planning: Ministry of Planning and Budget. *Azar 1363* (1984)

In the traditional sector much of this change can be attributed to the use of new materials and components, allied with the introduction of new technologies. These include the increasing use of cement and steel, precast concrete products, and the increased use of one older material, burnt bricks, in place of another, mud bricks. Table 7: 8 illustrates the gradual but increasingly rapid departure from traditional methods of house building towards today's conventional methods during a period of eight years (1967 to 1975). In this period, according to the Centre of Iranian Statistics, five categories can be distinguished. These categories are characterised by the type of materials used. Categories 1 and 2 include buildings with durable materials, Category 3 buildings that use semi-durable materials, and Categories 4 and 5, that use non-durable materials.

Table 7: T9 shows that the trend in the choice of technology is in favour of building with more durable materials. This is because most parts of the country are located on the earthquake belt. In recent years we have witnessed how they threaten life and homes of the inhabitants. There are of course other factors influencing the choice of technology, factors such as: changing aspirations of the people; economic and market conditions; political factors, and the implications of physical planning policies and regulations. In the area of residential building in the T./ C. Sector the most prevailing factors seem to be people's aspirations and market conditions. Whereas in the context of the modern sector political factors and government economic conditions prevail.

Table 7: 9 further illustrates the speed of departure from traditional methods, and particularly the higher rate of change in rural areas. The most dominant of all these methods is brick and steel I beam (category 7). This method has grown by 131 per cent in urban areas, and 600 percent in rural areas.

4.1. The earthquake factor, and the choice of technology.

'Iran is located on the Alpine Seismic Belt. It could be said that all parts (without exception) are earthquake prone.'[49] For thousands of years earthquakes have been a serious concern for *memars* and builders in this country. Their choice between forms, methods and materials have been made considering earthquakes among other factors, such as availability and affordability.

In the past the use of domes and vaults were quite common. Masonry structures present a nearly perfect continuum when they are roofed with arch, vault or cupola. The history of architecture records a number of prestigious buildings of this type surviving several earthquakes.[50]. Masonry walls when ended below the roof in a horizontal line and are then separately roofed with a flat or pitched roof, with the use of different materials and components, such as timber, earth, steel, concrete or a mixture of these, causes the traditional continuity to be disrupted and in some respects is less secure than the traditional homogeneous method of building.

Table 7: 9 Distribution of different building technologies used in residential buildings in the years 1976 and 1986 (in percentage)*

BUILDING METHODS	URBAN		RURAL	
YEAR	1976	1986	1976	1986
1) All Mud Brick and Mud	12	3	22	17
2) Mud Brick and Wood	16	5	55	36
3) All Wood	00	00	0.5	1
4) All Brick	-	3	-	2
5) Concrete Block	2	4	1	6
6) Brick-Wood Or Stone-Wood	20	13	15	19
7) Brick-Steel Or Stone-Steel	49	64	3	16
8) Steel Or R.C. Frame	1.5	5	0.1	0.9
9) Other Or Not Declared	0.8	2	4	6

*Figures are rounded by the author.
Source: Translated and devised by the author from: *Maskan va Sakhteman dar barnameh-e panj saleh-e Djomhoori-e Eslami-e Iran* (Housing and Building in the five year Development Plan of the Islamic Republic of Iran)

In the traditional urban fabric, buildings were somehow woven together in a harmonious and self supporting way. The architecture, style and even the size of buildings were

similar and an element of symmetry gave them a type of monolithic strength. In total this resulted in additional resistance to earthquakes. Traditional urban fabric - the arch, vault, or cupola, are nearly abandoned in most parts of the country, particularly in urban areas for a variety of reasons. Perhaps these are the major reasons why buildings today constructed with a mixed system, that is neither traditional nor modern, are considered to be more vulnerable to earthquake than examples of traditional buildings of the past.

> During the last 80 years, an average of one earthquake of magnitude 6 annually, and at the same time, ten earthquakes of magnitude 7 or more have occurred in Iran. Research work in this field has proved that the urban and rural residential buildings have been mostly exposed to the risks and damages of earthquake.[51]

The choice of construction technology is determined by many other social and economic factors as well. This is examined in Chapter 4 and with more detail in Appendix 4. But in the following sections of this Chapter, the impact of the earthquake as an environmental factor in the choice of building methods will be discussed from the technical point of view.

4.2. Roof and Floor Construction.

Today, despite the rich tradition in the use of domes and vaults, the flat roof has become the most common feature in all urban settings. The pitched roof, with a long history of use, is only still used in the northern provinces of Gilan and Mazandaran, but to a decreasing extent in new buildings. There are five main categories of flat roof construction; pole supported mud roofs and floors, flat brick arch, I beam with jack arch, in-situ reinforced concrete slab, and Joist-block roofs and floors.

4.2.1. Pole supported mud roofs and floors.

This type of roof (for building categories No. 2 and No. 6 of Table 7: 5) was once the most common type across the country but is diminishing rapidly. Different reasons are given for its rapid demise. Among them are:

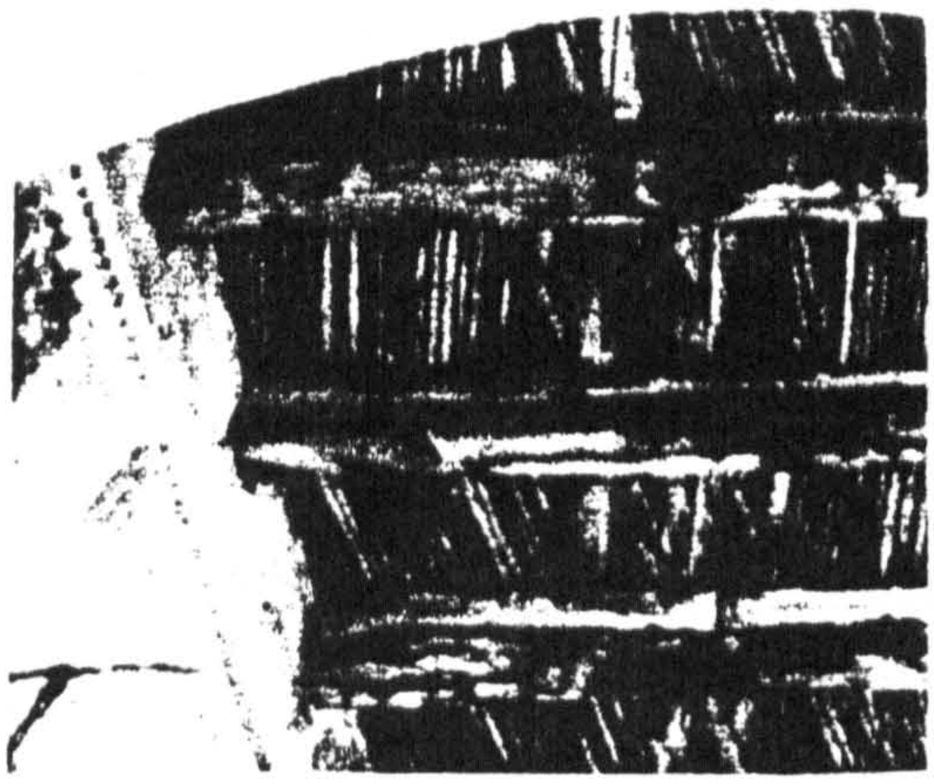
- The need for snow sweeping, roller compacting and regular care by the residents.
- The cost of maintenance, as every two or three years a new layer of mud-straw

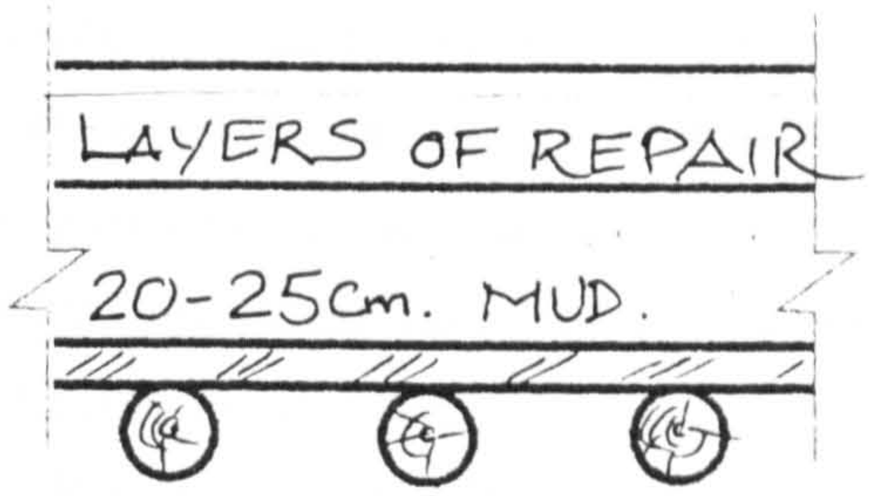
plaster must be applied.

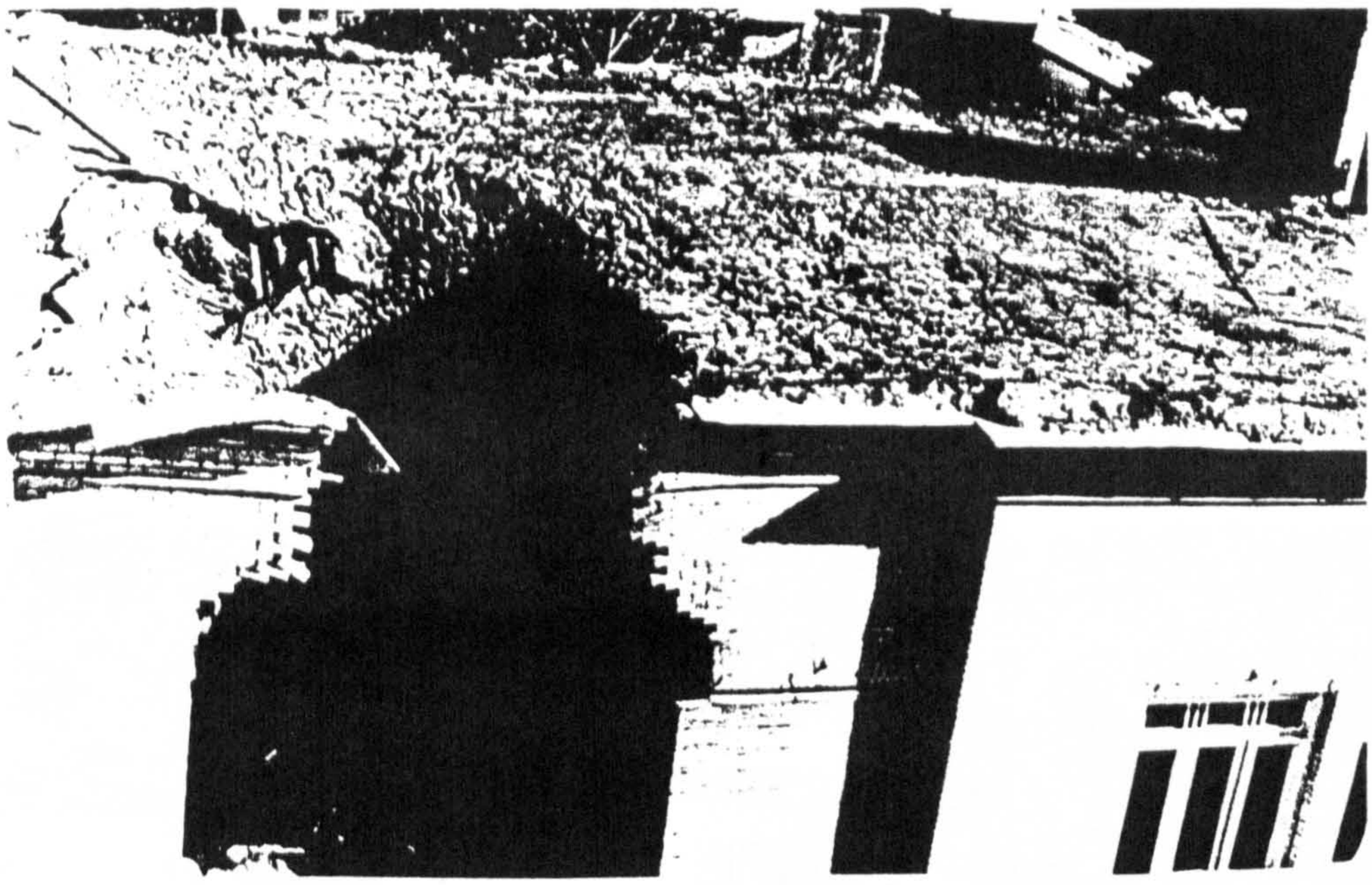
- The gradual increase in the roof weight as a result of accumulating layers of mud-straw plaster over a period of time, particularly after a few days of heavy rain.
- Effect of excessive roof weight resulting in structural failure during earthquakes and the consequent danger to inhabitants.
- The vulnerability of softwood-post beams to termite attack.
- The changing aspirations of the people and the growing importance of image, the effects of the changes in the urban fabric as were discussed earlier. and the cost of transporting massive volumes of soil that could be more expensive than, for instance engineering clay bricks.

There are other reasons out of the scope of this dissertation such as land use policies, land price, and the government's planning policies. But as it is still the cheapest option for rural areas, abandoning it by decree, as has happened in urban areas, would be a grave mistake. Though it appears that nothing can stop the changing aspirations of the people, remedies for technical problems can be promoted and used. The use of DIY tanking components may be one improvement as would be the application of one or two layers of tar-hessian.

Figure 7: 4. Pole supported mud roofs and floors.





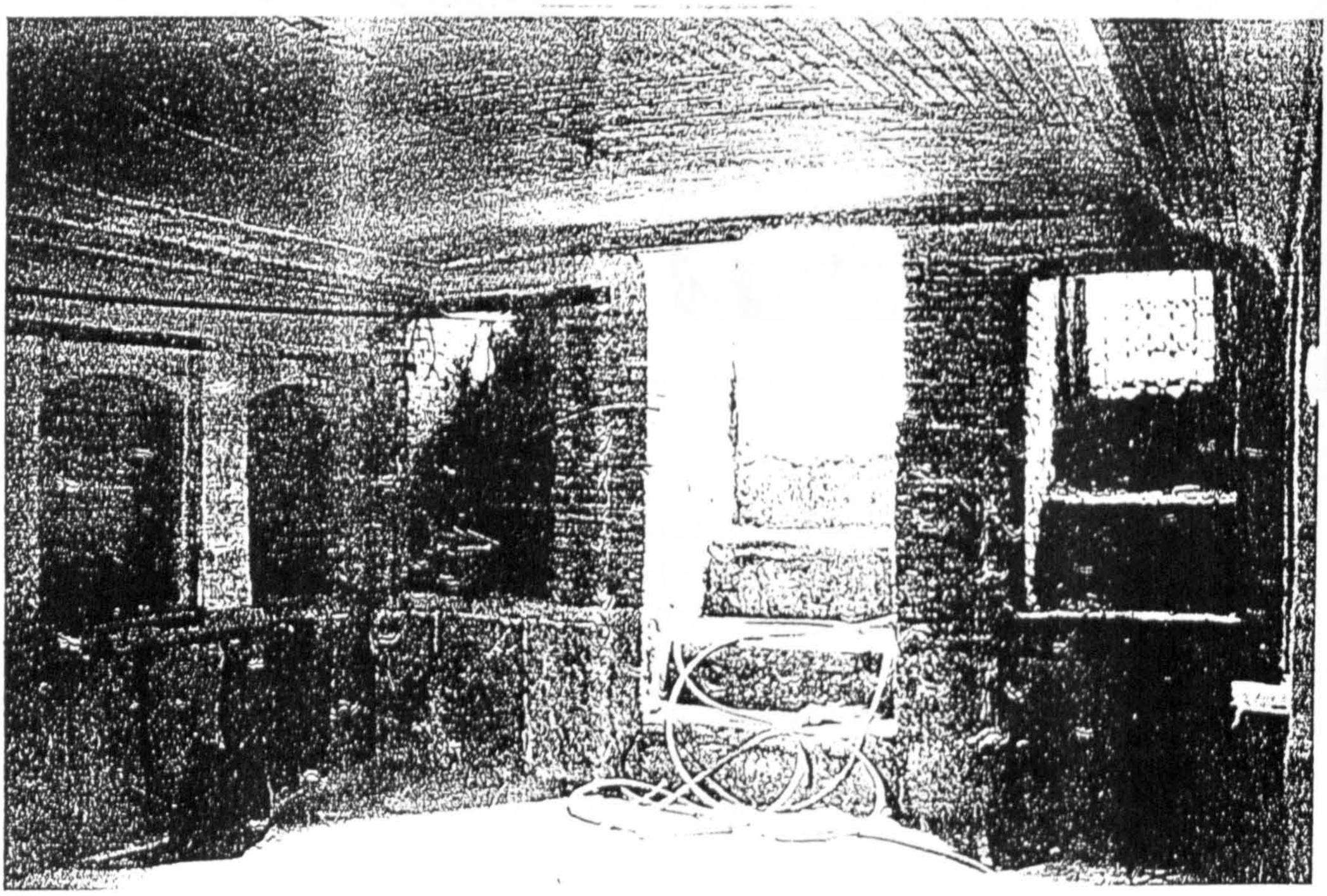


'Floors shall be constructed with suitable materials and in a manner that when exposed to seismic forces, will first, not become separated from their supports and, second, will remain whole and unshattered. The use of wood, as the bearing element, is permitted when the roof covering is made of light weight materials like boards, iron sheets, corrugated metal or asbestos cement sheets, and in such cases timber may also be used as tie beams. Construction of wooden roofs with a cover of mats or reeds and with a mixture of mud and lime or sun dried brick placed over them is not permitted.'[52]

4.2.2. Flat brick arch

This system can only be employed to cover basements. There is a technical reason for this; heavy walls are needed to make static equilibrium as a result of high horizontal thrust. There are other solutions to counter-balance this thrust such as the use of iron tie-rods, but these are rarely chosen by *memars*. They do however use iron rods on special occasions, where either the span is very wide or the top floor wall is built with burnt brick (as opposed to mud brick), and thus not heavy enough. There are other solutions like the use of a 'ring beam' of reinforced concrete on top of the load bearing walls to counter the horizontal thrust. However this method is not common for roof construction. Another reason may be the need for a very high skilled *bannay-e laghzan* (vault specialist mason) whom is not commonly available these days. That is because this type of flat vault is constructed without any scaffolding or shuttering. It is possible to build flat vaults with less skilled masons with the help of shuttering, the additional cost of shuttering on top of the R. C. tie beam makes it expensive and generally uneconomical.

Figure 7: 5 Flat brick arch.



4.2.3. I Beam with Jack Arch (IBJA)

With the introduction of I beams around 1950, the problem of flat arches apparently was solved. This method soon proliferated, and in fact had a great influence on all aspects of building. I beam, with all the characteristics of a fabricated element, such as standard dimensions and quality, was considered reliable, easy to handle, and provided the capability for covering wider spans, which had previously been limited when using wooden posts and flat arches. This method in fact substituted the two previous mentioned methods. With changes in lifestyle and aspirations larger rooms were required and the IBJA became conventional practice, particularly for residential buildings. In 1984 **94.7%** of the total new built urban residential buildings in the country used this method for roof construction. This figure later declined to **87.9%** because of a limitation in the import of I beam and the rapid development of the joist- block method.[53] This type of roof/ floor, the most common type, has a very bad record in relation to earthquake damage. Building and Housing Research Centre (BHRC) has come to the idea of total dismissal of this method, excluding it from official research.

> 'Among the different types of conventional floor and roof systems which were not considered was the steel I or W beam sections that are filled transversely with bricks and gypseous mortar. The reasons for this are its insufficient resistance against earthquake action, large amount of steel consumption and the shortage of steel production.'[54]

On the other hand, the same BHRC introducing its publication, 'The Iranian Seismic Resistant Design of Buildings' believed that if building practice complied with the relevant code, IBJA would be safe to use. Section 3. 11. 3. 1. of the code is about IBJA which reads as such:[55]

> '3. 11. 3. 1. Brick - Jack Arch Floors:
> a) The steel beams shall be joined to one another by means of steel bars or plates placed diagonally in such a way that; first the length of the criss-cross rectangle is not more than 1.5 times of its width, and secondly, the area covered by each criss-crossed element shall not be more than 25 square metres.'
>
> 'b) A suitable support is to be provided for the heel of the last span of arches. This support may be created either by placing a steel I beam and fixing it to the tie beam beneath or by anchoring it to the reinforced concrete tie beam. If this support is in steel, it must be fixed, by means of straightened steel bars or rods, at both ends of the beam and also at intervals of less than 2 metres from the last steel beam of the

floor.'

'c) The minimum cross-section of the steel bar or plate used for diagonal bracing of the floor beams or for the fixing of the last span, shall be that of a bar of 10 millimetres in diameter or/and equivalent plate.'

IBJA can be built stable and strong enough in normal conditions without seismic code details, and the problem shows only in the event of an earthquake. This is probably one of the factors why this detail was overlooked by *memars* and it should not be very difficult to put this code into practice. The additional cost for the implementation of these details is negligible compared to the cost of I beams and labour. Preparing the code was not a very complicated procedure either. In fact such details could be found in all technical specifications enclosed in formal sector contract documents. In other words government authorities were aware of the necessity of these details but made little effort to have them enforced in practice.

The Iranian Standards and Industrial Research Institute (ISIRI) was founded in 1954[56], and joined the 'World's National Standards Bodies' (NSBs) in 1960.[57]. One of the responsibilities of ISIRI was to prepare building codes and standards. By the end of Iranian year *Esfand 1361* (1982), many codes and standards for the construction industry had been prepared but nothing in relation to IBJA.[58]. The responsibility for the preparation of the 'Iranian National Building Code' was transferred from ISIRI to the MHUD (Ministry of Housing and Urban Development) in 1978[59] on the grounds of ISIRI delays on building codes. After ten years, in Feb. 1988, MHUD finally introduced the 'Iranian Code For Seismic Resistant Design', containing a section on necessary IBJA details. (quoted previously)

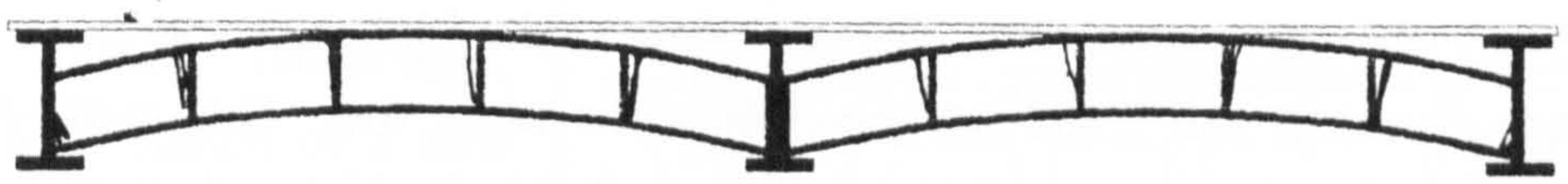
It is unbelievable that no government Ministry, organisation or professional body ever bothered about the introduction, education, or advising on these details to the traditional/ conventional sector in charge of 92 percent of the bulk of the urban buildings. Consequently all private sector buildings constructed in the forty year period by the private sector have been built without considering this rather simple code. This cannot be simply due to the government's negligence, or its lack of responsibly towards the public. It is a measure of the separation of the professionally trained government bureaucrats from the real world of building at the T/ C sector level.

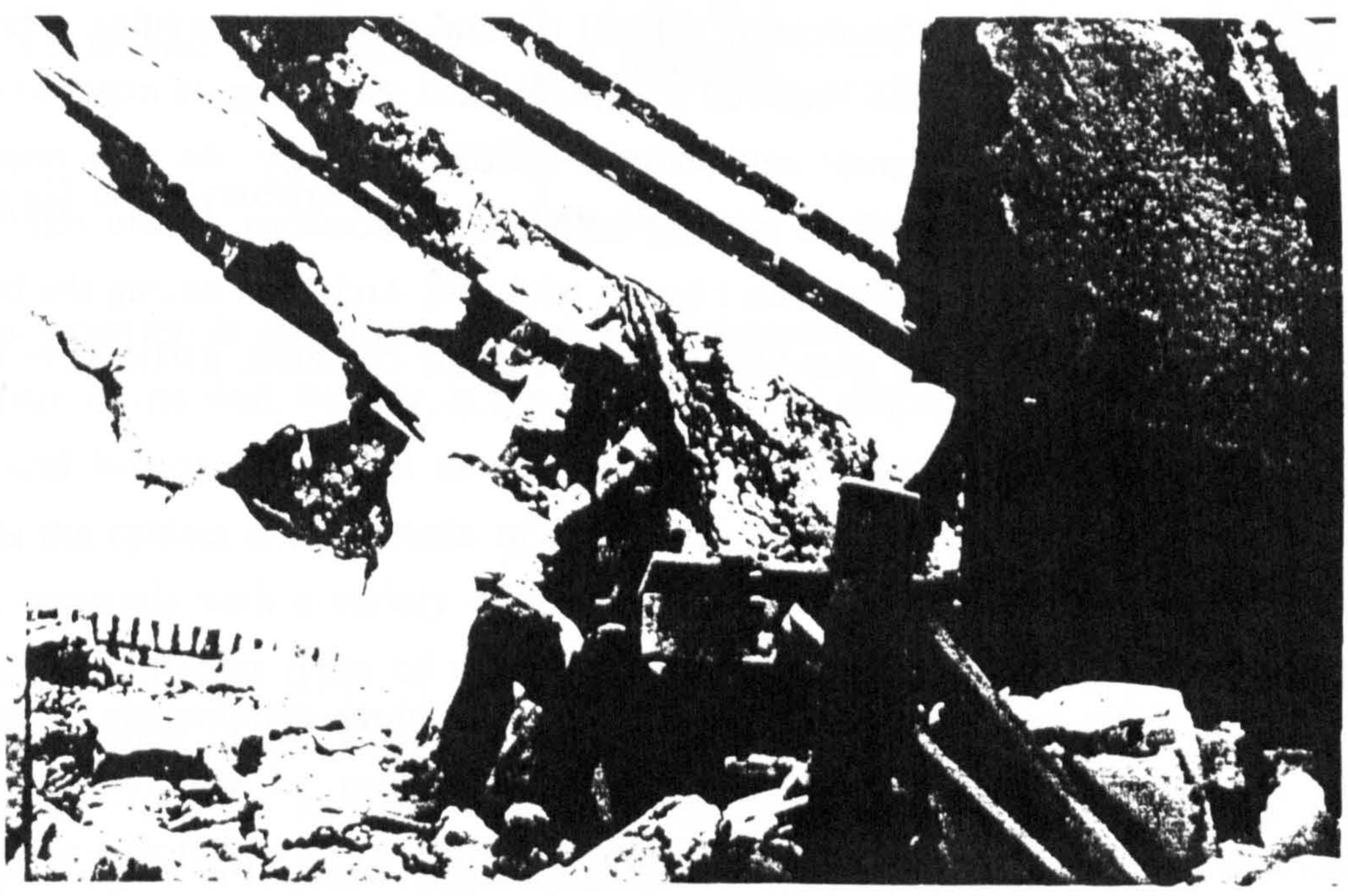
The author himself has been busy working for 25 years in both the modern and traditional/ conventional sectors, has witnessed the problem and yet did not even

consider the question. Now that, as a result of this study, the question has been raised, the author believes that, he can answer the question not only drawing on 25 years of work but also on the experience of growing up in a family of *memars*.

The answer now seems obvious, there is a problem of communication associated with professional arrogance. It has been already demonstrated that how various craftsmen and artisans do not have the prestige they had in the past, and are often regarded as inferior to white collar workers. In the same way the attitude of engineers and architects towards *memar*s is associated with disregard and arrogance. Ironically this is in spite of the fact that the young architect or engineer needs to learn much from the *memar* long after he/ she is graduated, and in fact will remain dependant on their knowledge and experience throughout his/ her professional life. This arrogant attitude of professionals is reflected in all levels of government executive and policy making institutions.

Fig. 7: 6 I beam and jack arch (IBJA).





Both sides lose as a result of lack of communication. Nadimi H.[60] believes 'The graduates of the Schools (of Architecture or Engineering) have a feeling of superiority over the mass of the society. This feeling is in tune with the general psychological characteristic of

the so-called 'educated group' with Western methods and values. The lack of communication is further described by Nadimi as: 'They did not attempt to inform themselves of the works and skills of the traditional Mimars (*memars*), and saw their role as being to compete with them by bringing modern knowledge and skills'. The main looser however is the client and society at large.

The Mass media is also to be blamed. Little or no effort has been made to educate and inform the owner-builder in the past. Considering their role in the building process it is fair to suggest that the right type of information could play an important role. In general, the media of the third world not only does not inform and educate the people for a better appreciation of their local needs and resources, but it tends to actively prompt Western values, technology and consumer items.

4.2.4. In-situ reinforced concrete slab.

Although this was introduced about the same time as the I beam, it was exclusively used by the formal sector, and it did not develop in the same way. This method, although praised by engineers for its monolithic structure suitable for high risk earthquake zones, it never really accounted for a considerable percent of total residential building. This due mainly to the fact that this method required scaffolding and shuttering, is expensive and less compatible with the traditional/ conventional building industry. As it is relatively heavier, it also demands stronger load bearing walls and foundations. In-situ reinforced concrete, although needing less steel than I beam- with jack Arch, and having the benefit of being introduced years before joist-block, never became common, particularly in the conventional building industry. .

4.2.5. Joist-block Roof and Floor

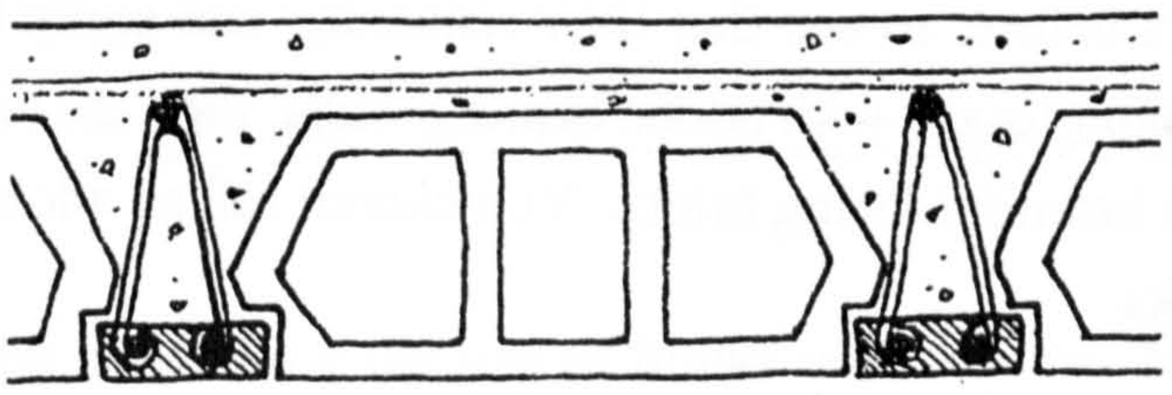
This is a simple floor/ roof system in which the joist and block components, which are produced off-site, are assembled on site, and then a layer of concrete (about 5 centimetres) is poured on top to form a composite structure. Joists and blocks also act as shuttering before the concrete is poured. This means it can be done with unskilled labour with a little supervision. Joist block can be considered as a *method* rather than a *system* in the context of 'system building'. It is a 'method' in the context and tradition of the conventional building industry.

After its first introduction around 1960 it has developed and has increasingly replaced the I beam and jack arch method. Joist-block needed less skill and was more manageable by *memars* because it did not involve shuttering. It is considered economical, practical and convenient by them and is becoming the conventional method in urban areas and rapidly proliferating even in rural areas. This type of roof has a very much better record in earthquakes, and the Seismic Code in relation to Joist-block is brief and simple:

> 'a) The concrete covering the blocks shall have a minimum thickness of 5 centimetres and the amount of bars in the direction perpendicular to the joists shall not be less than one square centimetre per metre. The bars shall be so placed that the intervals between them are not more than 30 centimetres.'
> b) If the spans of joists are more than 4 meters, they shall be joined by transversal bars to the reinforcement steel in a suitable manner.[61]

The story of the introduction of the Joist-block method is an example of a successful transfer of an appropriate building technology, and a successful launch of a new product to the building market. This was examined in Chapter 6.

Fig. 7: 7 Joist-block Roof and Floor



4.3. Wall construction.

Wall construction is an important element in masonry buildings, and mortar is the key component of the wall. Mortar, is the main factor for maintaining geometrical regularity, mechanical homogeneity, and as a consequence the main factor for lateral resistance which is the critical characteristic of a masonry wall in earthquake resistance. Different walling materials with a variety of mortars are used all over the country, in rural and urban areas; different types of stone walls, rammed earth walls, mud brick walls, and then burnt brick walls. Concrete block and hollow terrazzo blocks are the latest components used for masonry walls. The main technical criteria to judge masonry buildings is again earthquake resistance characteristics.

4.3.1. *Chineh*, and adobe walls .

This method once common practice in rural areas, is now only rarely and reluctantly used

for residential buildings. It is still common for sheepcotes however, and also for the walls surrounding yards, gardens, and orchards. This method is different from rammed earth method, and does not use any formwork or shuttering. Instead lumps of mud with an optimum moisture (workable yet dry) are laid and are shaped by hand on the edges. The tallest *chineh* walls were the shading walls of ice ponds (*yakh-chal*), which used to be built well over 20 feet high.[62] This type of wall is totally abandoned, and indeed banned in the cities.

'Earthquakes and adobe buildings together simply kill, is a popular slogan in seismic countries which are also mostly developing countries.'[63] Perhaps this is the main reason for the abandonment of mud brick structures. But is that merely a slogan, made by unthinking farmers whose main concern is their aspiration to imitate the trends in the big cities? Or is it the government's fault in building schools and banks in those areas with more durable materials? Those who argue as if prestige and people's aspirations are illogical or superficial, should look at thousands of city dwellings built no more than 50 years before, to see that their reasoning can easily be refuted. Although those buildings are built totally with adobe bearing walls, they are covered (and protected) on the facade, with beautiful facing bricks. You cannot tell an adobe building from one built totally with bricks.

Many students, in their dissertations on architecture and the built environment from the Third World countries, sadly denounce the abandonment of earth construction, pointing out the 'remarkable' experience of Hasan Fethi as an example to be followed. Despite this they never really give a clear picture of the reasons for this universal process from the point of view of the dwellers. It seems to the author that they may have followed an academic trend, perhaps to please their supervisor or the Western academic audience preoccupied with their own perception of preserving the 'global' environment.

Some politicians, unable to come up with real solutions, use this 'regret' to blame the people for their unreasonable thoughtless choice. Although the one strong point of their argument - lack of resources - is understandable, they go so far as to denounce the efforts of those who struggle and manage to build with more durable materials and better techniques. Perhaps the main concern is the global environment and 'sustainable development'. After all cement factories and brick kilns using fossil fuels create weather pollution, with the resulting damage to the ozone layer and global warming, and so on (more on this in Appendix 4.). But for now let us have a brief study of some of the concerns for the environment from the point of view of food, which is a prime concern

for most of the countries of the Third World.

Of the vast area of 165 million hectares, only 17 million hectares are cultivated land. Of this, 4 million hectares are under irrigated farming and the remaining 13 million under dry farming. Soil patterns vary widely. The abundant Mountain soils are shallow layers over bedrock, with a high proportion of gravel and sand. Natural erosion moves the finer soils into valleys where the agricultural land is formed and also used for pottery and brick making.[64] Dr. Rahmany believes:[65]

> 'Difficulties of dry farming; soil erosion; abundant sand and gravel land; lack of 'soil' in central parts and shallow soil in other parts; poor soil condition in terms of soil structure and lack of organic materials and living creatures, salty soil and so on means that **the situation of farmland in this country is critical**.....**Increasing use of soil for brick production and trends in use of bricks for buildings is worrying.' He goes on to suggest that instead of clay (mud) bricks, sand-lime or sand-cement bricks and blocks should be used.'**

4.3.2. Brick walls

At this point a more detailed discussion concerning the use of bricks is necessary. This subject is important because of the role of bricks throughout the history of Iranian building, and interesting for the light it throws on the effect of traditional methods on today's building practice.

In the past, hand made burnt bricks were usually used in residential buildings only on the facade for weathering protection, with a secondary decorative function. With the exception of public buildings and the houses of the rich, the main body of the wall was built with mud brick. Today, for whatever reason, the mud brick is totally abandoned in urban buildings, and is also rapidly disappearing in rural areas. Despite this, the basic traditional principle of having two layers of different materials still lives on. The body of the walls is built with burnt bricks and the facade by special manufactured and treated facing bricks. More recently stone cladding has also been used as a facing material.

For the reason of separating the facing brickwork from the inner wall brick work, two types of bricks are produced, one for the inner walls (*Seft- Kari*) which is called *Ajor-e Gari* (rough brick) and another type for the facade called *Ajor-e Nama* (facing brick). In the past both types of bricks were produced in different parts of the same kiln [66] and later

the facing bricks were prepared by *Ajor tarash* (brick cutter) who cut the bricks to accurate dimensions and with accurate 90 degree corner angles by trimming and grinding the brick face. Today the manufacture of both bricks takes place in separate kilns, usually in different factories. The facing bricks, although manufactured with considerable accuracy so that they are virtually ready to use, undergo the same traditional process to guarantee `fair face' and thorough accuracy.

This tradition affects the bricklaying methods of today. To help clarify this let us first examine the way English bricklayers work. An amount of mortar, sufficient for two or three bricks, is laid on the previous layer, and spread to the desired thickness. A brick is then taken and some mortar is put on the head. The brick is then placed against the adjacent already laid brick. This is done in a manner ensuring that both the vertical and horizontal joints are filled with mortar. Necessary bond is also maintained by A vertical and horizontal check with a split levels; The vertical joints should line up directly one on top of the other all the way up to the way up the wall. made to create a perfect bond.

Bricklayer in this country spreads a whole bucket of mortar, enough for laying 10 to 15 bricks. He then lays 10 to 15 bricks, one after another. The bricks are laid close to one another without putting mortar on the head or sides. Even vertical and horizontal bond is frequently skipped. This method was traditionally used for mud bricks, and it was suitable for that purpose. Mud bricks were laid with a suitable gap and mud mortar (with high plasticity compared with sand cement mortar) from the next layer could easily penetrate and fill in the vertical slots. In the case of burnt bricks the bricklayer deliberately lays bricks more closely so that less mortar is used. This is due to the fact that sand-cement mortar is more expensive than bricks, and more difficult to make and carry. Unlike the mortar, which must be carried by the unskilled labourer to the point of work on the wall, the bricks are skilfully thrown towards and caught by the bricklayer from a considerable distance. The distance can be up to a height of one storey, 3-4 metres vertically, and the same distance horizontally.

The speed the brick is laid with this method is considerably higher and consequently so is labour productivity. However, it also affects the strength of the wall, an obviously critical factor,[67] and so requires thicker walls for the same strength. This is particularly important when considering that much of the country is located in the earthquake zone, and strength against shear (cut) force is vital. This means thicker walls and/or less durable building, and, ironically, reduction in the overall productivity of material and labour.

This is an example of the sort of problem which cannot be solved by architects or engineers nor through a formal technical education. This once again indicates that the main area of difficulty within the conventional building industry is in relation to training with regards to the changes in methods of building and new technologies.

4.3.3. Concrete block walls.

Blocks are also laid in the same way as bricks, without adequate mortar in vertical joints. This affects the strength of the walls made with block even more. This is because the height of a concrete block is almost for times larger than of the brick. However the common practice of laying blocks contradicts the recommendation of the Iranian Code for Seismic Resistant Design:

> 'Walls made of stones shaped to rectangular blocks or of cement blocks shall be executed in such a manner that vertical joints do not coincide with each other, and are completely filled with mortar.'[68]

Figure 7: 8. shows such a wall after an earthquake in Djahrom of a magnitude of IV (1985)

Figure 7: 8.

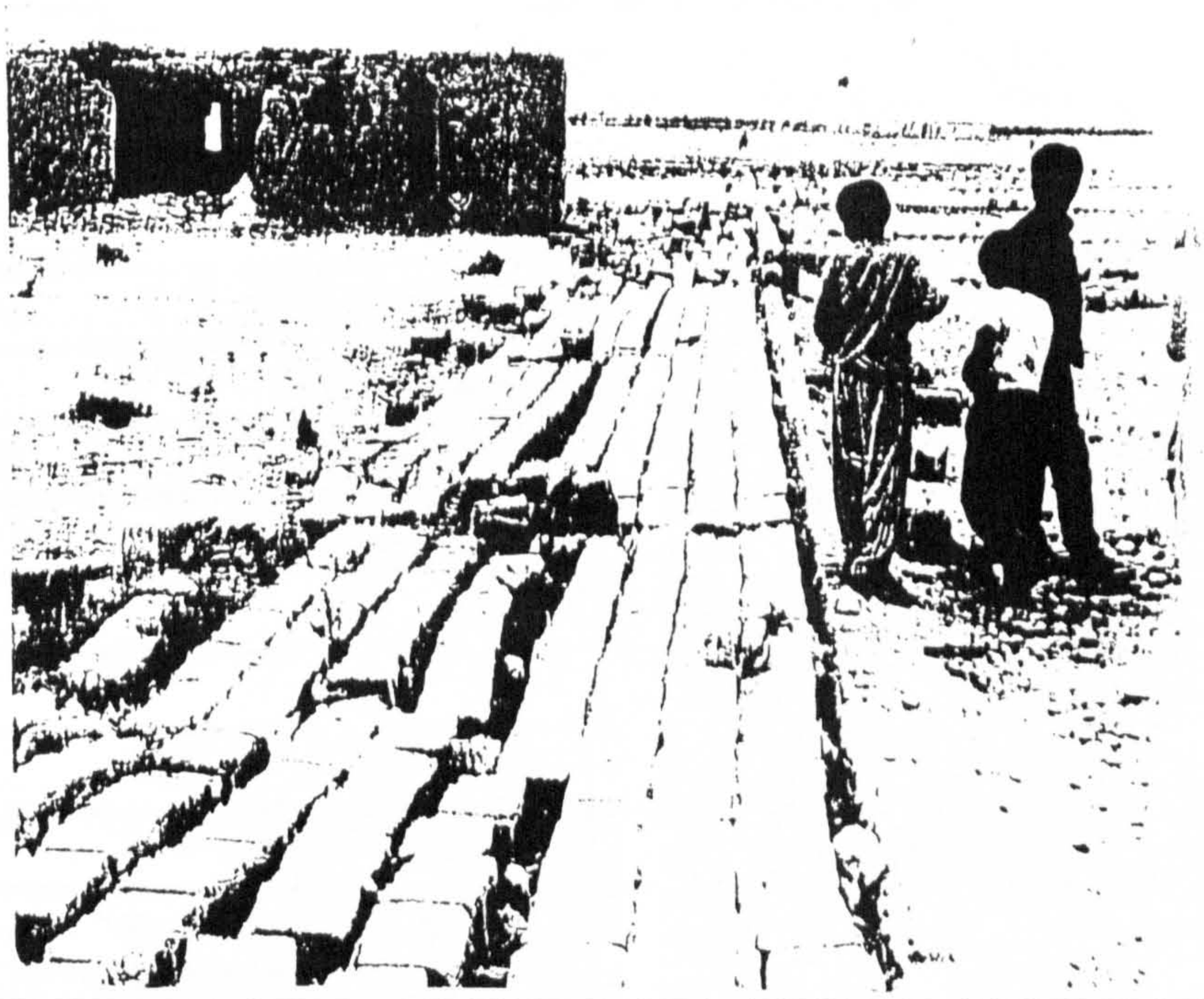
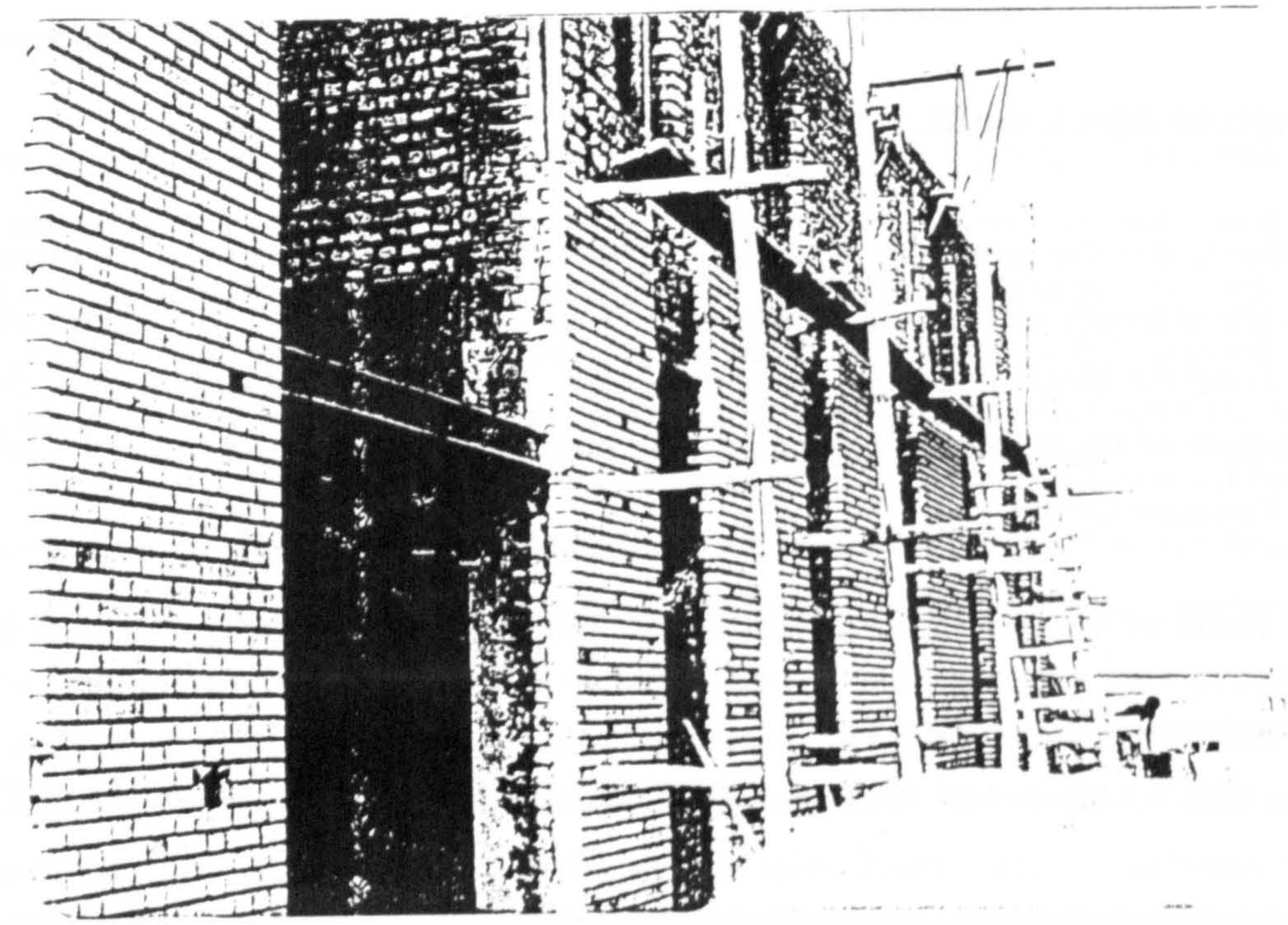
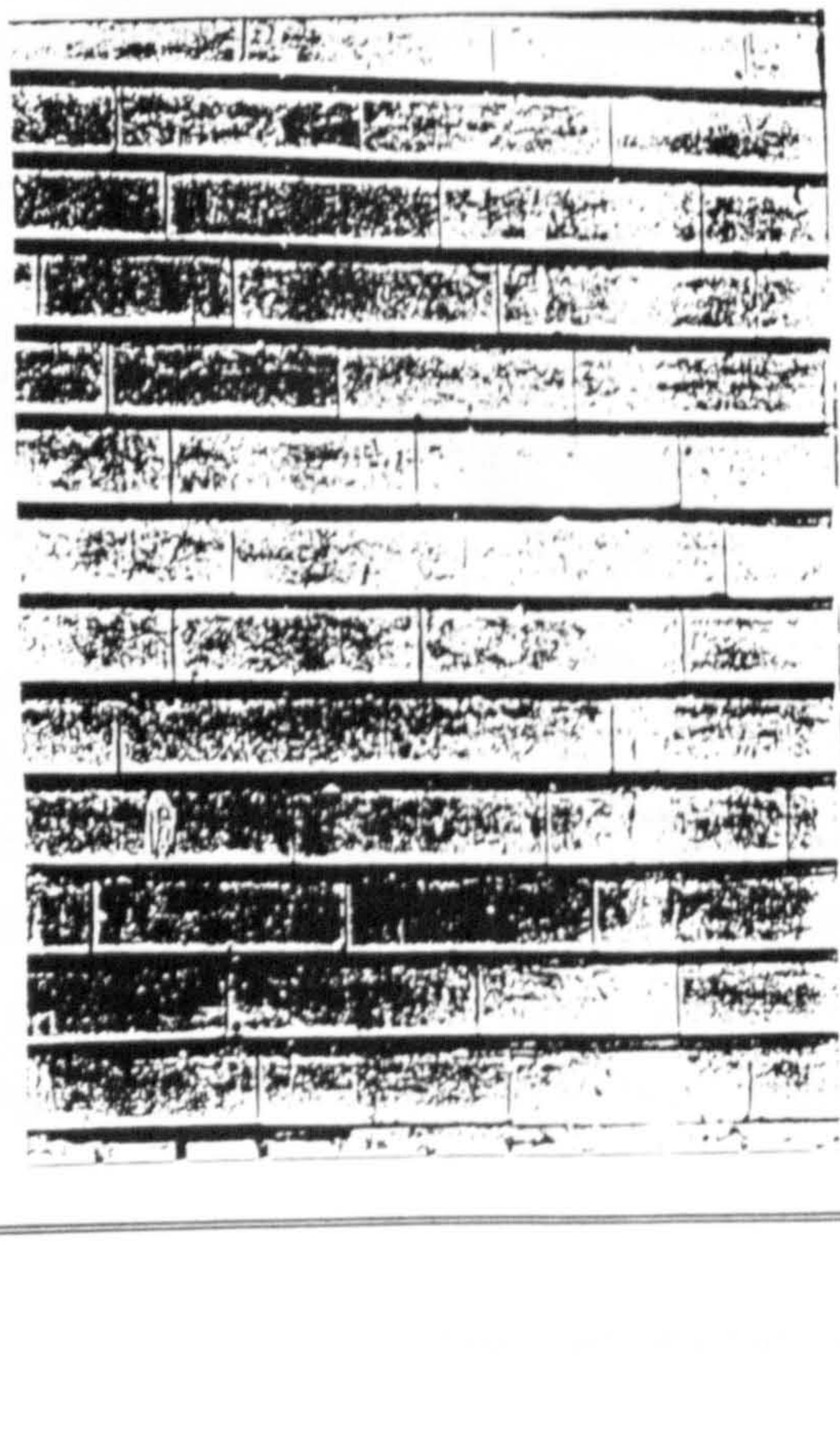


Figure 7: 9 Brickwork problems





5. Summary and conclusions

The structure of the following summary and conclusion is slightly different from the chapter's structure. This is due to the fact that some sections of this Chapter are more descriptive in the sense that conclusions on these sections could be drawn only in relation to the successive Chapter or other chapters as a whole in final conclusion. Here, apart from the analysis of organisation and management the emphasis is given to the problematic areas of training and technology.

Structure and organisation.

Table 7: 10 gives a brief framework of the structure and organisation of the T/C sector. This will be later compared to the structure and organisation of the modern CI in the final conclusive Chapter.

Table7: 10 The structure and organisation of the traditional/ conventional building industry

Elements of the organisation	Factors and functions
Entreprenеur/ Site Manager	***Memars*** (master builders)
Building trades	***Seftkar*** (mason); ***Nazok-kar*** (trowel tradesman)
Education & training	Traditional apprenticeship
Client	***Karfarma*** (work-orderer); private; owner contractor
Municipality	***Parvaneh-e Sakhteman*** (Planning permission) Building inspection; Planning Regulations and quality control
Architects and engineers	***Monads*** design and supervision
Nature of works	***Maskan*** (Housing) (92%), and **commercial buildings**
Contract	***Haghol amal*** **(cost plus)** ***Peymankari-e dastmozd*** (labour only contract), Trade sub- contracts
Job recruitment	***Karfarma's*** **choice:** word of mouth; relative's recommendations; compromise
Project design	***Memar*** and ***Karfarma*** collaboration; ***Mohandes*** (architects, engineers)
Supervision and quality control	***Karfarma*****;** ***Monads*** (architect or engineer); Municipality.
Technology	Traditional + Modern = conventional
Legal status and procedures.	***Ghanoon-e Nezam-e Memari va Sakthemani*** (The Law of Architecture and Building disciplines)

Importance and potentials of the traditional/ conventional sector.

1. All successes in the modern sector are likely to be illusory unless there is also a healthy growth - or at least a healthy condition of stability (of work and business) - in the non-modern sector. In the case of the traditional/ conventional building industry,

conditions are unsatisfactory and deteriorating. Any decision concerning the no-modern sector must take to account the people who will be affected.

2. The government authorities are not interested in the 'informal' sector because they cannot tax it, manage or handle it. There is nothing in the 'informal' sector for the benefit of 'formals', so they are quite happy to see it damaged. No serious research could be conducted on the basis of prejudice, which no one had been able to substantiate fully and which instead reflected an inability to understand or appreciate the informal sector's potentialities.

Compatibility to new technology

1. Some professionals who argue that bygones should be bygones and that new methods and technologies require new organisation and management. They argue for the need to employ new methods modern organisation, and in fact industrialised building. They base their arguments on the state of technology and low quality of the buildings built by the traditional conventional sector.

2. There is no contradiction between the traditional/ conventional building industry and improvement of building technology. Here the author shares Peter Stone's belief that: Traditional building usually uses a loose form of organisation in which the operations follow a recognised order and in which both the order and the work in each operation is well understood by the skilled craftsmen and is implied by the design without any need for detailed instruction. This situation is not necessarily changed in any fundamental way by the introduction of prefabricated components or by the standardisation of their measurements. In fact the reason why this author calls this sector traditional/ conventional (T/ C), and not traditional, is its potential for adopting new materials, and components perfectly, and to some extent new technologies. It is true that the T/ C Sector has some problems with new technologies particularly the concrete technology, but there are solutions to this problem by devising special training schemes.

3. It would be helpful to remind ourselves that even in Western industrialised countries in the first instance, and predominantly construction has been industrialised, not via the systematised prefabrication of buildings, but via the industrialised production of all materials and components, not by builders but by industrial manufacture and heavy industry. Further evidence could be found here in the failure of 50 years effort in the line of 'building industrialisation' with no links to other industries and even no

links to the indigenous traditional conventional building industry. There are lessons to be learnt by looking at the developments in the last 50 years.

The *Memar*s role and style in management.

1. The importance of management in the context of the building industry cannot be over emphasised. But many decision makers and research bodies in the Third World still do not approach building from organisational point of view, and building research institutes all over the world see construction mainly as a technical problem. It is probably the lack of interest in construction as a management problem which leads to neglecting the management potentials within the indigenous building industry and the search for solutions in imported high technology and mass housing.

2. *Memar*s are indispensable site managers in the context of the traditional/ conventional building industry. Their advantage lies in their management skill and their deep understanding of different building trades, both in terms of technology and in human relations. As a result they usually achieve a higher degree of labour productivity. As the *memar*, himself has been involved with, and in fact has been in the position of almost all trades during his progress to become a *memar*, he is fully aware of each and every single task. In the course of his own training, and later in charge training, the *memar* develops his management skills with a deep understanding of the 'human factor'.

3. Although some elements of dictatorship, and also participation in decision making is associated with *memar*s management, it is best compatible with the definition of Fathers management: *Memar* acting as the father and the relationship resembling a family relationship. *Memar*, ordering and caring, and the workers, obeying and faithful. It follows other reason, this is an indication of the advantage of traditional over modern training, in a society -- and in an industry, in which professions are not institutionalised, working agreements are by word of mouth, and trade unions do not exist or indeed are in their infantry period.

Training system.

1. Both sectors of the industry are dependant upon the traditional apprenticeship system within the conventional building industry. It is fair to claim that the apprenticeship system has served the building industry well and has adapted itself to social, economic and technical changes in many ways. This is due to the simple, apprentice-*memar* relationship. Apprentices are recruited directly by a *memar*. The system is still

an unmodified, ancient tradition based on non-standardised agreements, unpublished customs, tacit 'understandings' and procedures which have been developed through the history of building activities in the country. This is why *memar*s and their paternalistic style of management and 'family type' organisation is so important and indispensable. Besides the Western pattern is not necessarily desirable. In fact the strong point in the much admired Japanese construction industry is said to be the role of 'human relations' in its management.

2. Vocational education has failed to fulfil the needs of the building industry. It has failed to attract the interest of the urban youth. The formal education system has so far not been successful in contributing to the provision of bricklayers, plasterers, or any of the other skilled workers on a building site. This has a fundamental and important social reason. Certainly, the various craftsmen and artisans associated with the building industry do not have the prestige that they had in the past, and are often regarded as inferior to 'white- collar' workers. The only hope for an enthusiastic building worker is the chance to be upgraded to the position of *memar*.

The adequacy of the apprentice system

The adequacy of the apprentice system must be judged in relation to: A) supply of sufficient workers with requisite skills; B) efficiency and economy of training; C) effects on productivity.

A. **Supply of sufficient workers**: From the evidence of 'construction boom' period, of the first five year plan of the Islamic Republic, which coincided with post war reconstruction, one may come to the conclusion that the system failed to reach the expected target for providing skilled labour. But considering the fact that even the number of semi-skilled labourers, that is to say the number of apprentices, did not reach the target suggests that the problem may be the difficulty of recruiting reluctant urban youth as new apprentices. Although the need for sudden increase in the skilled workers may result in shortage and inproportionate increase in wages, but the problem of quality and the type of requisite skills can impose more important problems for the industry, if the system fails to provide. Usually there has been no problem in recruiting trowel trades in terms of numbers but the level of their skill is increasingly the main concern.

B. **Economy of training:** The apprenticeship system is economical. The apprentice is both earning and learning, the employer is both training him and paying him for

productive work. Apprenticeship is considered not only the most economical method of training for the building industry, but is the only possible way. This is due to the particular social status of the trowel trades which already have been discussed. It is certainly economical for the trainee and also for the government in the sense that government does not spend any money. This leads us to an important question. Instead of abolishing the system and try to impose formal vocational education, is it not better and more economical if the government spends a minute fraction of money needed for vocational education in the required scale, to the present system in helping it to improve the quality of training?

C. **Effects on productivity: dealing with problems of training:** It is fair to conclude that the productivity of the labourers in this country is lower than their counterparts elsewhere, but it should be acknowledged that there are problems in the methods of work which results in lower overall productivity and lower building life. Its is true that poor workmanship affects productivity in all levels, but the problems can be dealt with. The successful experience of the Society of Architects and Engineers of Fars with the close collaboration of the Union of *Memar*s in arranging educational evening sessions to improve the level of knowledge and understanding of *memar*s with regards to new technologies, and the discussions on the improvements on the methods of bricklaying can be taken as an evidence to this. With a little financial help from the government great results could be expected. Whereas the cost of modern vocational education, and employment of industrial methods, in addition to social costs is so high, that it becomes beyond the reach of even an estimate. The building industry was the first one to have a National Apprenticeship scheme in Britain. In 1943. Perhaps it is time to appoint an institution to closely look at the problem of training within the industry, and find solutions within the present precious and indispensable system.

6 End notes

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1 Schumacher E. F., Small Is Beautiful 1973 p143

2 The phrase in parenthesis is by this author. The original paragraph by E.F. Schumacher ends: 'Stability - among the very great numbers of people today whose life is characterised not only by dire poverty but also by hopelessness'. Obviously by this Schumacher means the non-modern sector, but in the case of the non-modern sector of the building industry in Iran, although conditions are unsatisfactory and deteriorating, dire poverty, and particularly hopelessness do not yet really exist.

3Akhundi Abbas, ' Housing Problem Can Be Solved By Planning, Foresight.' Kayhan International Feb. 24 1994 p9

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Haghol- amal kar means **commision agent; factor**
Haghol- amal kari means **factorage or commision**
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63 Op cit. Karaesmen, Erhan., 1989 pp245-259

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CHAPTER 8

Modern sector of the Iranian construction industry: Structure and organisation; problems and potential.

1. Introduction.

Following the study of the T/C sector, this Chapter provides more data on the structure of the modern CI. and deals with the study of the organisation, problems and potential of the modern sector. The organisation of the CI may be studied at three different levels: **1)** the macro-organisation of the CI at the national level; **2)** the internal organisation of individual firms; and **3)** the micro organisation in relation to site activities. Although some aspects of the micro organisation of the modern sector will be discussed in this chapter, the focus will be on the macro-organisation and its effects on the internal organisation of individual firms.

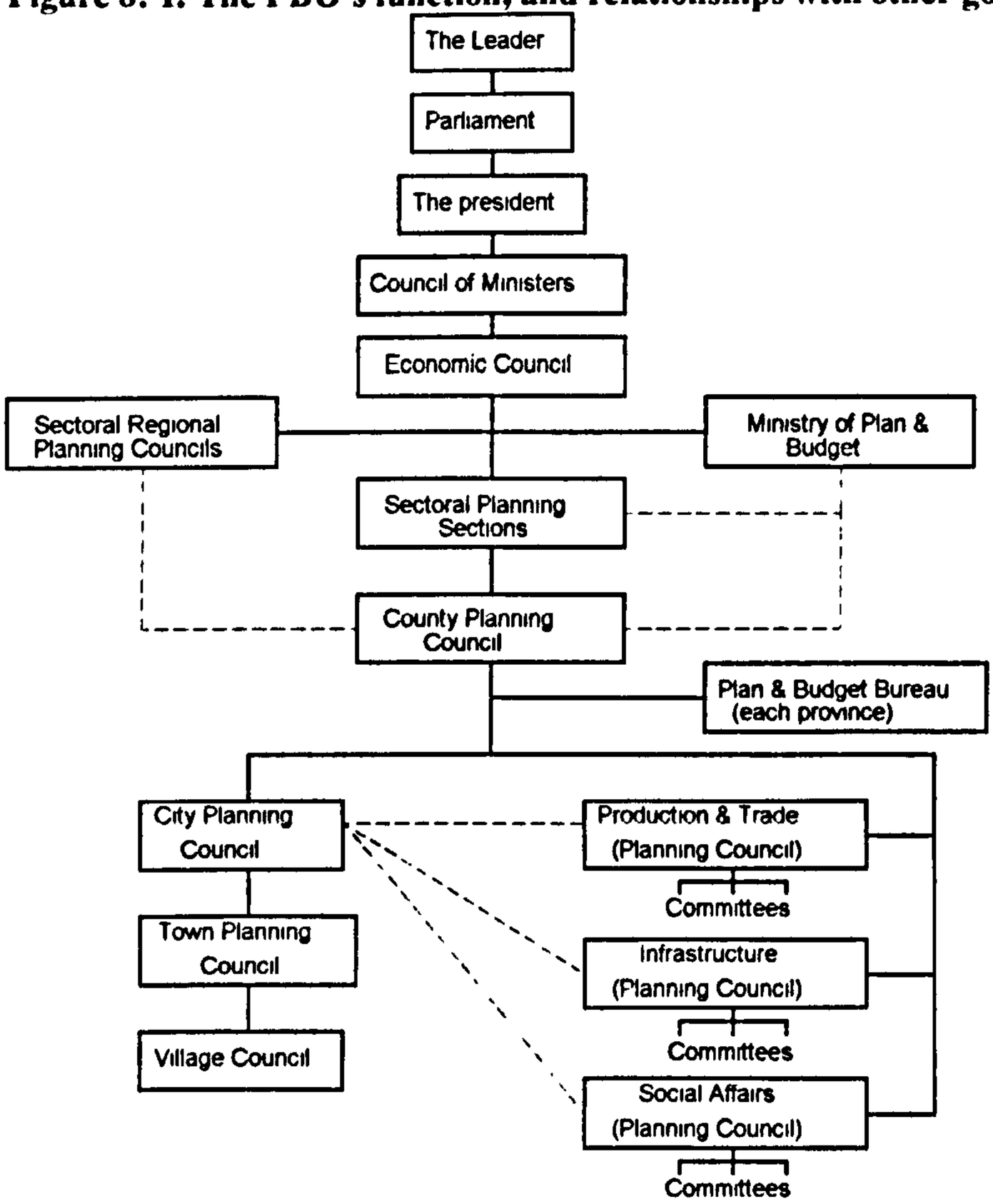
As mentioned in Chapter 2, the modern CI emerged in 1927 from minor sub-contractors who worked for the Western companies on the Trans-Iranian Railway project. In the early stages, i.e. until 1948, the modern sector was exclusively involved with railway and road construction. Foreign contractors carried out the main job and foreign firms provided all the consulting engineering services. When the government established the Plan Organisation (PO) and the first seven year plan (1948-1955) started, opportunities opened up for local contractors and the number of contractors started to increase. The organisation of the modern sector in fact developed under the influence of PBO[1] and its two special offices of *Daftare Omoure Peymankaran* (the Office of Contractors' Affairs) OCA and *Daftare Omoure Moshaveran* (the Consultants Affair Office) CAO, both operating under MPB then PO. Before we study the different components of the organisation of the modern sector we will briefly introduce these authoritative organisations.

2. The client organisation: the Planning and Budget Organisation.

In 1949 the Plan Organisation (PO), was established for the task of planning, controlling and directing development projects. PO, which was later known as the Plan and Budget Organisation (PBO), changed into the Ministry of Planning and Budget (MPB) in the

mid 1980's and again changed its name to Planning and Budget Organisation in 1990 but with little change in the organisation.. The PBO, being the main body for the country's economic development planning, plans all the development projects (See figure 8: 1). The PBO is also the supreme supervisor of the whole process of execution of these projects and of all parties involved i.e. the contractors, consultants and the *Mojri-e-Tarh* (project execution agent and the client representative).[2] See figure 8: 2

Figure 8: 1. The PBO's function, and relationships with other government bodies.



PBO, through its offices, is also in charge of supervising and controlling all stages of Project Design, Contract Adjudication and Contact Execution as well as enforcement of standards of qualification of individual contractors and consultant firms. The control is implemented through two offices of OCA and CAO by means of classification and accreditation and other rules and regulations.

A more detailed description of the duties and activities of the PBO is given below. Here we continue to explain its role in shaping the modern sector of the CI through its offices related to the contractors' and consultants' affairs.

2.1. Western influence; and the Office of Contractors' Affairs (OCA) (*Daftare Omoure Peymankaran*).

Right from the beginning the modern sector construction industry began with the emerging of contractors and sub contractors working on the Trans Iranian railway project. 'However , foreign firms provided all the consulting engineering services, and by

far the greater part of civil works, concentrating largely on railway and road construction was carried out by foreign contractors'[3]. Many of the characteristics of the structure of the modern CI were adopted according to the Western model. As in the west, 'the complex organisation of the construction industry is centred on the building contractor'[4]. The contractor, meaning a firm basically responsible for carrying out the construction work according to already prepared drawings and specifications, in an agreed period of time for a pre determined amount of money, was a new concept introduced to the country.

The fact that our modern construction industry relies on only one client - the government - for its workload is contrary to the conditions of demand for the British building industry in which, '. . .demand is fragmented among a myriad of different bodies, and clients'[5]. Given the macro-economic conditions which were described earlier in Chapter 3, in addition to this over dependence of the modern sector of the ICI, later developments in the ICI did not evolve according to market conditions, but according to the authoritative role of the PBO.

PBO and its office OCA used their authority in shaping the industry along Western lines. This was done by Western educated employees in the same atmosphere which we discussed in Chapter three in relation to the influence of Western architecture. Here the authoritative role of OCA played an important role.

With regards to Western model Jill Wells states: 'The most obvious and striking feature of the construction industry in capitalist countries, is the fact that the responsibility for production is divided among a wide variety of participants'[6]. This variety of participants in the context of the Western capitalist mode of CI is still to some extent, as Jill Wells mentions, the most common way in developing countries. . . In introducing the most important feature shared between the Western model and the developing countries' she continues to argue that: 'Most immediately apparent is the fact that the responsibility for the design of construction projects is completely divorced from the responsibility for their production.....which has serious, and fairly obvious, negative implications for the efficiency of the total construction process'[7].

This problem has been seen from different points of view. As a barrier to innovation P.A. Stone points out: 'The influence of the builders on the development of methods of construction depends on their degree of freedom in determining the materials and methods of building. This freedom is severely limited when they are building to the

detailed design and specification of a professional designer'[8].

The author noticed this problem through experience. Perhaps the most innovative approach of the author's 25 years of work happened when the opportunity arose to take responsibility for both design and construction of a major project. A detailed account of the project and the experiment was given in Chapter 4. This occurred during the war when the consultant firm dissolved as a result of the flight abroad of the director/ manager of the firm, and the responsibility of both supervision and design were added to the author's responsibilities as contractor.

Further developments in the Western CI led to the present situation in which 'an important part of building activity is carried out by contractors responsible both for the design and construction'[9], and the 'old' contractual arrangement is currently referred to as traditional[10]. 'During the past quarter or so, and particularly during the last ten years (since 1977), there has been a remarkable diversification of contractual arrangements in the building industry. . . A private survey in 1984 by the Centre for Construction Market Information listed 'the top sixteen management contractors' and showed that the number of firms offering that arrangement increased from three in the 1960s to five in 1970 and to 44 'national contractors by 1984. A further survey by the Centre shows that design and build and management contracts together probably accounted for about a quarter of all new non-housing construction in 1985: 15% percent by means of the former and 10-12% by the latter'[11] A point worth noting here is that it is not only the 'modern' technologies being transferred to the third world are already obsolete in the West, but also systems and organisational arrangements. This is because the economic and social environment in the source country allows for evolution and in the latter it does not.

After the Islamic Revolution in 1979, and the flight of large contractors, management contract was found as an appropriate method for the completion of those projects which were considered a priority. This worked very well indeed in practice. An example was the Shiraz University Campus. One of the local medium-scale Shirazi contractors was appointed and the job carried out with relative speed and even better quality. Although there were other examples of the use of this method for the completion of projects remaining from the former regime, this method has never been used for new starts. However, it is fair to claim that such a method is not allowed in the modern sector in Iran because of the authoritative role of the PBO which does not allow any other type of contract arrangement.

The main advantage of the separate organisations of design and building in the context of the British building industry has been described as:

> 'A significant advantage of this system is that the client has on hand an array of specialist advisors. These advisors work on a fee basis and thus there is a minimisation of any profit driven tendencies to either encourage or discourage clients from initiating more or less work to take account of changed circumstances. Although it has been pointed out on many occasions, that, for the quantity surveyor in particular, there is an interesting conflict. On the one hand he or she is responsible for the cost control of the project. On the other hand, by being paid on a fee basis, the consultant gets paid more, the more expensive the building turns out to be.'[12]

What is described as a significant advantage can result in more expensive projects particularly in the Iranian case as a result of the absence of the separate responsibility of the Quantity Surveyor. Quantity surveying as a rather separate entity does not exist in the context of the CI, and it is among the responsibilities of the consultant. Quantity control is usually carried out by an engineer or architect who is not trained as a quantity surveyor, and is appointed as the site inspector by the consultant firm. Here again the OCA can be held responsible. In copying the Western organisation, OCA 'left the line of' Quantity surveyor 'out'.

In common with the industry in the west 'this system did allow the professions to develop separate identities. . .interested in ensuring their own survival, . . and developed a reputation for sometimes delivering expensive buildings late'[13].

There are three types of 'division' in the modern sector organisation: 1) Design and building divide; 2) Divide in architectural and structural design; 3) Divide between public client and private contractor. The adverse effects of the division between design and building is also exacerbated by the divide in the design itself. As discussed in Chapter 2 the 'western influence' in relation to 'the departure from traditional architecture', architectural schooling and thus the profession was based on the *Baux arts* tradition. As 'in France, with its *Baux arts* tradition, the architect plays a narrow, almost remote role. He provides the overall concept and leaves the technical detail and actual construction of buildings to others. In Germany, with its total faith in science and technology, the architect is master builder. He does everything except the actual construction.'[14] The pattern of 'architect - engineer - in one' education would be more close to our traditional approach to building project organisation, and perhaps more appropriate for developing countries.

The division between design and building when accompanied by another division i.e. public client and private CI, in certain socio-economic conditions in the third world can be tremendously counter productive. We will discuss its consequences later in this chapter in relation to the 'problems of the industry' and 'the future of thc industry'

The most considerable disadvantage of this highly fragmented system is 'that it is very difficult for the client to identify who is responsible in the case of technical failure in the finished work'[15]. It must be noted that this division of responsibility affects the Iranian CI in a more damaging way. The bureaucratic structure of the modern sector results in a loss of demarcation in lines of responsibility. When the responsibilities are divided between complicated client organisations; consultant; supervisor; and contractor, a state of confused responsibility is often created. This prepares the ground for corruption which can spread to even the lowest levels in conditions of dire economic hardship.

It was explained how the authoritative role of the OCA tended to dictate thc shape of the industry before the revolution. An example of this authority and the degree to which it could be exercised and also the way the industry could be affected will clarify this causal link. After the Revolution OCA, rather hastily, brought about new regulations, which meant that almost all technical staff would be share owner partners. They also determined the percentage of shares for each partner. According to these regulations construction companies were categorised into seven groups in relation to their capacity to undertake projects. To obtain a medium grade, for instance 'four', the chart for the number and speciality of partners was as follows:

Table 8:1 The chart for the number and speciality of partners

Description	Experience years	No.	Percent Min	share Max.
1 Engineer or Architect	5	1	18	27
2 Senior construction technician/	10	1	15	22
3 Construction technician/	5	2	13	19
4 High school diploma	10	2	10	16

Minimum members of the board of directors = 3

Characteristics of the director:

Speciality: Engineer or architect

Work experience: minimum 5 years[16]

Adaptation to these regulations was made compulsory. Some companies had been established and run for years as 'Limited', and were in fact family businesses, where usually one member of the family had more than 51 per cent of shares and full authority. These had to change from being limited companies to becoming joint-stock holding companies first. Thus they had to bring in quickly half a dozen new partners with whom they had no previous association.

These regulations were totally idealistic and did not have any link with cultural or commercial realities and often ignored the economic facts and technical environment of the industry. Although these regulations were later changed to be more pragmatic for a period they did cause tremendous problems for the companies, notably for management and decision-making. Many companies went bankrupt, including most of the co-operative construction companies established after the Revolution.[17]

2.2. *Daftare omure Moshaveran* (Consultants' Affairs Office) CAO

Consultants were late-comers compared to contractors. Until the 1960s most consultants were either foreign companies or joint ventures. These companies were gradually replaced by the newly established local firms initiated and encouraged by the CAO. Many of these firms were established by former employees or partners of foreign consultants. The CAO' initiative had a major role in the establishment of consultant firms but continued its influence by dictating the structure of consultant firms in the same way as the OCA.

The principle mode of control of the CAO was through the division of the workload and its influence was even greater here than in the case of contractors. CAO directly appoints consultants for individual projects regardless of any kind of competition. The appointment of a consultant is done directly by the CAO based on a ration system and, to some extent, the area of specialisation.

2.3. The Project Executor *(Mojri-e-Tarh)*

Mojri-e-Tarh represents the client (government) through one of the government Ministries related to the project. It conducts its duty from a special office within one of the regional offices of the client Ministry. Apart from the 'parent' Ministry it maintains

direct links with the PBO and also with the consultant and contractor. Terms and conditions of its relationship with consultant and contractor are determined by contract document. See figure 8: 2.

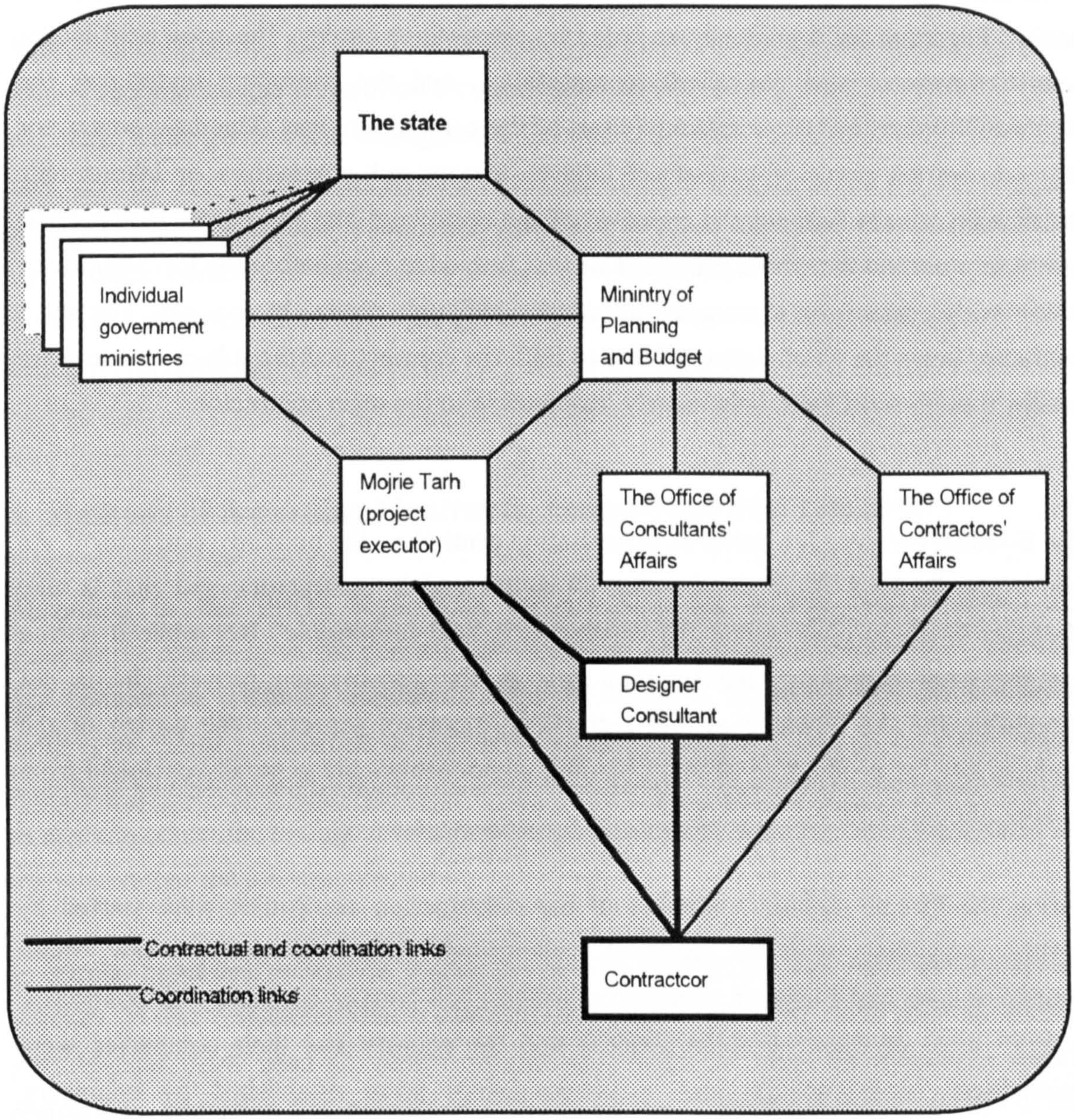
Mojri-e-Tarh, being the representative of the client, also acts as the supreme project manager and oversees the consultant and the contractor. *Mojri-e-Tarh:* in liaison with the PBO's two offices, OCA and CAO, controls the project execution and also the implementation of the rules and regulations devised by these bodies. In liaison with the CAO it also selects the consultant firm, usually a single firm responsible for both architectural and engineering design. It also briefs the consultant briefing providing an overview of the project function and the approximate budget.

3. The consultant; characteristics of the entrepreneur; and its function.

Almost all consultant firms were privately owned and managed before 1979. During the few years after the revolution the function of many big consultants was interrupted by the flight abroad of their main partners. A few of these were taken over by government management while others were transferred to senior employees as new owner/ partners. Almost all consultant firms are at present owned and run by local architects and engineers[18].. Very few firms engaged in highly specialised civil engineering design, such as off-shore building for the oil industry, have foreign partners. It is a requirement in law that at least 51 percent of the capital must be owned by Iranian nationals.

The consultant is responsible for all aspects of design (architectural, structural, electrical and mechanical), as well as supervision. The whole process of design and supervision is carried out in three phases. Phase one is the preparation of the preliminary design and joint approval by the PBO and *Mojri-e-Tarh.* Phase two is the preparation of detailed drawings, specifications, and Bill of Quantities, approved by the client's representatives. In phase three the project is put out to competitive tender, based on the documents of contract prepared by the consultant. Contract documents consist of: the contract, drawings and specifications; bill of quantity and price list, and also general conditions of contract. As the contract is usually awarded to the lowest bidder and the *Mojri-e-Tarh* is in charge of all procedures from advertising or letters of invitation to the opening of contractors' price proposals, the consultant has no other authority than overlooking the procedure. Phase four is the overall and site supervision of the project.

Figure 8: 2. Relationship between basic participants of the modern sector of the ICI.



The consultant is also responsible for re-measurement and final quantity surveying and, to some extent, cost control. In general terms the cost is controlled by the Ministry of Plan and Budget through the introduction of a nation-wide price schedule, which is usually published yearly, and a system of price adjustment. However, within these cost control guide-lines the consultant controls all the payments to the contractor.

4. The contractor ; characteristics of the entrepreneurs

The contractor is basically responsible for carrying out the construction work, according to the drawings and specifications, in an agreed period of time, for an agreed amount of money. The contract is generally awarded by competitive tender. The successful bidder signs the contract with the client representative, and the consultant undertakes the responsibility that the terms and conditions of the contract are met. The main contractor may subcontract parts of specialised jobs to various sub-contractors or labour only contractors, usually without the approval of the consultant and the client. However he cannot subcontract the whole project. This was forbidden even before the Revolution but it was widely practised then and still occurs although rarely. In any case the main contractor bears the whole responsibility to fulfil the contract and the sub-contractors are usually, though sometimes only loosely, responsible to the main contractor.

'The Building Industry is a complex organisation centred on the building contractor'[19]. As seen in the figure 8: 2, it appears that all routes end in contractors, and that is why whenever anything goes wrong the contractor is held responsible'. But while it is true that the main contractor plays a vital role in the construction process, he is not responsible for the whole of it. Two crucially important aspects - the design of the products and the production of materials and components - are generally excluded from his area of control.'[20]

During the former regime, a number of big construction companies were started by wealthy individuals with no technical background. Although relatively few, these companies have had a kind of monopoly, through their corrupt contacts with politicians. In 1979 most of these company owners fled the country and their companies were nationalised. Most medium and small companies were established by engineers, architects and technicians. This was partly because of the requirements of the classification regulations[21] by the Ministry of Plan and Budget, and partly because of the general economic situation, which attracted wealthy individuals to make money from land speculation and foreign trade. After the Revolution the tougher conditions for contractors meant that even some of those companies owned by experienced and technically educated entrepreneurs, who survived the harsh situation of the early years, shifted from construction to the easier profits to be made in the Bazaar, dealing with general imports and the sale of different commodities.

Of the total number of nationally registered as dissolved companies in 1982, 75% measured by capital assets belonged to the CI, though they were numerically only 28 percent of the total.[22]

Almost all contractors' and consultants' firms were privately owned and managed before 1979. After the Islamic Revolution a considerable number of big firms were nationalised and came under government management. A number of these companies were dissolved later, and the rest reverted to private ownership. However the number of state owned contractors and consultants is limited. Despite the fact that almost all construction firms are privately owned and managed in comparison with Western models they cannot be considered as private firms since the government has always had great control over their structure, function, and development.

5. Methods of Awarding Contracts; competition and conspiracy

According to the PBO's regulations the contract has usually been awarded by competitive tendering to the construction firm who submits the lowest tender. 'The fact that competitive tendering appears to offer an impartial, objective basis for allocating work is particularly important in the public sector where the award of contracts might otherwise be determined by favouritism and corruption.'[23] This was true usually for small to medium contracts, but big contracts were often awarded skipping these regulations on the pretext that the job was special!

In special cases and whenever it was possible to find an excuse, such as a project's urgency, it was considered that a particular contractor would be more capable for the job. *Mojri-e Tarh* used to obtain special permission to omit the contract's award regulations. Obtaining that permission was the means of involving the politicians in the big jobs and large contracts. Even the upper-medium contractors who were struggling to gain access to those corrupt channels, were usually unsuccessful. First they had to get a sizeable job to show an ability to handle major projects. This was a matter of 'chicken and egg', because the 'club' of large contractors was to a large extent closed.

Upper medium contractors had another method round the regulations. This method was more possible and frequent in the 1970s when the level of workload was high and contractors not too keen to win a new contract. In this method, which contractors termed 'combine', they would call all the prospective bidders around a table and someone

was chosen as the 'successful bidder' with the ultimate possible price. In exchange the 'successful bidder' paid an agreed sum of money to the rest. The winner was the one who came with the highest offer to pay off his colleagues. There was a limit to bidding high, a ceiling existing of 10% over the consultant's estimate or nation-wide system of price schedule, to limit the damage of this conspiracy. However, the government could still lose almost 20 percent; as the difference could be anything from 10% below the estimate. It must be noted that with the usual overcrowdedness of contractors in this range this practice was limited to a period of two to three years in the mid 1970s.

To confound this operation counter measures were employed by the OCA. Instead of awarding the contract to the lowest bidder, it was decided that the successful bid would be the one which was closest to the average bid. Extra complications were also introduced such as the inclusion of the consultant's estimate or a change in the method of calculating the average, practically deterring the 'combine' practice. In case of equal difference above and below the average, the decision would be made by the 'contract commission'. This commission comprised representatives of the Project Executor, Consultant, and PBO (*Zihesabi*).[24]

Ironically, with the best intentions on the part of the managers of medium sized firms on the client side, and even when the 'anti-combine' measures were successful, contract commission members did not quite feel they were on the side of 'justice'. They were aware of corrupt business at high levels and knew that by saving the government's money they were not giving any benefit to the public; but merely diverting it to big contractors and corrupt politicians. This was exactly the feeling of the author when he occasionally took part in contract award commissions while in charge of the area office of the Shiraz University Campus Consultants.

6. Emergence and demise of private developers; the modern sector's involvement in private housing.

Although the first major urban housing construction 'boom' occurred as early as the mid 1960s (during the Third Plan period), as a result of high overall government spending, the emergence of real estate developers, similar to those in other capitalist economies, did not occur until the 1970s. This was during the second considerable 'boom' created by the drastic oil price increase. The emergence of this type of developer was mainly

confined to the capital Tehran and limited to the state clientele. 'The pattern of investment favoured the expansion of the private sector and the groups loyal to the political establishment. Also during this time international construction groups were involved.'[25] In the mid 1970s a trend started where large companies became involved in all construction related activities: as developers; as building materials and components producers, and as distributors. This trend was short lived and since 1979, with the flight abroad of the owners of those large companies and the Islamic Republic's Urban Land Law, it has been completely abandoned. More recently the role of developer has, to some extent, been taken up by the government.

Government, which already had the role of financier and developer in the context of development planning projects, was inclined to take up the role of developers in the area of housing. The function of the Ministry of Housing and Urban Development has traditionally been technical advice co-ordination and legislation. Although there were housing schemes in which MHDU acted as developer before the Revolution, since then have abandoned private developers role and has become the sole developer on the scene. MHDU is increasingly under pressure from private contractors to take up the role of developers more seriously. This will enable the contractors to obtain a greater share of the private housing sector demand, which would otherwise be directly provided by the T/C sector. Politicians would be seen to have involvement with the 'good cause' of solving the housing shortage. The latest evidence for this are the statements of the director of housing (Samari Mohammad 1993) and the Minister of MHDU (Akhundi Abbas 1994) in favour of mass housing and the involvement of the modern sector in urban housing cited in Chapters Three and Four.

7. Developments in the modern sector since 1979.

After the Islamic Revolution the CI faced a number of serious problems. First of all the industry, having been the main tool for the implementation of the Shah's policy and its association through the big contractors with corruption, faced suspicion. The very existence of the system came seriously into question and to some extent under attack. We will deal with this later under the 'Government Views and the Future of the Industry'. It was probably for these reasons that the Islamic government transferred the war time duties of the construction industry to *Jihade Sazandegi* (construction crusade). 'The construction sector suffered most from the cut-back in development spending and the austerity programme in government expenditure. The only major exemption was the

construction crusade, which received the equivalent of $2.5 bn. for projects in the war zone and development in the rural areas, including irrigation and house building schemes.'[26]The whole issue of the importance of the CI was overshadowed by a variety of social and political factors. Here we address some of these problems as reflected by the Syndicate of Contractors in Tehran.

As virtually the whole modern sector of our CI has always been dependant on government patronage, it is the patron who is generally seen as being responsible for problems that occur. This has particularly been the case since the Revolution of 1979, when most of the big companies were nationalised, and medium and small companies have had great difficulty in maintaining their ability to operate efficiently. The nationalised companies survived only by virtue of government subsidies with many medium and small companies going bankrupt as a result of the hard conditions and lack of support. In other words the post-revolution political and economic atmosphere did not favour the contractors who were all regarded as former clientele of the Shah's regime.

It is not only the drastic economic problems and the decline in workload which has affected the CI but also the social and political environment. The CI was seen as the bulwark of the former regime and the bad reputation of contractors, particularly that of a few big companies who were directly related to politicians, meant that after the Islamic Revolution of 1979 the whole industry was under suspicion. Many of the smaller construction companies who had survived confiscation or nationalisation had to suffer the consequences of the actions of those few big ones and as a consequence have been dragged into bankruptcy and closure.

Moreover the old, almost one-sided, legal framework which favoured the client, made a difficult situation even worse for private companies.[27] The cost of materials, equipment and machinery, as well as labour, was rocketing and a rationing system was employed. This did not really help because there were simply not enough building materials available to satisfy needs. As a result contract deadlines were exceeded often by long periods, and contractors were frequently evicted from the project or went bankrupt.

In addition to the old Contractors Syndicate in Tehran (established 1947) many other newly established syndicates and organisations sprang into existence in several provinces after the Revolution . They tried hard to improve the situation,[28] but it seemed that the suspicion of new statesmen had overshadowed their understanding of the importance of

the CI. Moreover the almost entirely young, enthusiastic and inexperienced new executives had little of the experience necessary for running their technical jobs.

The fact that 'The construction industry is an important contributor to the process of development.'[29] was often ignored. The whole scene provided overwhelming evidence that: 'the constraint on development imposed by inadequacy of the construction industry is seldom recognised.'[30] The CI not only did not get the necessary attention but, perhaps for the first time, its development was hampered by wrong and irresponsible actions of these young executives.

It seemed absolutely vital to raise the awareness of the new statesmen concerning the importance of the industry and potential problems. With this in mind the Tehran Syndicate of Contractors and professional organisations from elsewhere in the country, wrote hundreds of letters to different government officials.

A letter to Mr. Rafsanjani, whilst he was Chairman of the Islamic Parliament, explained that there were 700 member companies working on development plan projects all over the country and that some of these projects had started as early as 1974. According to their contracts, the duration of most of these projects was about 3 to 4 years. Since 1973 the effect of the world economic recession and inflation had forced a system of price adjustment to be introduced, to compensate for any rising cost of materials, machinery and wages during the contract period. Every three months the Central Bank was responsible for introducing a price index according to which the PBO determines the adjustment coefficient. Unfortunately the central Bank often delayed in determining the co-efficient and the PBO caused further delays through its slow communication. However, this index co-efficient was not only late but frequently false, and the combination of these factors meant that contractors did not receive compensation for even half the rise in their contract costs.

> '. . . as a result of this (the price co-efficient matter) and, further financial problems caused by the misconduct of government officials in charge of the execution of projects, about 700 private construction companies have been dispossessed including a great number of recently established co-operative companies, and as a result of the young work-force who must serve in the reconstruction of the country, the majority are either on the run or are in prisons.'[31]

In another section of the same letter The Syndicate mentions:

'. . . We must frankly inform you that member companies under these unilateral pressures have come to the conclusion that certain hands are at work (there is a conspiracy going on) to destroy Iranian construction companies and open the road (pave the way) for foreign companies.'[32]

To give an account of the degree and the intensity of the situation, I will quote a few more paragraphs from the correspondence with government officials as reflected in different issues of the Bulletin of the Contractors' Syndicate.

Letter to the Prime Minister Ref. 454/125210 Dated *22/3/61* (12 June 1982), In protest to a directive which the Syndicate calls unlawful. Part of the letter again mentions the destruction of the whole industry.

'. . . What does the destruction of this industry mean? It means to beg the foreigners and ask for help. Is it possible not to develop at all? Are all the services done by the industry since the revolution, not to mention before the revolution, useless? Were kilometres of road and railway and many buildings including residential, industrial, agricultural etc. were unnecessary?'

In another letter[33] to the President on *23/3/1361* (June 1982), the syndicate writes:

'. . . The total collection of letters, recommendations and requests by this Syndicate since the Revolution to government statesmen and officials, particularly to the PBO, would make an extremely thick book. Despite this it appears that nobody listens and the same mistakes are repeated!'

7.1. Problems of the Industry

In a motion signed by two hundred construction and civil engineering contractors the main problems of the contractors in general were summed up as:

'1) The difference between the contract prices and the real prices (actual cost of works), and the ignorance of the client (government) concerning this incontrovertible fact.

2) Intense inflation caused by the war and economic blockade. Changes in the price of materials, tools, machinery and wages, and false price adjustment indices (co-efficient), and long delays in the payment of the approved difference. All these resulted in the increasing debt of the companies since 1358 (1979).

3) Shortage of materials, machinery and spare parts and inadequacy of the

government system of material provision.

4) An atmosphere of spite and mistrust between the executors (government/client representatives in the project) and the companies, which often takes the form of violation of the contractors' rights. Deduction of illegal amounts on various pretexts. An aggravating bureaucracy which results in a weakening of the companies from the financial point of view and finally, closure of the project.

5) Credit sales in the bazaar and indeed the whole credit business with banks, which contractors used to enjoy, have been terminated. Pressure by the creditors for the collection of debts, arrest, imprisonment and insult to both managers and engineers (workers) of the companies.

6) Continuation of the interest regime in the banking system (despite Islamic laws) and ever increasing debt of the contractors to the banks and a lack of understanding from bank managers.

7) Negligence of the underlying facts and realities by the project executors and bank authorities and their unlawful retention of the bank guarantees on spurious pretexts.'[34]

The author has a record of 97 letters of this kind by the Tehran syndicate and other professional bodies all over the country. Ten years later when the author met the chairman of the contractors syndicate on 15th of February 1992 in Tehran, there seemed to be little evidence of much improvement. Mr. Djavad Khansari[35] complained that very little improvement have been made. He summed up the problems of contractors as:

Shortage of instrumentation, machinery and equipment. Shortage of building materials and components. Problems and shortcomings of rules and regulations which determine the relationship between the contractor, client and consultant. The existing regulations simply do not accord with current conditions (and as a result contract deadlines are often exceeded by long periods). As a consequence of these factors many contractors did not survive to finish their projects and if they did the cost and duration of the projects increased several fold. Khansari then mentioned the characteristics of this period of development projects in relation to the problems of contractors as:

1) **Unstable, and excessively increasing prices of materials, machinery and wages**, to such an extent that nowadays no cost estimate is valid for more than two months. A contractor with a reasonable bid finds himself, after only a few months, facing the monster of inflation and an unrealistic price adjustment which does not compensate for the price increase. Yet the PBO has been unable to introduce a

solution.

2) **Worn out machinery** and expensive prices for replacements and spare parts. In recent years, because of the ban on the import of machinery and spare parts, the machinery, even if working, is very inefficient.

3) **Shortage of materials**, particularly 'Key Materials' which are under government control, is one of the main problems.[36] Lack of proper planning by the government in this respect has exacerbated the situation. As a result of delays in the delivery of materials such as cement, brick or steel the efficiency and productivity of the site is badly affected.

4) **Decrease in labour productivity** for a variety of reasons, notably a change and deterioration in labour/employer relations, a lack of discipline and the lack of commitment to undertakings.

5) Personal and family problems of company workers due to financial difficulties and the intricacy and confusion of social relations. These problems particularly affect site management due to the diversity of social and financial status.

6) As distinct from general problems (as mentioned above) a particular factor exacerbating these problems is that of inexperienced and occasionally miserly government executives. In the years after the revolution a large number of engineers/architects and experienced managers resigned or were made redundant and were replaced by younger and less experienced managers. Even in the best circumstances, new managers need years of experience confronting problems. When they don't get this experience they can cause considerable damage to projects and to contractors. Unfortunately because of certain factors - low government salaries for instance[37] - this very important problem is most difficult to tackle. At present there is little hope that experienced and capable managers will be absorbed into government posts.

7) **The chaotic state of and mismatch of rules and regulations** inappropriate to the rapid changes that have occurred both in the area of prices and general conditions of work. Drastic changes too in the general economic outlook meant that regulations which were perfectly valid when first introduced by the PBO, became a source of confusion only a few months later. In this uncertain situation

clients increasingly interpreted the regulations according to their own judgement, in effect denying the primacy of the PBO.

8) Unfortunately despite serious warnings by the Syndicate and some statesmen, the completely unnecessary employment of foreign contractors has increased. In these contracts the prices are higher; the contract document is more reasonable and conditions are less stringent than those for local contractors. This results in the further increase of prices, and makes the difficult condition of work worse for local contractors.

The Syndicate advised the contractors to support and co-operate with them by maintaining a close relationship. This refers particularly to the gathering of necessary information and data to help the syndicate reflect members' views in their meetings with the authorities.

7.2. The problems of medium and small scale contractors as reflected by Shirazi Contractors.

A more detailed account of contractors' problems is presented here as summed up in a session requested by the author and organised by the assembly of the board of directors of the council of the contractors in Fars province in 22nd of May 1989. The importance of the views of these contractors in Shiraz lies in the fact that they are mostly medium to small scale contractors dealing with projects both in Shiraz, smaller cities of the province, and rural areas. In fact they can be considered as representative of the main body of contractors, who are involved in other provinces dealing with fundamental education, health, provincial roads and other basic infrastructures. However the problems as reflected by the council of Fars province contractors are as follows:

1. Drastic escalation in the price of building materials.

2. The problem of management and decision making at the level of the company caused by its structure (`company form') as imposed by *dafter-e omour-e peymankaran* (the Office Of Contractors Affairs in the Ministry of Plan and Budget.

3. Bank requirements for the issuing of the letters of guarantee. The banks require either equivalent cash or property lieu several times the value of the sum of guarantee

4. Unfair distribution of responsibility as a result of imposed 'company structure'. (In relation to the requirements of banks on letters of guarantee for example, the bank guarantee is usually issued on the lieu of one or two of the partners who happen to own a house or a property irrespective of the proportion of the company share which is dictated by the OCA).

5. Low workload and underbidding as a result of wrong estimates, usually by less experienced companies and late comers.

6. Long delays and impossible scheduling of works because of uncertainties in the delivery of building materials, particularly key materials like cement and steel, and the inadequacy of the ration system associated with corruption and the black market.

7. Poor management at company and site level for a variety of reasons, including decision making difficulties as a result of partners relationship problems, and labour/ employee relationship.

8. Lack of good bookkeeping practice and procedures preventing the management from assessing the financial status of projects and the company as a whole.

9. Long delays in the supply of key materials such as cement, shuttering wood and reinforcing steel.

10. Continuous disputes and a bad working environment as a result of company structure imposed by the rules of classification of the Office of Contractors Affairs (*Daftar-e Omour-e peymankaran*). This is particularly problematic as even the number of partners is dictated by the office.

11. One sided contract documents favouring the client in a way that client organisations can skip their responsibilities.

12. High overhead costs and insufficient workload to cover the general overheads.

13. Lack of work continuity which makes it almost impossible to build up technical staff and investment in machinery.

14. Difficulties in obtaining the loans and guarantees from the banks that are required for bidding and later for obtaining per-payments from the client (government).

15. Shortage of building machinery and spare parts.

16. Lack of knowledge, conventions and a good code of practice in the area of warehousing and material storage. The result is loss through possible theft and fraud.

17. Problems in the relationship between consultant and contractor.

18. Problems in site management as a result of poor labour-employer relations and a lack of appropriate methods of labour performance measurement.

19. Lack of standards for the quality and quantity of work undertaken by tradesmen.

20. Long distances between sites and central offices and problematic communication due to a lack of telephone lines and a quick and reliable postal service.

7.3. The problem of underbidding; Overcrowdedness of the Industry.

In a situation of low development spending, the fact that the contract is usually awarded to the lowest bidder regardless of any other considerations, means that contracts are usually awarded to those contractors who are desperate for the job. Those who carefully analyse and offer a realistic bid, never have a chance. When it comes to advice to the members, the chronic problem of under-bidding has been frequently addressed by the Syndicate. The syndicate warns the contractors about their under-bidding and the dangers arising for the bidder, the client, and the industry as a whole. This warning does not seem to have any affect. P.A. Stone[38] mentions, the prices quoted by different contractors will differ for a number of reasons.

> '1) Differences in efficiency and therefore in costs; 2) **Some firms will be more anxious for the contract than others, perhaps because they are short of work,** or for purposes of prestige or good will, and hence they will consider it worthwhile to accept only a small contribution to their overheads and profits from the job in question; 3) Some firms will have achieved a better understanding of the technical nature of the job than others and are prepared to reflect this understanding in their tender price; 4) Some firms aim at lower standards of work than others and; 5)

> Some firms will have found ways of ensuring a high final settlement price, even on a low tender price.'

With overcrowdedness in the industry, and the government's policy favouring Construction Crusades,[39] particularly during the 1980s, most contractors tend to underbid simply because they are short of work. They aim at lower standards of work and hope to find ways of getting a final settlement price, not least through corrupt channels. Another problem is the unstable economic situation. Even when the bid is reasonable and realistic as Kharrazi[40] points out: 'Today no price estimate is valid for more than two months'

Contractors are hoping for a more stable economic situation and until then they expect the help and understanding of the government. Solving the complicated problems of the industry needs government initiative, and unilateral co-operation of all parties involved including contractors, consultants and client organisations.

8. Move towards improvement; The Efforts of Contractors' Syndicate.

It is certainly true in both developed and developing countries that 'Government actions affect the construction industry most directly at the microeconomics level. Poor planning and execution of public sector projects frequently exacerbate the severe fluctuation in the demand for construction'.[41] But in our case, it appears that the effect is rather the macroeconomics level. The process of generating demand is through economic development planning which in turn is at the mercy of volatile oil market.

It seems to be common in developing countries that the government fails to consider the health and development of the CI. 'We found that government economic planning agencies have paid little or no attention to the implications of general development plans for the construction industry'[42]. Or in the case of a particularly well developed CI in times of economic hardship, governments often fail to deliver the necessary support for helping the industry, limiting the intensity of the damage and assuring its survival. A responsible government with sound planning would be able to minimise the intense damage to the construction industry.

> 'Loss and damage to the industry and the key personnel is not accounted for. Poor planning and execution can also lead to the loss of key personnel (such as engineers and skilled workers), who are difficult and costly to replace, and to the

> inefficient use of construction equipment, which may be made to lie idle. The losses to the industry can, at times, be permanent when, for instance, trained personnel emigrate, or inactive equipment becomes obsolete or too costly to recondition; or companies are unable to meet their financial obligations and, therefore, are forced to liquidate. These risks are likely to discourage investment in the industry and, in the early stages of its development, the entry of high-quality management.'[43]

The Syndicate considers it its duty to try and alleviate the situation of contractors by encouraging the assistance of government in areas such as provisions for price escalation and settlement of disputes, improvement of the calculations to prepare more realistic and accurate indices for applying escalation provisions, shortage of materials and machinery, increases in wages, contract forms and contracting practice. The syndicate is also active in other fundamental matters such as apportionment of risk between client (government) and contractor, weak management on the part of the client (government) organisations *Mojri-e Tarh*, and the employment of foreign contractors etc. The Syndicate claims to have been working hard on these issues and to have achieved some results.

1)On the issues of increases in wages and machinery hire costs, the Syndicate has collected from members necessary data and carefully prepared well documented reports for the technical office of the PBO. These are intended for consideration when calculations of the price index are made.

2) Concerning the problems of price adjustment regulations, the syndicate has had a number of meetings with the PBO and amendments to the regulations have been decided as necessary.

3) With a view to amending the contract document, meetings have been arranged of all involved parties, including the Syndicate representative, and the document subjected to serious scrutiny. As a result of these meetings a new price analysis document was prepared for construction, road building and pipe-laying.

As we have seen in this chapter the problem of the modern sector in relation to government policies are varied and complicated. The sectors requirements needs government recognition, initiative, and planning. In hard times it needs support, and in normal or flourishing times, measures to help further development and the high efficiency of the industry. For example, short and long term training programmes, investment in plant and equipment, and the development of new building materials industries might be

planned; some construction might be postponed to give the industry a chance to develop and to lessen demand and supply fluctuations. Staging of construction is an additional possible means by which the industry might be somewhat stabilised, for this makes construction a continuous rather than a project-oriented process. Only in this way can the development of the construction industry progress smoothly with the rest of the economy.[44]

While it is the governments' duty to soften fluctuation levels in the workload, it is a task for the contractors' associations, probably the Tehran Syndicate, to devise necessary arrangements with the members and help from the government to forecast and inform the industry in advance. This would help them to be able to adjust and survive.

8.1. Forecasting the Workload Levels.

'Workload levels affect everyone in the construction industry -- boss or employee, contractor or professional, office bound or working on a dirty site'[45]. 'Abrupt fluctuation in workload bedevil the commercial operations of most developing country contractors, since they inhibit a serious commitment to the industry and render investment in improved capacity uneconomic. 'The importance of the effect of workload fluctuation is universal.'[46] Forecasting CI workload is to some degree possible for the majority of the countries, and can help everyone involved in the industry to adapt and lessen the fluctuation effect. Various research bodies in the West usually attempt two kinds of forecast ; short term, and long term.

Comparing the forecasts in the context of the British construction industry with the actual output over a long span of time, Nigel Chaldecott[47]concludes that 'the smaller changes are easier to foresee but the major changes are difficult to forecast especially in the degree of their change.' This may even be true in the context of the Iranian construction industry. However the first sections of this Chapter constituted an effort towards this more difficult forecast. However the study of 'recent developments and situation in 1994' shows that it is safe to assume that 1970s will not happen again.

There is no harm in high hopes, but foundations must be laid on firm ground. However the positive forecast is accompanied by the message to colleagues that high efficiency in the context of contractors' firms means higher productivity for the industry and the nation. However, with a more normal situation and the easing of drastic fluctuations,

syndicates of contractors all over the country should attempt to gather the necessary data in order to be able to forecast and plan ahead. It would also be to the benefit of the government to provide the necessary information and collaborate with the syndicate in such a scheme.

In the UK in addition to various research bodies RIBA, in conjunction with *Building,* organises a yearly seminar for drawing a picture of future demand. In a one day seminar[48] in 1st of December 1988, issues were discussed broadly initially and then, depending on their importance, more specifically. For example: world economy; UK economy; UK construction in relation to the UK Economy (down to balance of payments, growth etc.) were narrowed down to the effects of the proposed changes in the VAT treatment of construction and property.

The experts and executives from various disciplines discussed wide ranging issues affecting workload and the CI. For example: Professor Paul Ormrode from the Henley Centre of Forecasting discussed the overall economic situation for 1989-1990; the RIBA director of marketing presented the latest RIBA survey figures on workload. Nigel Chaldecott from Building Materials Producers discussed future demand. Other major speakers included Building Societies Association representatives, a Department of the Environment representative, and quantity surveyor Geoff Trickey. These experts drew together the available facts and then gave their projections for the future workload situation.

One of the issues discussed in this seminar was the changing trend in the dependency of the CI from public to private workload. Nigel Chaldecott[49] states :'In bygone years the construction industry was beset by governments which used it as an economic regulator. Uncertainty reigned and output fluctuated between peaks and troughs. Manufacturing suffered as the risks were great and as a consequence some development was delayed. In the 80s there has been a switch of emphasis from the public to the private sector:

	PUBLIC	PRIVATE
1955 (Approx.)	60%	40%
1977	50%	50%
1987	36%	64%

Chaldecott argues that 'this has led to a more stable output less easily affected by short term policy changes in government and in consequence output has risen steadily.

The modern sector is 90% dependent on government development projects. In development plans the nature of works and the level of workload have been determined on the basis of the Macro economic policies of the government. In the former regime the bulk of its energy was directed towards industrialisation policies, but present government's preoccupation is the improvement of the current economic situation. It appears that in both periods the government neglected its most important tool for the implementation of those policies. There has been little concern about the capacity of the industry or the way that high or low level of workload may affect it.

8.2. Potential of The Industry

On the side of contractors it is believed that despite all the impacts and damages to this industry during the years of war and economic blockade, and the loss of many colleagues (in bankruptcy), if reconstructed properly the industry still has the potential for the fulfilment of all the duties and demands of the country. At the annual meeting of the members there was some optimism in the air when Mr. Khansari stated[50]:

> 'After all these years of stagnation and recession in which our colleagues were even reluctant to take part in the annual meetings so that we had problems in reaching the necessary numbers , we had to re-invite several times, this year we are witnessing the presence of the majority after our first invitation.'

The fact that, in keeping with its historical tradition, during the last 30-40 years the industry has been self reliant in the sense that the share of foreign contractors in the construction market has always been small, particularly since 1968. The industry has been able to grow rapidly in times of increasing workload. In fact the situation still accords with the description made in 1972 in a special IBRD mission report on the ICI.

> 'the construction industry became rapidly overcrowded despite the rapid expansion of construction demand stimulated by rising development expenditures, and diminishing share of foreign contractors in the construction market.'[51]

The secretary of the syndicate believes that 'It is to the benefit of the country that statesmen are not deceived by foreigners (foreign contractors and politicians), and try to reconstruct and maintain the national CI[52]. Statesmen should be confident that if they help to ease the burdens of local contractors and support them, then much sooner than

they imagine these struggling companies will become a real power and the local CI self reliant and reliable.

9. Government views and the future of the Industry

In common with uncertainties surrounding the private sector, it is apparent from the voluminous, often one way, correspondence of the syndicate with the government and individual statesmen, the future role of the modern sector has been uncertain. Government for various reasons has never cleared this uncertainty. ' The problem is that as yet no single line has been defined for the economic policies. The most important question in the Iranian economy is that of investment guarantees and boundaries.'[53] The contractors have always been waiting for a public announcement of government views on the future of the industry.

In a television interview with the representatives of the PBO and the Tehran Syndicate of Contractors, the problems of development projects were discussed, specifically with relation to contractors. This interview was important not only because most contributors were the government representatives, but the fact that it was on television. It was the first time since the revolution that syndicate representatives had been invited for a television interview. This usually means a public announcement. Various issues regarding development projects and the importance of the CI as well as the role of contractors were also discussed.

On the important issues of contractual arrangements Mr. Haj Saied Djavadi of the PBO conceded that:

> 'The PBO saw that it was necessary to modify the contents and terms of contract so as to ensure that the risks and responsibilities were appropriately divided between the employer and contractor. It was agreed that the Construction contracts should provide for an equitable settlement of disputes between the two sides'.

It is particularly important to understand that in a turbulent and difficult economic situation disputes are more likely to happen and it is important that the contract provides for rapid and just settlements of them. Mr. Haj Sayyed Djavadi went on to say that:

> 'A crucial part of the contract which has caused many bankruptcies deals with

conditions for the termination of the contracts. He again conceded that this section must undergo a serious correction and change'.

The interviewer argued that it was important for the country that development projects are completed within the contract period. Most of the projects face long delays he said, and sometimes exceed the time allocated several times over. He urged the panel to develop a method for identifying which element amongst those involved in the construction process (i.e. PBO, project executors, consultants, contractors, and other factors like materials, machinery, capital, and banking system) was responsible for delays in contract completion.

One of his respondents believed that materials and machinery were the most important factor. If in the planning process, this factor was considered and tackled properly other factors and problems would be easier to resolve and overcome. Another contributor believed that although machinery and materials are vital, projects need all the elements present and functioning properly like an orchestra. Even if every factor is provided but the *Mojri-e Tarh* does not fulfil his duties as client, all materials and machinery will be wasted and made redundant. Or if the contractor does not have access to enough money for every - day site expenses the whole project will also come to a standstill. If the rules and regulations governing the contract are inadequate or very bureaucratic and confusing, materials and machinery will again remain idle. It is clear that it only needs one element out of key to disrupt the harmony of the whole process.

In the same interview another participant stated his belief that the most important factor is the contractor himself. If the entrepreneur does not have the managerial skills, is not dedicated enough or is simply a charlatan, then facilities will not be used properly, or worse still, will be used for the wrong ends. He concluded by arguing that if one wants to put these factors in a sequence according to their importance it would be as follows.

1. The contractor must be competent and devout.
2. The client organisations must have competent managers.
3. Materials and machinery must be available.
4. Contractors must have access to enough funds.
5. Contract rules and regulations must be appropriate and responsive.

The same questions were addressed by Mr. Lajwardi, one of the PBO representatives, from the planning and budgeting point of view. He explained the way that available funds

were distributed to projects without considering the problem of accurate estimates and careful budgeting. He went on to say that the PBO usually distributed a certain amount of its available budget to all the projects. Each project gets only a fraction of what it really needs. For instance if a project needs 100 million rials for completion in the financial year they can only allocate one million. The important point is that this does not mean that a tenth of the job can be done in that period. It in fact disturbs the whole management of the project and, as a result, a considerable amount of resources is wasted.

The interviewer concluded the session in the following words :

> "A contracting system exists. Within that system the PBO sets the rules and regulations and supervises their execution. The PO is related on the one hand to government budgets and, on the other, to development projects and contractors. One view is that the problems in the existing system can be solved and once the problems of material, machinery, rules and regulations and so on are solved the system will be adequate, reliable and efficient. The whole discussion argued for this view."

He went on to say that, 'There is another view, which says that we have inherited this system from the former regime and it must be totally revolutionised'. The commentator did not give any explanation as to how this might be done, and postponed it for another occasion. This view though was strongly held by the revolutionary government for a number of years after 1979.

As a sample of the dominant view during those post-revolution days an interview by the Council of Contractors of Fars [54] on March 1982 with the director of the PBO office in Fars Province is very interesting. In answering a question as to the role and the share of the private sector in future development projects in the region he stated:

> 'The budget directive recommends and encourages the `direct administration method' [55] (and not the contractor[56]) but the fact that the capacity of the government organisations are limited cannot be ignored, and those contractors who want to work under the principles of the Islamic Republic, will be put to work. On the other hand government projects can be only a part of the contractors occupation, contractors however can have a role in serving the private sector in certain types of jobs.

In the whole interview there was nothing to alter the view that the government is determined to introduce more and more state involvement and the role of contractors is

to be gradually reduced. The same worrying trend is reflected in the lengthy correspondence and numerous interviews conducted with government authorities, mainly by the Tehran Syndicate of Contractors and other professional bodies in various regions in the country.[57]

Two months later, in May 1982, the Tehran Syndicate, raised the question of state involvement in a letter to the Chairman of the Parliament, Mr. Rafsanjani as follows:

> '. . . Your excellency Mr. Rafsanjani, We too showed that we are attached to the glorious revolution of our people by resuming our works immediately after the settlement of the Islamic Republic and have been working in harsh conditions since those very early days. We have repeatedly announced to the PBO that if to work as a contractor is against Islamic principles (although in Act 44 of the Islamic Republic constitution all three sectors: government; co-operative; and private are approved) we are ready to hand over all our tools and machinery to the government. The government can then end contracts, freeze our debt to the banks and people and put our expertise as professionals to good use.'

At present, although advocates of the direct administration method are considerably reduced in number, there is a minority group of government executives who advocate direct administration through state owned companies. They believe in minimising the role of private sector contractors in public sector projects.

An important point which has never been addressed in relation to the CI in Iran is the advantages of a 'one client' industry. Jill Wells states: 'In the 'unplanned' or market economies on the other hand (including the vast majority of least developed economies) attempts at standardisation of product and rationalisation of the building process, with one or two notable exceptions, largely resulted in failure'[58]. Here we face an important question which is: How can the anarchy of un-regulated market mode of production be overcome so that the attempts at standardisation of product and rationalisation of the building process can be successfully implemented? We will attempt to answer this question in the light of this research in our final Chapter.

Jill Wells continues to argue that: 'Far from ironing out the peaks and troughs in demand governments, with their 'stop go' policies, have helped to exaggerate them. The resulting discontinuity of production is exaggerated even further by the fact that demand is fragmented among a myriad of different bodies, or clients, of the CI and seldom are attempts made to co-ordinate or structure that demand in any sort of rational way. The particular industrial structure that has developed in construction under capitalism is

largely a response to this situation'[59]. Given the fact that the modern sector is at present reliant for more than 90 per cent of its work on public sector development projects, this means either the total destruction of this sector, or a massive change actively taking part with the T/C sector in supplying private sector clients.

10. Summary and Conclusion

Structure and organisation of the industry: dependence on the government.
The modern sector started with government projects and developed according to the government's needs. Furthermore this dependence was actually incorporated in the structure and organisation of the modern sector through the enforcement of stricter standards of classification and qualification by the PBO. Table 8:2 shows a summary of the structure and organisation of the modern CI.

This sector has been able to increase its capacity in response to the demands of development projects. For example during the third plan, extending over five years ending March 19,1968, the construction industry became overcrowded. This trend continued to the end of the fifth five year plan during the favourable economic conditions of the 1970s. However, it shrank considerably during the hard times of revolution and war, a painful experience for all those involved in the industry.

The 700 corporate bankruptcies mentioned earlier illustrate the extent of this destruction. During these bleak days for the CI a hope for better days after the war and the great task of reconstruction was the main source of inspiration for those who remained in the industry and managed to keep going. However, the situation started to improve again after war and the much needed post-war reconstruction. The government paid more attention to the problems of the industry and conditions improved enabling it to respond to the demands of the first development projects of the Islamic Republic. The government had to employ foreign contractors again as the ability of local contractors had declined. With the considerable increase in workload and some attention from the government side to the problems of contractors, the working environment became gradually tolerable for contractors and consultants and indeed for the CI as a whole. Since 1993 the industry again has faced drastic cut-backs in its workload.

Table 8:2; summary description of the structure, organisation, and the environment of the modern sector CI.

Factors	Descriptions
Historical development	Emerged With Trans Iranian Railway project 1927, rapid development during 1960s and 1970s.
Key entrepreneurs	Contractor; Consultant. (comprising engineers, architects, technician and a few businessmen.)
Enterprise ownership	Mainly Private enterprise, few public and co-operative currently in transition to private enterprises.
Entrepreneurs/ managers status and reputation in the society	High status, low reputation, particularly big companies associated with corrupt politicians in the former regime
Client	Public; government Ministries administrated by Planning and Budget Organisation
Nature of works	Civil engineering infrastructure and public buildings (100%) Housing (8%)
Workload	Development Planning projects, vulnerable to drastic oil revenue fluctuations; drastic decline in oil revenue and workload.
Project design	Consultant firms (architect - engineer associations), design - built divide
Contract	National standard contract form; 'base price' schedule, price adjustment indices.
Contract Procurement	Lowest bidder through listed contractors according to specialisation and other regulations.
Supervision and quality control	Site supervisor also acting as quantity surveyor appointed by the consultant
Technology	International/ conventional; general tendency towards equipment intensive methods; dependency on building trades supplied by traditional/ conventional sector.
Choice of Technology	By the consultant firms considering market conditions; government and international influence.
Education and training	University, polytechnic, intermediate colleges of technology, and vocational schools
Professional institutions	Syndicate of Construction Companies, and Society of Consultants in Tehran; affiliated but independent contractors' syndicates, and Societies of *Mohandesin* in province centres.
Legal status	Formal; organised by the Ministry of Planning and Budget; company structure dictated by grading system

It would appear that for a long time to come the sole client of the industry will continue to be the government, making it extremely vulnerable.

'Governments in the third world do not seem to be sufficiently aware of the importance of the CI and its major role in economic development'.[60] This fact is recognised, if at all, only during those periods of high expenditure on development projects directly related to oil revenue. However there does now appear to be a slight change in attitude and since the end of the war certain government officials have noticed that at least some attention needs to be paid to this sector. Tehran syndicate of contractors tried very hard to raise this awareness, as we have seen from their extensive correspondence. Some government officials finally joined those calling for a rescue of the CI.

Workload problem

Apart from numerous problems facing the construction industry as identified through the views of syndicates of contractors in Tehran and Shiraz. The major problem of the industry appears to be fluctuation of workload in general and a decline in the public spending on development projects in particular. Workload levels affect not only everyone in the construction industry, but the effect is nation-wide. Forecasting CI workload may help the industry to adapt and lessen the fluctuation effect. By preserving the industry the nation can benefit from a healthy and efficient CI. The smaller changes may be easier to foresee, however in Chapter 3 an effort was made to make a long term forecast. The study of 'recent developments and situation in 1994' in that chapter confirmed that forecast: 1970s will not happen again and modern CI needs to lay its foundations on firm grounds.

Syndicates of contractors all over the country should attempt to gather the necessary data in order to be able to foresee and plan ahead. It would also be to the benefit of the government to provide the necessary information and collaborate with the Syndicate in such a scheme. High efficiency in the context of contractors firms means higher productivity for the industry and lower cost of development projects which can lead to higher demand.

The government is aware of the fact that: the modern sector is 90% dependent on development projects. In the former regime the bulk of its energy was directed towards industrialisation policies, but present government's preoccupation is the improvement of the current economic situation. It appears that in both periods the government neglected its most important tool for the implementation of those policies. There has been little

concern about the capacity of the industry or the way that high or low level of workload may affect it. The government should make various effort to reduce the effects of drastic fluctuation, for example by staging development projects .

Statistics show that the traditional/ conventional sector, which depends on private sector clients for its workload, has been less hard hit. This is due to the fact that it relies on the less turbulent demands of the private sector for its workload. The modern sector would be increasingly inclined to share this huge market potential to reduce its dependence on government. There are efforts by the influential contractors and some policy-makers to shift a considerable share of demand in private housing sector from the T/C sector to modern sector by the implementation of 'mass housing' polices. This will damage both T/C sector and housing situation. The modern sector can share the private sector housing demand and contribute to improvement of productivity by investment and involvement in the production of building components. This will be discussed in more detail in the following conclusive Chapter.

11. End notes

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1 For more information on the main functions and activities of the PBO see Razavi H. and VAKIL F. The Political Environment Of Economic Planning In Iran: 1971-1983 :From Monarchy To Islamic Republic, 1984 p39

2Ibid Razavi et al p 39

3 De Wilde John. C., Gates Marvin., Werth Nicholas., Cockburn Charles., A 'Framework For The Development Of Construction Industries In The Developing Countries' 1972 World Bank: Report of a Special IBRD Mission vol. I p21

4 Willis. Arthur J and Willis Christopher J. Practice And Procedure For The Quantity Surveyor. :(first published 1951) 1972. p 103J

5 Wells. Jill. The Construction Industry In Developing Countries: Alternative Strategies for Development 1986 p7

6 Ibid

7 Ibid

8 Stone P.A. . Building Economy, Design, Production and Organisation. 1968 p45

9 Ibid p45

10Raftery John, Principles of Building Economics: An Introduction. 1991 p35

11Cooney E. W. 'Innovation and Contracts in the Post-war British Building Industry' Construction History Vol. 3, 1987 p 115

12 Op cit. Raftery p44

13 Ibid

14Ibid Rafteryp189

15Ibid. Raftery p44

16 '*Aeen Naamehe Tashkhise Salahiate Peymankaran* ' (Contractors Grading Regulations), approved by the committee of ministers; on 30/2/1360 (May 1981) p31

17 Op. Cit. (Iranian) Syndicate of Contractors Monthly Bulletin, Volume 29 Teheran, *Meher 1362*(Oct. 1983) pp 21.22

18 Most consultants until the 1960s were either foreign companies or joint ventures but gradually these companies left the country giving way to newly established Iranian firms, many of them started by former employees or partners of foreign consultants.

19Op. cit. Willis Arthur J et al 1972 p 103

[20] Ibid

21These regulations which are set by the *Daftare Amore Peymankaran* (the Office for Contractors Affairs) or OCA are compulsory and all contractors who want to be recognised and therefore invited to bid and later to sign contracts, must comply with them.

22 (Iranian) Syndicate of the Contractors, Monthly Bulletin, Vol. 29, Teheran *Meher 1362*(Oct. 1983) pp 21-22

23Op. cit. De Wilde et al 1972 Vol. I p81

24 *Zihesabi* is an office within the MPB, with its regional offices all over the country, in charge of overall finance control. Contractors would need to authorise their cheques which are already signed by Mojri-e Tarh, by *Zihesabi*.

25 Ghanbari Parsa Alireza 'The Interaction of Planning Policies and Construction Technologies In Iran' PhD dissertation,: Department of Town and City Planning : University of Newcastle Upon Tyne. 1989 p125

26 Ibid Ghanbari p 125

27 These rules and regulations which were inherited from the former regime, are widely believed to be one sided and give tremendous authority and power to government officials so as to enable them blackmail the contractors.

28 The author helped to establish the Council of the Contractors in Fars province and was later elected as the chairman

29 The Construction Industry 1984 The International Bank for Reconstruction and Development/ The World Bank

30 Charles Cockburn; Construction: A management problem; The Architects' Journal 15 October 1969 pp 930-931.

31 Bulletin of the contractors Syndicate Teheran: Letter to Mr. Rafsanjani, Chairman of the Islamic parliament. Ref.: 454/125206 dated: 22/3/1361 p4 of the *Khordad* issue(June 1982)

32 Bulletin of the contractors Syndicate Teheran: Letter to Mr. Rafsanjani, Chairman of the Islamic parliament. Ref.: 454/125206 dated: 22/3/1361 p4 of the *Khordad* issue(June 1982)
Letter to Mr. Rafsanjani

33 Bulletin of the contractors Syndicate Teheran: Letter to the prime minister Mr. Mir Hossein Mousavi dated: 22/3/1361 p7 of the *Khordad* issue(June 1982)

34 Bulletin of the contractors Syndicate Teheran: Esfand 1361 (March 1983)

35 Khansari Djavad: The chairman of the Syndicate of Construction Companies. Teheran. He was interviewed in the Syndicate office in Teheran on 15 Feb. 1992

36 Since 1981 the distribution of steel and cement. and in some periods also other materials like facing bricks and glazed tiles. has been distributed under the government control.

37 This is also an explicit notion of widespread corruption as a result of the hard financial situation of

government executives at middle and lower levels.

38 P.A. Stone. Building Economy, Design, Production and Organisation. 1968 pp 125/126

39 Op. cit. Ghanbari p 125 'The construction sector suffered most from the cut back in development spending and the austerity programme in government expenditure. The only major exemption was the construction crusade, which received the equivalent of $2.5 bn for projects in the war zone and development in rural areas, including irrigation and house building schemes.'

40 *Payame Abadgaran* Syndicate's bulletin issue 78 Tehran 1990 p6

41 Op. cit. World Bank 1984 p45

42Op. cit. de Wilde 1972 Vol. I p35

43 Op. cit. World Bank 1984.p45

44 De Wilde John. C. et al, 1972 Vol. I p211

45 Luder Owen 'Workload levels affect everyone in the construction industry.'; *Building* (magazine printed in UK). 1988 p30

46 Edmonds G. A., and Miles D. W. J., Foundations for Change: Aspects of the construction industry in developing countries, 1984, p 118

47Chaldecott Nigel 'Construction Workload 1989/1990' Paper presented to RIBA & *Building* seminar held in The RIBA, 66 Portland Place, London W1N 4AD Thursday 1st Dec. 1988

48 Op. cit. RIBA & *Building* 1st Dec. 1988

49 Op. cit. Chaldecott Nigel 1988

50 Mr. Khansari Javad., addressing the annual general meeting of the members of Teheran syndicate 1991

51 Dewide John. C. et al, 1972 vol. III appendix 2 p11-13.

52 Khansari Javad., addressing the annual general meeting of the members of Teheran syndicate 1991

53 Naraghi Ehsan Dr. Advisor to the UNESCO ' interview with the author of 'From Shah's Palace to Evin Prison.' Kayhan International Feb. 24 1994.

54 The Bulletin of the Council of Contractors of Fars. *Esfand 1361*= March. 1982 pp 12-16. The interview was held in Feb. 1982 by the author who was chairman of the Council of Contractors of Fars (the Fars Syndicate of contractors). The aim of the interview was an assessment of the volume of development projects in the coming year (Iranian New Year starts on about 20th of March).and partly a response to the worries of members about the future of their business as contractors.

55 In this method the client (one of the government ministries) acts as its own contractor.

56 The sentence in brackets is added by the author.

57 The author found the following interviews and correspondence addressing the role of private sector contractors. In the following list the dates are given according to the Iranian calendar which starts around 21st of March with a difference of about 621 years; for instance 1st of Farvardin 1370 corresponds to 21st March 1991.
22/3/1361 (12/5/1982)

58 Op. cit. Wells Jill

59 Ibid

60 Op. cit. World Bank 1984

CHAPTER 9
Conclusions and recommendations.

1. Introduction

Chapter 9 is a re-examination of the major arguments and hypotheses which developed in the course of the study.The major arguments were: 1)There is a general but false assumption that the *memars* sector is 'unorganised' and inadequate; 2) There is little or no up to date assessment of the importance and potentials of different sectors of the industry and their role in housing and economic development; 3) The oil income, in the context of development projects providing workload for the modern sector, is in continuous decline; 4) The modern sector is increasingly looking to housing demand, which has been traditionally supplied by the T/ C sector, to increase its workload through influencing the authorities to adopt 'mass housing' policies. This will eventually damage the T/ C sector and the housing situation will deteriorate. 5) There is already a widening gap between supply and demand in the housing market; 6) In this situation the industrialisation of building has become the goal while other less capital intensive ways of increasing productivity are ignored.

The hypotheses were:

Hypothesis 1: There is a two tier building industry in Iran: the traditional/ conventional and the modern sector, with a rather weak relationship between them. Implication of this hypothesis suggests that the lack of recognition of this unique structure and particularly the importance of traditional/ conventional sector and its crucial role in housing may result in inappropriate decisions for 'building industrialisation', or 'mass housing'. Both sectors have their role to play, and it is for the benefit of both sectors to maintain a better relationship, to help one another's development, instead of damaging one for the benefit of the other.

Hypothesis 2 One of the appropriate ways to increase productivity of the building industry in Iran is rationalisation of design and process of building with a gradual introduction of **light- weight, loose fit, low technology components (LLLC). This idea of 'componentisation'** may have a role to play : in improvement of overall productivity in both T/ C and CI sectors of the building industry; help in solving problems of both sectors and maintain necessary link between them; and increase

housing supply.

The study while covering all the above issues, has emphasised, firstly, that the role of the T/ C sector in housing supply is as a 'valuable' organisation that must be preserved and enhanced. This does not mean one should ignore the important role of the modern sector in providing the infrastructure for economic development, but that there is a symbiotic coexistence of these two 'dissimilar' sectors which are inestimable resources the country cannot afford to waste. Secondly, the focus of this study is on the potential role of the LLLC componentisation, not only as an aspect of rationalisation but to provide a means for intimate association of the two sectors to share the increasing national housing workload.

There are strong links and considerable overlap between all these arguments, therefore separate examinations of them would have involved a considerable degree of repetition and would in the authors judgement have prevented consideration of those issues in their interelatedness. The approach therefore is a recapitulation of the issues concerning the raising of the efficiency of the T/ C sector to a complimentary level to the modern sector. The focus is on the upgrading of the indigenous Iranian construction industry in its socio-economic environment.

It is also tried to draw together the aims set out in the initial synopsis namely to: 1) Study the nature and organisation of the construction industry in Iran, identifying the specific problems affecting its sustainable development. 2) To study the different ways open to the industry to increase its productivity; 3) To examine the potential for the increasing use of standardisation and production of building components; and finally 4) To assess the feasibility of these concepts in the increasing climate of a market economy.

In this Chapter specific recommendations have been made or courses of action in problem solving and improvement of the situation in the T/ C sector, the modern sector, and their links, through the development of the building component industry. The final Section is on the acknowledged limitations of the present study and the areas for further research towards implementation of these notions.

2. Nature and organisation of the construction industry in Iran.

Initially the social, political, and economical environment in which the industry developed and is currently operating will be examined with due consideration of its deep cultural roots. For this purpose the study adopted a historical perspective leading to a more detailed study of the traditional/ conventional sector. In addition the developments in the modern sector of the construction industry were examined. Comparing the role, potential, and problems of both sectors, as well as a study of existing overlaps and links between the two sectors of what this study considered as a 'two tier industry'.

2.1. The political, social, and economic environment: a historical perspective; traditional values and modernisation.

The study of the dynamics of development in the organisation of the building industry and its future trends involved due consideration of deep cultural roots, as well as changes in the social, cultural, political, and economic environment. The focus was an examination of the historical **'background'** of traditional building activities; the **'departure'** from those traditions and the emergence of the modern sector; **'recognition'** and appreciation of the merits and values of traditional building; and possible paths for its **'re-orientation'** in present circumstances.

A) Background: Iranian architecture and building technology developed gradually through stages of trial and error to become thoroughly harmonised with the environment and the people's way of life. It is impossible to over-emphasise the significant role played by construction throughout the history, due in part to the severe physical environment of the country and the peoples' efforts to survive and prosper. The *memars* as the captains of this long process, have contributed to and enhanced the art of building over hundreds of years through various techniques and design innovations for all aspects of the built environment. Iranian architecture and engineering was based on survival through popular principles; self sufficiency, climate mitigation, standard measurement and local materials.

Despite growing contact with Europe, during the Qajar period, the *Memar*s 'system' continued to develop along its traditional path. It was not till the Pahlavis that significant changes introduced. Nevertheless the previous Qajar period created an atmosphere of resentment towards those cultural traditions. The cultural stagnation and political corruption of this period prepared the path for a greater introduction of 'Western methods'.

B) The departure: In the pseudo-modernist atmosphere of Pahlavi's era a small but growing group of 'Europeanisers', with little understanding of European developments, begun to prosper, grow in numbers, and become influential in all aspects of life. These 'pseudo-modernists' were alienated from their culture and history, both in intellectual ideas and in social aspirations. Industrialisation was viewed not as a means but as an end, and modern technology, was seen as omnipotent, solving through the simple act of importation, any and all of the socio-economic needs.

Despite the potential benefits of huge oil revenues, the Pahlavis failed to develop national autonomy and despite its bureaucratic largesse, in effect relinquished control of industrial development to the determinations of the world oil market. To plan properly it needs to be recognised that imported bureaucratic centralism - the essence of oil despotism - can only be damaging to the development of a socially useful and integrated industrial network. To attempt to industrialise by decree, to implant technology, can only lead to an alienation of industry from the culture and environment which ought to be nourishing them. The modern construction industry, having a significant role in the economics of the despotic regime, was particularly shaped according to that distorted structure.

In reaction to this so called pseudo-modernism, an antithesis has been formulated towards a rediscovery of the traditions. This growingly accepted corrective has substantially developed within the past twenty years. There is nothing in itself wrong with the idea of openness and progress, both in the intellectual and the material sphere of life, if it is not accompanied by an indiscriminate disrespect for the traditions of the past. The centrally located courtyard for example, is perhaps the most recognisable feature of the traditional house. Its development is the result of climate, available materials and centuries old cultural factors. The introduction of the automobile coincided with the pseudo-modernist era (1925-1979), and resulted in the demolition of much of the traditional urban fabric and the adoption of Western style city planning, which in turn has affected the traditional residential architecture.

Apart from the obvious influences of the mass media on ordinary people the main Western influence on Iranian architecture has been through the new generation of 'western-style' professionals. Architectural schooling in Iran no less than other disciplines, has been dominated by Western values, relationships and patterns, and in addition, has failed to become an integral part of present day building industry. Today there is a great failure on the part of the practitioners of modern architecture to

understand traditional architecture, its methods and practices.

C) Recognition and appreciation: However certain aspects of the traditional architecture, although neglected to a great extent, have never been totally abandoned. This influence appears both in the 'product' and the 'process'. The existence of a large centrally located 'hall' with an skylight or an adjacent patio in the majority of modern house plans may be taken as evidence of the former. And, the still active *memar*s system, as evidence of the latter. The still significant role of the *memar* on site, and in apprenticeship training is a precious heritage and evidence of their continuing influence. Despite the disregard for this resource on the part of government and the unquestioning adoption of a pseudo-Western structure for the development of the modern construction industry, the *memar*s live on with their traditional organisation of production. It should be recognised that *memar*s used to understand their clients needs almost intuitively. Their practices were codified by tradition and the *memar*s needed only to follow those customs.

In this context, there are five main traditional principles for architectural design and two for city planning. One of these principles is *Khod Basandegi*; which means self sufficiency. **In practice it meant the maximum use of existing facilities from *Boom-avard*** (grown in, or bringing out of the local habitat) **components, that are locally produced from the local materials with a high degree of productivity.**

Through generations of experience, *memar*s still intuitively understand their clients needs, and as the questionnaire survey showed, they share the same views in the choice or rejection of building components. In many cases they are still preferred to modern professionals by private clients when it comes to the single unit, owner-built housing. Significant disagreement between experts and users have been demonstrated in several studies of residential environments elsewhere. A study of 'mass housing' apartment block projects for instance in post-war UK, suggests that there is much evidence to establish links between aspects of social malaise - from litter and vandalism to family break up - due to the design and layout of high rise public housing estates.

Perhaps the most important feature of the order of precedence within traditional building is **'Land > people> works'**[1], rather than the more **authoritarian Land> works> people.** The `natural' process of housing in the country has involved the traditional /conventional building industry in close collaboration and harmony with the people, in a process of: **People >land >*memar*> works. Any effort by decision makers to disturb**

or undermine this system will have serious consequences and must be avoided. We must not allow these new forms of 'mass housing' that have affected European family life to become the problem in the future.

D) Re-Orientation, and Present Conditions: There is a growing lobby of enlightened architects and planners who appreciate the values of traditional (national) architecture, deplore the break in continuity and who are seeking ways of re-linking with traditional and conventional architecture and their corresponding building methods and techniques.

'Dead history revives and past history again becomes present, as the necessity for life demands them'[2] It was explained that how 'Europeanisers' created an atmosphere of 'pseudo-modernism' as the 'philosophy' behind destructive anti-cultural policies. **'Royal Despotism', Pseudo-Modernism',** and the **Oil Economy'** were identified as the main pillars of the Shah's Regime. The Islamic Revolution put an end to Royal Despotism and the 'Pseudo-Modernism' era, while the place of oil revenue in the economy has changed due to drastic changes in the world oil market. The eight years of the imposed Iran-Iraq War was yet another major factor of social and economic change.

There are many groups of conscious intellectuals in non-western countries who strongly argue that the adoption of Western architecture has resulted in the development of a built environment inappropriate to their cultural and environmental conditions. Careful study and active publicity of the merits and values of vernacular architecture, are the first steps in building up confidence in a successful process of 're-orientation' of the building activities. This must not however result in nostalgia and a non-pragmatic attitude of simply trying to impose **'indigenous'** architecture. Rather should be an effort to **enable** 'a traditional construction industry' to grow again from within - the word is **endogenous**. The author have reached the inevitable position that the study of traditional architecture must include not only the **product** but also the **process**. It is important to preserve the traditional/ conventional building industry if the cultural values, in the sphere of the built environment are to be preserved.

The Islamic Republic should provide a balanced social, economic, and cultural environment to get the best of all worlds as, to some extent, the Japanese have. If the Islamic government is truly based on the sound foundations of **Islam, Iranianism,** and **modernism,** then **historical, religious,** and **cultural** issues will be central to the future development. The study has tried to show that the oil revenue is neither reliable nor sufficient. Iran's earnings from oil are roughly half what they were in 1979, yet the

population has risen by two thirds. First of all this means that government will be increasingly dependant on the tax payers' money, in contrast with the Shah's regime, and this implies greater interaction and a closer and at the same time freer relationship between the public (tax payer) and the government. Thus, **Iranianism** (in the Islamic regime) should replace **oil revenue** (in the context of former regime) and this should be interpreted as **'seeking public support'**. This implies that the Islamic Republic needs the public's active support to **invest, work hard, produce, and pay taxes. This above all will help to turn the wheels of the economy again.**

The **'re-orientation'** phase is dependant on a successful process of understanding and the recognition of the historical, cultural, and practical merits of traditional values. In this study efforts have been made to show some of the merits of traditional architecture and building process. However the country will continue to be affected by fluctuating world relationships. The notion of 'The New World Order' does not look promising for us. This implies that greater self reliance in economic and technological terms transcends the external factors to take in our social and geo-political situation.

But despite the prevailing economic problems, there remains much to be optimistic about. The abolition of despotism can be considered as a firm base for a period of national responsibility, hard work and achievement. In this process our cultural and historical strengths would certainly help as they have in the past, to overcome fractious problems. The traditional/ conventional building industry is one of those strengths; it must be appreciated, conserved and promoted.

2.2. The importance and potential of the traditional/ conventional sector

The importance: The traditional/ conventional sector still accounts for about 92 percent of residential building. Both sectors of the industry are dependant upon the *memar*-supervised apprenticeship system; they also indispensable construction managers. They understand of the local 'human factor', and thus can achieve higher labour productivity. Western style management methods take little or not account of cultural factor in man management. Although this may now be changing, with increasingly competitive production process world-wide, the strong point, in the much admired Japanese construction industry, is still said to be the role of 'human relations' in its management.

There is contradictory evidence concerning the traditional apprenticeship system. For

example, the bricklaying practice results in lower building life and thus lower overall productivity. Vocational education has so far not been successful in improving the productivity among bricklayers, plasterers, and the other skilled building workers. Certainly, the various building craftsmen and artisans associated with the building industry do not have the prestige they had in the past, and are too often regarded as inferior to 'white- collar' workers. Thus working on the building site is for those who cannot afford formal education; they hope to upgrade to the position of *memar*.

Apprenticeship is considered the most economical method of training; It is certainly economical for the government who do not spend one rial on it. In present circumstances there is no question of replacing apprenticeship with formal education but it gives ammunition for the greater employment of industrialised building systems. Successful experience and close collaboration between the Society of Architects and Engineers of Fars and the Union of *Memar*s in arranging educational evening sessions leads the author to believe that a change of attitude and policy is what is wanted.

More literate apprentices must be recruited. Literate *memar*s obviously have a better chance to upgrade their knowledge through special training schemes, and to inform themselves of new techniques. This depends on an increase in literacy, particularly in rural areas.

The potential: Some professionals argue that bygones should be bygones and that new methods and technologies require new organisation and management. However, there is no contradiction between the traditional/ conventional building industry and improving building technology. On this point much evidence from the studies of Peter Stone have been cited. He has argued for the retention and development of traditional building: **Thus development can be assured by the introduction of prefabricated components** and standardisation of measurement. The introduction and adoption of more than 20 such components by the T/ C sector is evidence to this.

Despite the merits of this so-called 'informal' sector and its genuine role in the overall economy, much concern is increasingly shown by development economists concerning the general neglect of this important sector. Despite lofty statements by politicians to the contrary, conventional wisdom suggests that the state in the world has never been the expression of the people. An ever increasing number of rules and regulations are initiated and tailored by the body of 'formals' and they never consult the body of society i.e. the 'informals'. Government authorities are not interested in the 'informal' sector because they

cannot tax it, manage or control it. There is nothing in the 'informal' sector for the benefit of 'formals', so they are quite happy to see it damaged and go out of existence.

The field survey showed a drastic decline of the share of *memar*s in architectural design in Shiraz; replaced by architects and engineers. This is mainly caused by the as a result of *Ghanoon-e Nezam-e Memari va Sakthemani* (the Architecture and Construction Order Act.) when building design is exclusive to architects and engineers. The result is houses with split levels in plan, set backs in the facade, too much circulation, larger spans and deeper cantilevered balconies are all signs of professional architect's hand. Most of these features are expensive to build. It is worth noting that *memar*'s designs were simpler and cheaper to build.

In Jan. 1989, Shiraz Municipality implemented the Act when not only restricted *memar*s in the sphere of design but also in management. Further evidence of this neglect was shown when a Commission was set up to supervise and inspect the implementation of building regulations and quality control. A representative of the *Memars* was not invited on to this commission; the Architecture and Construction Order Act has clearly ignored the *memar*s role as a whole. It is true that the T/ C Sector has some problems particularly with concrete technology, but there are solutions to this. Condemnation of the only available building system, in circumstances where there are few affordable alternatives does not help.

All parts of the country are located on earthquake prone zones of the Alpine seismic belt. Earthquakes are a serious concern for the builders; the choice of forms, methods and materials have always been influenced by this factor. Modern masonry building which uses different materials and components, such as timber, steel, and concrete does not have the same monolithic characteristics of traditional building interwoven as it is with the traditional urban fabric, and are in some respects less secure.

The I beam and jack arch method have a much better record when the earthquake building code is used. No government Ministry, organisation or professional body has ever seen the heed to upgrade and support such a vital service as is provided by the T/ C sector; they did not bother to give the necessary education and advice about these codes and simple details to *memars*.

The attitude of engineers and architects towards *memar*s is commonly associated with disregard and arrogance. This arrogant attitude of the professionals is reflected at all

levels of the government executive and policy making institutions. They do not attempt to inform themselves concerning the work and skills of the *memar*s, thinking only of their own role in competition with them.

2.3. The importance, potentials, and problems of the modern CI.

The modern CI emerged and developed with the supply of government civil engineering projects and according to the government's needs. Furthermore this dependence is incorporated in the structure and organisation of the sector through the enforcement of strict standards of classification. The capacity of the industry in terms of volume of work and its capability in undertaking a variety of specialised jobs has always increased rapidly during favourable economic conditions, for example during 1970s. However, the modern sector shrank considerably, both in terms of specialisation and capacity, during the hard times of the recent revolution and war. The 700 corporate bankruptcies[3] illustrates the extent of its career destruction and the hope for better days after the war with the great task of reconstruction was the main source of inspiration. However, the working environment gradually became tolerable for contractors and consultants until 1993, when again they faced drastic cut-backs in workload, caused by the decline in the oil revenue.

There is a total disregard in the socio-political environment that is associated with hostility and negligence. This situation obviously damages the development and the efficiency of the industry. It is widely acknowledged that although the modern sector has been the main tool of implementation of development policies and has had a great role in the 'oil-development economic structure' of the country, **the government has never had a policy for the development of the construction industry itself.** Further evidence of this negligence were demonstrated in this study through the extensive correspondence of professional bodies, particularly the Tehran Syndicate of Contractors.

One could argue that the government's attitude has been as a consequence of the Iran Iraq war situation, but that can only be seen as a part of the problem It was demonstrated that, six years after the war resolution the situation is worse. In fact the government itself is very much reliant on oil revenue, not only for its development projects, but also for running the day to day economy. It was made clear that how unstable unreliable and increasingly insufficient the oil revenue is.

Statistics show that the demand for private housing has been less turbulent and in fact

fairly reliable. This has created increasing pressure from the modern sector for a share of the private sector's demand. In the past the modern sector has been reluctant to undertake private sector housing. This has been mainly as a result of an essentially single unit owner-built housing situation. Thus the scale is not economic for the modern sector contractors. There are efforts by the influential contractors and some policy-makers to shift a considerable share of demand from the T/ C sector to the modern sector by the implementation of 'mass housing' polices. This will damage both the T/ C sector and the housing situation.

In the former regime government policy was towards industrialisation, but the present government's preoccupation is with the improvement of the current economic situation. It appears that in both regimes the government planners have neglected one of the most important tools for the implementation of their policies; the construction industry. There has been little concern about the capacity of the industry or the way that high or low levels of workload may affect its productivity. The government should make more effort to understand the nature of the industry and to reduce the effects of drastic fluctuations in demand. For example development projects must be phased; programming workload levels and informing contractors must be considered. This may alleviate the damage caused by drastic fluctuations.

2.4. Major differences, overlaps and interaction between the two sectors

According to The World Bank [4], the structure of the building industry is shaped by three main factors: 1) nature of the work to be done; 2) the choice of technology; 3) social and economic environment. The study has shown that these factors, on top of direct government influence concerning the company structure in the modern sector, make the two sectors profoundly different in character. Although operating in similar environments and linked in many ways, particularly through the modern sector's dependence on the conventional sector for its recruitment of skilled labour; these two sectors are distinct in a number of aspects. They are so distinct it would be fair to conclude that: there is a two tier building industry operating in the country with distinct characteristics organisations and roles. See Table 9: 1

In the treatment of the traditional/ conventional sector the links, or possible future links, as well as the overlaps with the modern sector were pointed out. Their overlap in terms of their involvement in private sector building activities were examined. The major findings of the survey in relation to the role and involvement of modern professionals in the T/ C sector are as follows:

- That architectural design is not exclusively the architects' domain, but is mainly shared with the engineers. This is partly due to the low proportion of the number of architects. Architects are mainly based in Tehran and involved in the modern sector, designing development projects. In smaller cities their involvement in the private sector is with the upper strata of the society and richer clients.

- In addition to their involvement in the modern sector as contractors, engineers are considerably involved in architectural design in the T/ C sector. They are also involved in the building materials and component manufacturing industry. This is probably due to the fact that engineers tend to be better equipped with the technical knowledge needed in this field and partly because they are more active in executive and management occupations.

- The share of *memar*s in design is diminishing. There is a shift from *haghol amal kari*, once almost the dominant type of working arrangement with the client, to a less traditional method of labour-only contract. 93.3% of *memar*s were involved in the building of single private housing unit. Their involvement in commercial buildings is not great. It is fair to conclude here that **the existence of *memar*s system is very much relied upon the above mentioned market**.

Although the two sectors are separate in many ways; the survey shows that there is a considerable overlap between the two sectors; almost 51% engineers; 63% of architects; 60% of service engineers; and 70% of technicians. This has further increases as a result of the implementation of *Ghanoon-e Nezam-e Memari va Sakthemani* (The Law of Architecture and Construction Order). This may also be taken as partial evidence of the fact that the political pressure behind so called 'mass housing', high-rise development does not come from professionals seeking employment, but from the large contractors.

Table 9: 1; Major differences between the two tiers of Iranian construction industry: The Modern CI and the T/C sector.

Factor	Modern Sector	Traditional/ Conventional Sector
Historical development	Emerged With Trans Iranian Railway project. 1927	Deep rooted (early significant example of work Persepolis 500 BC.
Key entrepreneurs	Contractor; Consultant. (comprising engineers, architects, technician and a few businessmen.)	*Mehraz, later Memar* (master builders)
Enterprise ownership	Mainly Private enterprise, few public and co-operative currently in transition to private enterprises.	Private
Entrepreneurs/ managers status/ reputation in the society	High status, low reputation, particularly big companies associated with corrupt politicians in the former regime	Medium status, although they do not enjoy the high reputation of the past, still trusted by the public and preferred to modern sector contractors.
Client	Public; government Ministries administrated by Ministry of Planning and Budget.	Private (owner-builder); Private enterprises.
Nature of works	Civil engineering & public buildings(100%) Housing (8%)	Residential and commercial buildings (92%); Mosques & religious buildings.
Demand, Workload dependency	Vulnerable to drastic Oil revenue fluctuations; drastic decline.	Overall economic condition. more stable than the modern sector.
Project design	Consultants (architect - engineer associations)	*Memar* and client; (architects, and engineers)
Contract	National standard contract form; 'base price' schedule	*Haghol amal*(cost plus) labour only' contract
Contract Procurement	Lowest bidder through listed contractors according to specialisation and other regulations.	Client's choice, negotiation, relative's recommendations/ compromise
Supervision and quality control	Site supervisor appointed by consultant	By the client, *memar* and *Mohandess*, municipality
Technology	International/ conventional; general tendency towards equipment intensive methods; dependency to building trades supplied by traditional/ conventional sector.	Traditional/ conventional; labour intensive traditional methods; a tendency to use power tools and small machinery (concrete mixer and electric hoist.)
Choice of Technology	Consultant; market conditions, government and international influence;	*Memar* and client; market conditions, ; and to some extent municipality regulations;.
Education & training	University, polytechnic, intermediate colleges of technology, and vocational schools	Traditional apprenticeship
Professional associations	Syndicate of Construction Companies, and Society of Consultants in Tehran; affiliated but independent contractors' syndicates, and Societies of *Mohandesin* in provincial centres.	Emerging *memar*s unions.
Legal status	Formal; organised by the Planning and Budget Organisation; company structure dictated by grading system	Conventional; recently affected by *Ghanoon-e Nezam-e Memari va Sakthemani* (The Law of Architecture and Construction Order)

2.5. Resource management and productivity.

Concerning greater Affordability, the discussion has led to the importance of resource management, and its link to improved 'productivity'. The concept of 'Productivity', and its relationship with social, economic, and environmental aspects, and thus to a more sustainable form of development was examined. The conventional wisdom attributes the achievements of productivity in the West to scientific and technological advancements. It was argued that 'technology' itself is a subagent of productivity increases. Though we are fascinated by the role of technology, the other ways and means of increasing productivity are neglected, but technology is something that is imported and not developed from within the society. We do not possess it; it possesses us.

Productivity awareness is usually created in times of hardship and serious shortages; after the Second World War and more recently in Iran. The statement by Nategh Noori (*Hojj*), the Speaker of the Parliament has said: '**The country's revenues should be raised through boosting productivity** and exports and improving the quality of domestically made commodities to deter any problems arising from fluctuations in the price of oil '[5]

It is commonly claimed that economic development aims to raise living standards by increasing the production of food, shelter and other commodities. On the one hand, with the consequent increase in the people's income this in turn makes these products affordable. Some development economists clearly show that low real incomes are a reflection of low productivity, that low levels of productivity are self - reinforcing social and economic phenomena in Third World countries and, as such, are the principal manifestations of and contributors to their underdevelopment.

In the West, the most disputed issue in relation to productivity increases have been the negative effect on employment. It is believed that as demand rises in most developing countries, then the improvement in productivity would not necessarily lead to more unemployment, but in-fact for a considerable period of time to the very opposite. It is argued that if higher productivity is translated into lower costs and lower prices in a competitive market, demand will grow as well as profits and industry will be strengthened as efficiency increases. More demand in turn creates new job opportunities.

Environmental imbalance is no respecter of national boundaries. Perhaps the increasing awareness of the fragility of Mother Nature can teach us a lesson. There are many

divisions in the modern world: cultural, religious, ideological. The environment transcends these boundaries and sets us the problem of how to foster understanding of the mutual interconnectedness. While most environmental problems have a global dimension, solutions invariably lie at national, local and even individual level. Environmental protection must be integrated into any development planning and/ or course of action to increase productivity in a truly 'One World' view.

Different businesses use different types of productivity agreements to encourage employees to become more highly motivated to perform better. These policies and methods can include: payment by results, bonuses, fringe benefits, flexible working hours, elimination of demarcation between different jobs, and methods for the elimination of time wasting. The higher incentives of the private entrepreneur and greater flexibility of the private sector in using these methods can result in better product quality and higher productivity. Considering deficiencies of authoritarian and bureaucratic approaches to public supply in Iran, the author advocate the advantages of the greater efficiency within small and medium scale private enterprises.

On the other side of the argument the main areas for justification of state control are ideological issues such as: better safety, better apprentice training and the employment of disabled persons, and highly unionised labour force. Moreover, public enterprise is often the sole option for those projects that private firms are unwilling to undertake. Projects in high risk war zones for instance, were executed by 'construction *jihad*' during the Iran - Iraq war. At present 40 % of the rural development budget (itself 19% of the total development planning budget) goes to the Ministry of Jihad. It has undoubtedly done a considerable amount of work in the affected rural areas. One cannot deny the political and social importance of the Construction Jihad but nevertheless there are justified criticisms in relation to efficiency and productivity.

The move to a market economy is being attempted by a considerable number of countries including Iran. But is this move on its own enough to encourage people to participate in the growth of their economies and to build the necessary structures for sustainable development and economic growth in the future? The main emphasis should be on human development. It is not enough to simply strike a balance between private and public enterprise, but to create a market which truly serves the needs of the people.

The small firm is now regarded by many economists and governments as offering better prospects than the large firm for increasing productivity and national wealth and at the same time providing employment. The argument has led to the conclusion that the encouragement, help and promotion of small firms is the sole vehicle for the implementation of the 'people friendly' market. Moreover in developing countries small businesses avoid the problems of imported technology. As small businesses usually grow from informal, indigenous industries the case for inappropriate technology would be eliminated.

On the market effects on the modern CI, the study came to the conclusion that 'mass housing policies', implemented to boost demand in the modern sector, will strongly damage the whole existing traditional/ conventional building industry and the delicate small scale *memar* system. However it was argued that by increasing productivity, both sectors can enjoy a higher demand.

3. Factors affecting building productivity; the role of building components.

It was identified that productivity is the end result of a complex social process including: science, research and development, education, technology, management, production facilities, workers and manufacturing organisations. Productivity improvements are now understood to be the result of varying determinants: physical, cultural, and political. This means advances in technology, even if the key issue in some cases, cannot be properly implemented without the necessary changes in social and economic institutions and values. On the workshop floor or building site, increases in productivity depend to a large extent on management and training, which in turn helps the utilisation of knowledge and technological know-how in cutting production costs. The difference between labour productivity in different countries can be attributed to specific reasons such as traditions in design; technology used; structure of the industry, site organisation and working conditions. Productivity improvement can be considered in different levels; national, regional, each sector of the industry, company or production unit, and individual trade.

The importance of management in relation to productivity is a matter of complexity and scale. The more complex the procedure the higher management skill is needed to improve productivity. In other words the more complicated the supply organisation the

more complex the situation of housing would be. **This leads us to the advantage of the simple *memar* system for the problem of housing to be kept simple!**

While the introduction of new technologies in the construction industries of the industrialised nations has been the prime factor in the gains in productivity, the import of those technologies to developing countries has not usually been effective. Copying organisational factors from other countries with obvious historical, social, economic, and cultural differences is more likely to be inappropriate and its disadvantages likely to outweigh any technological benefits which they may bring.

Contrary to the repeated notion of radical technological solutions by some professionals and government authorities, a great contribution to the improvement of productivity can come from improvements in the workmanship and methods of different trades. **The reason for the failure of radical methods may be the absence of a link between local culture and the industry.** Rather than adopt radical solutions, a very small improvement in traditional techniques may have a great effect. A clear example was given in the case of bricklaying and how deficient masonry practices can not only affect the life-time of the building but also necessitates thicker walls, thus reducing productivity at all levels. Improvement of workmanship, for a great part, is related to adequate training.

The shortages of material and uncertainty over the time of delivery currently hampers any planning and management efforts to ensure a smooth flow of work, and minimising non-productive time. Donald Bishop argues that non-productive time varies from almost 80 percent on one site with a broken sequence of tasks, to a few per cent for straight-forward and uninterrupted work.

According to the questionnaire survey the rank of main obstacles affecting management on site in present conditions are: 1) the shortage of materials; 2) an insufficient use of machinery; 3 & 4) labour's performance and discipline; 5) material waste; 6) weather effect.

The respondents clearly showed that the main problem on site is shortage of material and delays in their delivery. This was also one of the main complaints of contractors when considering problems of the industry discussed in Chapter 5. Shortage of building materials and components is not a new problem in Iran. Although Development Plans recognise the importance of the 'key' materials of cement, steel, timber, and ceramics, do

not recognise the importance of a range of other building materials and components. 'Critical shortages of even small components (say even screws) would interfere with construction output, out of all proportion to their value as inputs.'[6]

The importance that the respondents have given to the use of machinery can be attributed to two factors, the first being the managers' common wish, and the second is a 'universal' aspiration for the elimination of hard physical labour. As a result of problems in the use of machinery, particularly in the *memar* system discussed under 'building mechanisation' in Chapter 7, the initiation for the establishment and development of plant hire businesses should be seriously considered.

The issue of labour productivity is reflected in two options. One is the performance which is related to skills and training, while the second is commercial discipline, which is a socio-political, cultural, and to some extent economic question. But although discipline to a certain extent can be improved through training, usually the other factors prevail. Korean contractors' achievements were attributed to their high discipline. In the author's experience before the 1970s and according to the *memar*s, building workers have always maintained a good discipline and a high respect for *memar*s and senior tradesmen. They were proud to state that 'their word was better than a written agreement'. Two main events have affected commercial integrity in recent times; the first being the economic situation of the 1970s (the oil revenue boom), with drastic increases in government expenditure on development projects, resulting in the emergence of many 'cowboy' contractors, and the second was due to the effects of the events after the revolution when anarchic propaganda was put about by irresponsible political groups. However established contractors and their permanent workers showed a higher level of discipline than temporary workers.

The waste of building materials is a common feature of every building site in Iran, particularly with regard to sand, aggregate and bricks. Materials are wasted as a result of inappropriate methods of handling, packaging, storage, and use. A great improvement in productivity could be achieved through improved methods concerning the production and use of materials.

The study reached to the conclusion that mass housing policies not only damage the T/ C sector but also fails to create an acceptable residential environment. From the study, it seems that 'component building' can go some way to raising productivity of the T/ C house building capacity. The trend towards increased component building is also likely to

involve the modern sector in increased production and distribution of components. In fact production development in this area has been practically the domain of the modern sector. This will push the T/ C sector towards more modern building solutions. Society will benefit as a result of higher productivity and cheaper and better housing. See figure 9: 1

The theoretical justification for component building has been best given by Donald Bishop. Pointing out the fact that non-productive time cannot inevitably be avoided he suggests: 'that reducing the number of stages substantially improves 'control' of the system, ... Similarly 'control' is improved by reducing the number of activities contributing to a stage. Finally there is a substantial improvement in 'control' if all resources can be committed at the earliest rather than the latest start time. Taken together these tactics can help to produce higher productivity by creating circumstances in which resources can be committed with confidence. **Their effect is reinforced if the designers adopt 'component' building, a term that does not necessarily imply factory production.** . . . Such a pattern was characteristic of traditional building and well understood by early examples of industrialisation'.[7]

'Clearly, industrialisation of building is an aspect of design, of construction and the organisation of the building industry itself. Perhaps **rationalisation is a better word to describe the application of science to building than is the term industrialisation.**'[8] Rationalisation of building aims at the optimal utilisation of manpower, building materials, and tools and equipment, does not require considerable investment or important changes in the existing structure of the building industry. There is much to be found which is irrational in all aspects of organisation, design, process and construction techniques. For the majority of developing countries the first step for the improvement of productivity would be a consideration of the rationalisation of building industry in the literal sense of the word.

The main contribution to the rationalisation of design must come from the improvement of designs in relation to the process and products of the building industry so that they require less labour, less materials and land, and less capital. Designs should also consider the more efficient use of the building and a longer lifetime. If the designs can accommodate an easier method of construction not only will the productivity of the industry improve but self - build or BIY (Build It Yourself) will begin to revive. To aid this, more effort should be made to develop cheap, serviceable, and easily assembled building materials and components.

Component building requires the development of performance specifications procedures. In the UK components specified in this way have been relatively simple units e.g. windows, door sets, partitions, flat roofing systems. In the last 25 years in the UK, component building has changed from more 'closed' systems to 'open' and versatile 'loose fit'. The opinions expressed by a number of British professionals and academics show developments in component building and its share in the improvement of productivity has been increasing in the last 25 years. This has been gradually reducing the number of operations on site, thus reducing non-productive time. The most important point was to learn the link between 'componentisation' and rationalising traditional ways of building.

If 'componentisation' is properly introduced with the present barriers to its implementation removed and appropriate support provided, then it could result in an appropriate and feasible method of developing the capability of the Iranian building industry. One of the central advantages of this concept is that it would develop strong relations not only between the two sectors but also with other sectors of the national economy. Taking this more conventional path is economically safer, is more adaptable to various levels of technological development, and uses less capital intensive technologies than previous attempts at 'imported industrialisation'.

3.1. The problems of acceptance and the use of building components.

The problem of innovation and the resistance to change is a well documented subject in the post-second World War context in Europe particularly in the UK. It was examined, by analogy, the arguments put forward by Marian Bowley9 and their relevance to the Iranian case along with the ideas of Jill Wells[10] based on her findings in a number of developing countries, here the author have further examined the issue based on his experience, direct observation, and survey findings in the Iranian context.

It is worth noting that there is no research or consensus into the problems of innovation and resistance to the introduction of innovation and launching new products in the context of the Iranian building industry. Why did ready-made doors or concrete wall blocks did not develop in the same way as floor tiles or even more complicated joist-block component/ system? They and other less complicated components have not even been addressed as candidates for introduction to the market. The answers to these questions and a diagnosis of the obstacles can help to remove barriers to the

development of componentisation. The questionnaire survey in this respect was focused on three components in a 'medium' stage of development and one component/ system which recently have developed and proliferated.

56% of the respondents were against the use of prefabricated doorsets. One of the main reasons for reluctance to use these products was uncertainty about its quality and durability. Other factors for reluctance have been lack of standard and the poor quality of primary materials. 75% of the respondents were against the use of concrete blocks for residential buildings. The reasons for their rejection was: Bad quality of available blocks ; Adverse effect on the price of building; Problem of cutting groves for plumbing and wiring conduits; Limit to wall thickness; and block walls' tendency to crack. The limited range of block size was also a major obstacle in their use. %63 of the respondents were against the use of roofing membranes. Although manufacturing companies actually issue a letter of guarantee, still their dedication and attitude were a matter of complain.

It is clear that launching a new building component into the traditional market needs some prerequisites. An examination of a successfully launched product may help to identify some of those prerequisites. Within the last 20 years the Joist-block has become the preferred method. %95.7 of the respondents preferred to use joists and blocks over the older components I beam and brick. They expressed the view that Joist-block is cheaper to use, Stronger, monolithic - and more earthquake resistant, quicker to build with, and have advantages in heat and sound insulation properties. The main reason behind this unanimous acceptance may be the lack of a better alternative. There is a possibility that a developed local building component industry and a revived T/ C sector, inspired from traditional techniques, succeed to develop a better solution.

Pattern of acceptance of Joist-block suggests that in addition to merits and advantages, a new product needs to gain certain credibility. In the case of joist- block it was partly achieved when it was used in government buildings. The product must be introduced properly to gain its credibility. In the T/ C sector where the *karfarma* (work-orderer customer) have considerable influence over the choice of components, the major tasks of marketing is to inform not only the professionals but the 'owner-contractor' that is the public at large.

3.2. Pattern of development of local building components industry.

O'Brien and Turin once stated that 'There is no single pattern of industrial development of the building materials and components sector which would be applicable to all countries. Like many other manufacturing industries, the building materials and components industry is to a large extent dependent on the availability of local resources and conditioned by local traditions.'[11] However, they believe that the impact of local conditions should not be unduly exaggerated as different countries follow similar trends and eventually reach similar stages of building technology. Turin believes that in the majority of developing countries the most likely sequence of industrialisation goes through the industrial production of walling materials, followed by roofing and flooring, providing the essential elements of the building carcass. Finishes and fittings follow with the production of doors, windows and then services starting form pipes and conduits followed by fittings and accessories.

Charles Cockburn once stated: 'Conditions and trends show the way to the future. The joist-block example suggests that developments are 'arbitrary' and 'scattered'- not from the foundations up - but rather where there is the best chance to introduce innovation to meet an expressed need. An 'open' approach.'[12]

The use of new building components has already started without conscious planning. Componentisation would be an 'endogenous' development in harmony with the indigenous building industry if based on an open approach and applicable in the context of the T/ C sector. This would be an appropriate way of increasing productivity in both sectors by rationalisation of design and process of building with a gradual introduction of **light- weight, loose fit, low technology components (LLLC).** In this way it will grow out of the local economy and will generate new opportunities and more permanent and reliable employment. As it grows out of local industries it will develop links with local architecture, and other regional and local characteristics and interests. LLLC will help the further development of the building industry by increasing productivity reducing costs and increasing demand.

The most important outcome could be the re-emergence of the old concept of self built. LLLC must be considered as a versatile concept at a manageable scale. It should also help to promote components made from locally grown timber. The tradition of growing aspen which is reduced as a result of abandonment of 'wooden post and mud' roofing method, this can be revived by the use of treated aspen for all sorts of timber building

components. 'In so far as it involves the greater use of domestic resources to satisfy domestic demand, it would also constitute a vital step in the 'inward - reorientation' of the economy - seen by a number of authors as an essential precondition for raising the level of development of small, dependent, underdeveloped economies'[13].

The development of interdependence between the traditional/ conventional and the modern sector of the industry within the general environmental, social and economic environment will benefit all concerned. See figure 9: F1. The problem of transportation implies that component manufacture should be light weight and regional in its distribution. With component building, regional resources and local professionals; materials manufacturers, designers, contractors, and sub-contractors can all contribute to the productivity of the industry at a local/ regional level.

One may argue that adoption of an open approach suggest that the way ahead is through the old method of trial and error which is a lengthy process, and that there are opportunity costs to consider. Once professor Duccio Turin said that innovation 'demands a conscious attempt to move forward, to progress' and that it should not be 'stultified either by ignorance of the market or credibility gap between the researcher, manufacturer, designer, or user [or by] a social environment in which the products of innovation are restrained for economic, financial, or psychological reasons.'[14]Jill Wells, while pointing to the failure of market economies attempts at standardisation of the product and rationalisation of the building process, and demonstrating the success of the 'Cuban experience' also believes in the necessity of a conscious attempt to rationalise building, and that the process should not be left to the vagaries of the market. The balance between strictly planning and an open approach depends upon the social and political structure of the country. However, all these suggests that governments have a crucial role to play, and as Jill Wells put it 'positive action will be required to achieve this end'[15].

What is now needed is an awareness so that the proposed changes get sufficient support for their faster and smoother implementation. While raising awareness on the merits of this concept can play an initial role, there are problems and barriers to be addressed correctly and resolved accordingly.

4. Difficulties in the establishment of a factory to produce building components.

Establishment of a factory for the private investor have always been an extremely difficult job to handle. According to the respondents the major problems in descending order were: 1) government permission; 2) shortage of primary materials; 3) loan and finance; 4) High cost of and permission for Imported machinery; 5) Recruitment of experienced technical manpower; 6) Marketing problems; 7) problems in acquiring appropriate plot of land in agreement with the municipality; 8) Ordering, purchase and delivery of Iranian made machinery; 9) choice of product; 10) choice of technology; 11) other problems.

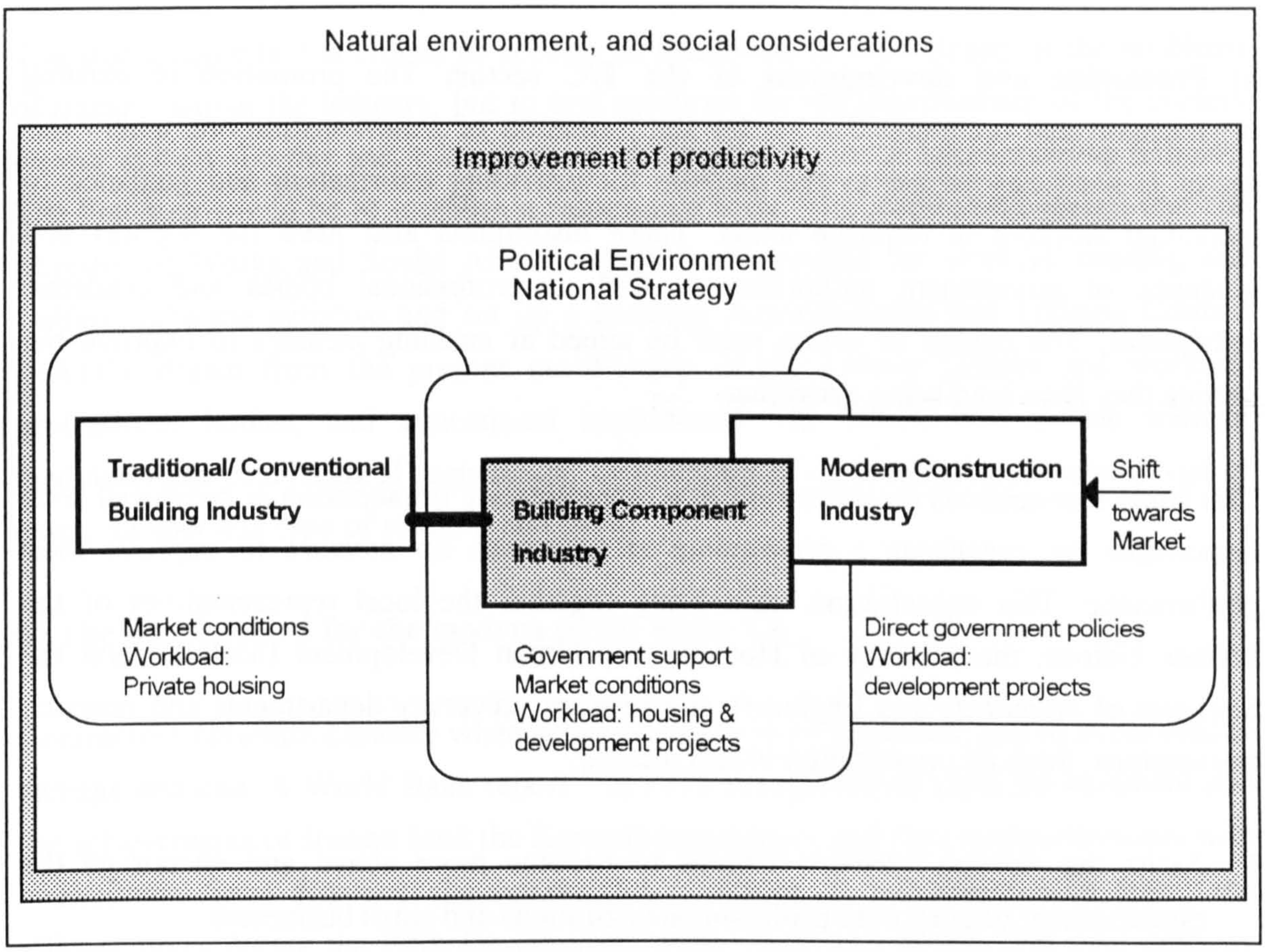
One of the major restrictions for the issuing 'principle permissions is apparently governments obligation to provide the necessary cement and steel ration for every factory which has got the permission and successive operation licence. While the second important problem stated by the respondents is also shortage of primary materials. The government has been aware of the problem of cement shortage and determined for increasing production. Governments efforts seems to have had some effect as the ration for cement and steel has been lifted since mid 1993.

The problem of finance is still a major problem. While there is a 'mountain' of problems for productive activities, rapid profit for the middlemen is readily and easily available as a result of general economic conditions. Despite willingness of the government and Bank Markazi Iran, bank managers are very cautious in approving long term loans for investment in long term projects as opposed to a tendency towards investment in short term economic activities such as import - export, sale - and resale of different consumer commodities. This can be called a Bazaar economy as opposed to production economy.

The problem of imported machinery was quite understandable with drastic (then 30 folds and currently almost 40 folds). An inquiry about the situation of Iranian engineering firms who were involved in the production of building machinery and plants revealed that the main obstacle here again is the primary materials. The chairman of the Co-operative of Construction Machinery Manufactures (C.C.M.M.) which is in charge of the purchase and distribution of primary materials for members expressed his belief that most of those thirty eight firms, if supplied with the crucial primary materials, were technically capable of design and production of most machinery and plants needed in the building industry and the building materials and component industry.

There is still a high enthusiast and so called enterprise initiative amongst engineers, and a willingness by the contractors to invest in building component industries which may help to solve most of the problems one may expect in the way of any new establishment. But there are problems and barriers out of the control and ability of these professionals which must be solved and removed and the 'necessary environment' should be created so that the existing potential, knowledge, and technical know-how can be taped and canalised to increase production capacity and introduction of new components to the market.

Figure 9: F1 Proposal for a possible organisation for component manufacture and use.



5. Recommendations

Much of what might be recommended for development of the construction industry and improvement of productivity in the context of building activities has been implicit in the arguments and discussions in previous chapters. Here the focus is on 'external' intervention or planning. The concept of planning varies between countries because of

differences in institutional arrangements, the structure and organisation of the construction industry, and planning machinery. For example, in this context, the modern sector is more relevant to (direct) planning than the T/ C sector. It is also worth noting here that intervention can cause more harm than good particularly when the 'planning machinery' is inadequate. However attention have been paid that the recommendations be in line with a foundation-up 'enabling' the industry from within rather than an authoritarian 'top-down planning'. This is particularly with regards to the T/ C sector dealing with private sector owner-contractor housing which is not under direct government control.

a) Promotion and development of the T/C sector: The promotion of existing organisation and recommendations for the formation of a new institutions within this sector is necessary to act as the medium for providing information and guidance to individual workers in requisite areas. These institutions also need the support and guidance of government authorities as well as professional bodies and academic institutions. The course of action must be aimed at enabling *memar*s to improve the service they have long being providing.

This study recommends the formation of a representative organisation at provincial level responsible for organising a programme of assistance for *memar*s to improve their performance. This organisation must bring together the local representatives of the *Memar* Unions, the Ministry of Housing and Urban Development (MHUD) and the Societies of Architects and Engineers and relevant university departments and research associations. Such an organisation would include:

1. Assist the existing *Memar*s' Unions to become more active and encourage the establishment of corporate professional institutions and small businesses.

2. Increase the efficiency, capacity, and capability of this sector by generating help and support with apprenticeship training and dissemination of technical, commercial and management skills and information.

3. Raise awareness of the importance of this sector in housing process, its social and cultural value in those responsible for legislation, economic and physical planning.

b) Training

In the course of the study it became increasingly evident that one of the major areas in need of improvement is the apprenticeship system, and of the *memars'* knowledge with regards to new technologies. Among the declared aims of the Society of Architects and Engineers of Fars (SAEF) is the improvement of building construction and better collaboration with other organisations in the building process. The successful experience of the SAEF with the close collaboration of the Union of *Memar*s in arranging educational evening sessions to improve the *memar*s' understanding of new technologies, improvements in bricklaying, suggests that these problems can be solved at a very low cost.

The study suggests it is crucial to appoint an institution to look closely at the problems of training within the industry, but to find solutions for the improvement of the present *memar* system. To this end it is necessary to devise a National Apprenticeship Scheme. The first step would be to establish a responsible body. The study recommends that the Ministry of Works and Social Affairs, which is responsible for workers' training and welfare, take the initiative and set up a Building Apprenticeship and Training Council (BATC), drawn from the present membership of the *Memar* Unions and workers, professional bodies, and educational institutions. The BATC will devise training guidelines and conditions of registration, certification of apprenticeship, minimum age of entry, number and type of sessions and so on.

b) The way forward for the modern sector of the CI.

Contractors optimum capacity when achieved needs to be sustained, and to avoid drastic damage and loss. A World Bank report[16] in 1972 acknowledged rapid development and the achievements of Iranian (and the Korean) contractors, and their competitiveness with international firms. However the vulnerability of this sector was shown even during the affluent times during the Fifth Development Plan, when easy profits and over-capacity workload resulted in a decline in efficiency and productivity. It was also demonstrated that after the revolution and during the war, it was an atmosphere of negligence, suspicion and hostility towards contractors which played havoc with the modern sector CI.

The authoritarian and 'one-sided' nature of the Ministry of Planning's Office of the Contractors Affairs (OCA) prevents it acting efficiently either as an office for classification and accreditation of contractors or as an agency for contractor development. What is needed is an a Contractor Development Agency (CDA). 'An

essential feature of the CDA concept is that it should have sufficient autonomy to be in a position to gain the trust of both contractors and their clients.'[17]

Although the Syndicate of Contractors has voiced the contractors problems, the gains were minimal because they represented only the contractors side. The author would like the government and the industry to set up a Joint Task-force with a five year objective to strengthen professionalism and public accountability of the industry. This Joint Task-force comprises of government representatives from the Ministry of Planning and Budget (MPB) - and client Ministries on the one hand and contractors and manufacturers on the other. While the Contractors Syndicate in Tehran believes its duty is to defend contractors interests nation-wide, though essentially it represents the larger contractors based in Tehran. Contractors in other provinces have gradually established regional Contractors Syndicates or Councils after the revolution; the voice of regional contractors must also be heard.

The Task-force would take decisions on creating a safe working environment, forecasting the workload, improving contract conditions by amending the existing obsolete Contract Document. The Task-force can identify weak management areas in client organisations and produce procedures for their improvement. Proper supervision and control of contracts and the use of foreign contractors, must be decided upon. It would also help to sort out the delays and difficulties of the acquisition of materials and plant, training, finance, price adjustments, payment procedures, contracting practice, settlement of disputes, and disciplinary action against negligence, bribery, and fraud.

d) improvement of productivity

This findings of this study suggests that a marginal improvement productivity within the industry is more appropriate and achievable than importation of 'high' technological solutions that are alien to the culture. A strategy for action at national and regional levels requires: 1) Delineating and developing better understanding of the factors influencing productivity in the process of development and expansion of the built environment; 2) determining how to control or influence these factors; 3) assess the courses of action which must be taken to put the industry on a sound professional footing capable of operating in the international market place.

Research and development on such a multi-disciplinary matter at national and regional levels needs the participation of a number of experts and specialists. The study suggests

that initiation and co-ordination to organise efforts for a national strategy needs a responsible body and an enthusiastic, knowledgeable director. The Building and Housing Research Centre (BHRC) has been involved mainly in technical research and less in the much needed co-ordination and guidance of research in the areas of socio-economical or socio-technical systems concerning the built environment. The Ministry of Planning and Budget (MPB) which is involved in economic Development Planning lacks a focus on built environment problems. Both the BHRC and MPB need a link with the NGO professional bodies within the T/ C and the modern CI. A joint commission of MPB, BHRC and NGO professionals which may be called MBN (taken from the first letters of the three parties), would be an appropriate body to initiate the primary steps towards devising those strategies. This commissions would also need inputs from a wide range of specialists. Through commissioning academic institutions and researchers and holding various seminars, the MBN will develop a better understanding and achieve a wider consensus on the issues of concern.

Advancement in the use of Light weight Loose fit Low technology Components (LLLC).

Although the approach is different from the conventional open system of industrialised building which needs strict modular co-ordination and standardisation, it is still to some extent is in need of those pre-requisites. This study of the problems in the manufacture and acceptance of building components showed that a lack of standards hampered the development of door-set manufacture and quality control and guarantee are the main problems in acceptance.

Quality control

A comprehensive quality assurance system in ensuring that buildings will be more reliable in performance and less troublesome in operation and maintenance is a distant desire for the majority of developing countries. Even those countries who inherited (from the colonial period) or adopted Western building codes and agrément systems, cannot afford to build to those standards. This does not mean that quality control concepts do not apply in developing countries. This study showed that one of the problems in the acceptance of new products and the development of building materials and component industry is a lack of a quality control system. There is a need for a credible institution to provide independent appraisal of new building products.

This study proposes that the BHRC which is currently responsible for the preparation of

building codes and standards take positive action in devising standards for components and in establishing a responsible body for devising a quality assurance scheme appropriate to regional conditions. This could begin to cover building materials and off-site manufactured components. The scheme should also cover installation practice with regards to those products which are sold as installed, such as roofing membranes. Here again, technical problems are minor compared with institutional and organisational problems. However technical criteria have to be developed against which quality management capabilities and product performance can be assessed. The critical question is how far should the scheme move towards strict specifications and rigorous procedures.

6. Limitations of present study and areas for further research.

The limited existing research into the Iranian construction industry necessitated an overall survey and a multi-disciplinary approach. With the 'system' approach the author further required an assessment of the social and economic environment in which the industry has developed and currently operates. This kind of study by its nature does not allow a very detailed examination of many of the issues concerned. In general it has provided a survey of a number of subjects surrounding the building industry and has raised a number of issues for deeper research and investigation. The areas for further research are implicit in the recommendations. Here a number of issues which have not been covered in this study will be pointed out.

A larger survey of materials and component producers must be carried out in relation to the problems of factory establishment and business management.

In the course of this study it was revealed that there is a considerable lack of literature, data, and statistics on the Iranian building industry inside the country and outside. This research while being an effort to fill a part of this gap, has been constrained by this lack of data. Much work is needed to provide the necessary data enable researcher and policy to develop the country's future building industry.

7. End notes

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APPENDIX 1
Country profile.

1) The Land

Iran is situated in South Western Asia in a strategic point. It borders Turkmenistan, the republic of Azarbayjan , and the Caspian sea in the North, Turkey and Iraq in the West, the Persian Gulf and the Gulf of Oman in the South, and Pakistan and Afghanistan in the East. The country has an area of 165 million hectares (628000 square miles), an area larger than that of Italy, France, Switzerland, West Germany, the Netherlands, Belgium, Luxemburg, Denmark and Great Britain combined.

Total area: 1,648,000 km 2; land area: 1,636,000 km 2

Terrain: rugged, mountainous rim; high, central basin with deserts, mountains; small, discontinuous plains along both coasts

Mountains: Chains of mountains surround the interior basin which prevents moisture from reaching it. The Zagros range stretches from the north west to the Persian gulf in the south, and thence eastward into Baluchestan. As it moves southwards, it broadens into a 125-mile-wide band of parallel alternating mountains. The Alborz mountain chain, narrower than Zagros, but equally preventing moisture penetration, runs parallel to the Caspian seashore and then stretches to Khorasn in the east.

Natural resources: petroleum, natural gas, coal, chromium, copper, iron ore, lead, manganese, zinc, sulphur

Land use: cultivable land 8%; permanent crops negligible; meadows and pastures 27%; forest and woodland 11%; other 54%; includes irrigated 2% Environment: deforestation; overgrazing; desertification

2) Climate

Iran has a varied and complex climate, ranging from sub tropical to sub polar. In winter while high pressure from Siberia creates a driving wind from west and south to the interior of the Iranian plateau, low pressure develops from the warm waters of the Caspian sea, the Persian Gulf and the Mediterranean. In Summer, one of the lowest pressure centres in the world[1] prevails in the South and as a result different wind patterns

are created in different regions. Principle winds are the Shamal which blows from February to October north westerly, and the ' 120-Day' summer wind in Seestan region.

Temperatures vary from -37C (35F) in Azarbaijan in the north-west to +51C (123F) in Kusistan in the South. About 1.2 million square kilometre (73% of total land) has an arid climate, 400'000 square kilometres (24.4%) is temperate, and about 40'000 square kilometres (2.4%) has a cold 'mountainous' climate. Shiraz and most of other cities of Fars province are located in ' arid' zone except for southern cities of the region which are located in hot and humid zone. Temperature in arid zone varies between 35-40 degrees in summer and 0 to -5 in winter; in hot and humid zone between 35-40 and 0 to +5. The following map give details of the climate in the four major population areas. [2]

3) People

- **Population**: 59,051,082, **growth rate** 3.6%; Life expectancy at birth: 64 years male, 65 years female. **Ethnic divisions**: Persian 51%, Azerbaijani 25%, Kurd 9%, Gilaki and Mazandarani 8%, Lur 2%, Baloch 1%, Arab 1%, other 3%.
- **Religion**: Shia Muslim 95%, Sunni Muslim 4%, Zoroastrian, Jewish, Christian, and Bahai 1%.
- **Language**: 58% Persian and Persian dialects, 26% Turkic and Turkic dialects, 9% Kurdish, 2% Luri, 1% Baloch, 1% Arabic, 1% Turkish, 2% other.
- **Literacy**: 54% (male 64%, female 43%) age 15 and over can read and write (1990 estimate).
- **Labour force:** 15,400,000; agriculture 29%, mining-and manufacturing 18.% Construction 11.%; Services 42%; shortage of skilled labour (1987 estimate).
- **Organized labour**: none

4) Government

- **Long-form name**: Islamic Republic of Iran.
- **Type**: theocratic republic.
- **Capital**: Tehran.
- **Administrative divisions:** 24 provinces (ostanha, singular: ostan); Azarbayjan-e Bakhtari, Azarbayjan-e Khavari, Bakhtaran, Bushehr, Chahar Mahall va Bakhtiari, Esfahan, Fars, Gilan, Hamadan, Hormozgan, Ilam, Kerman, Khorasan, Khuzestan,

Kohkiluyeh va Bayer Ahmadi, Kordestan, Lorestan, Markazi, Mazandaran, Semnan, Sistan va Baluchestan, Tehran, Yazd, Zanjan.

- **New Constitution of the Islamic Republic** : 2-3 December 1979; revised 1989 to expand powers of the presidency and eliminate the prime ministership.
- **Legal system**: the new Constitution codifies Islamic principles of government.
- **Executive branch**: cleric (faqih), president, Council of Ministers.
- **Legislative branch**: Islamic Consultative Assembly (Majles-e-Shura-ye-Eslami).
- **Judicial branch**: Supreme Court.
- **Member of**: CCC, CP, ESCAP, FAO, G-19, G-24, G-77, IAEA, IBRD, ICAO, ICC, IDA, IDB, IFAD, IFC, ILO, IMF, IMO, INMARSAT, INTELSAT, INTERPOL, IOC, ISO, ITU, LORCS, NAM, OIC, OPEC, PCA, UN, UNCTAD, UNESCO, UNHCR, UNIDO, UPU, WFTU, WHO, WMO, WT.

5) Economy.

- **GNP**: $80.0 billion, per capita $1,400; real growth rate 0.5% (1990 est.).
- **Inflation rate** (consumer prices): 30-50% (1989 estimate.) 20%(1992 estimate.).
- **Unemployment rate**: 30% (1989)
- **Budget**: revenues $63 billion; expenditures $80 billion, including capital expenditures of $23 billion (1990 est.) 'Foreign exchange spending soared 56 percent t $30.9 billion in the last Iranian year 1971 (1992-1993) when revenue was little over 16 billion[13]
- **Exports**: $16 billion 1372 Iranian year (1992-1993).
- **Export commodities**: petroleum 90%, carpets, fruits, nuts, hides. partners: Japan, Turkey, Italy, Netherlands, Spain, France, Germany.
- **Imports:** $11.6 billion (c.i.f., 1989); 30 billion 1372 Iranian year (1992-1993).
- **Import commodities:** machinery, military supplies, metal works, foodstuffs, pharmaceuticals, technical services, refined oil products; partners: Germany, Japan, Turkey, UK, Italy.
- **External debt:** $12 billion (1989) 30 billion (1993).
- **Electricity**: 14,579,000 kW capacity; 40,000 million kWh produced, 740 kWh per capita (1989)
- **Industries**: petroleum, petrochemicals, textiles, cement and other building materials, food processing (particularly sugar refining and vegetable oil production), metal fabricating (steel and copper)**Agriculture**: principal products--wheat, rice, other

grains, sugar beets, fruits, nuts, cotton, dairy products, wool, caviar; not self-sufficient in food.

- **Currency**: Iranian rial (plural-rials); 1 Iranian rial (IR) =100 dinars; note-domestic figures are generally referred to in terms of the toman (plural-tomans), which equals 10 rials.
- **Exchange rates**: Iranian rials (IR) per US $164.941 (January 1991) at the official rate; black market rate 1,470 (January 1993). Fundamental change in the exchange rate is taking place as: ' In his budget speech in December 1993, Mr. Rafsanjani pledged further moves to unify the exchange rate by removing an increasing number of items from the official rate of about IR 70 equal to the dollar (US). Only essential items, such as basic food-stuffs and medicines, will remain at that IR 70 rate, some items for industry will continue at 1R600 to the dollar but almost everything else will be at the floating rate, currently about IR1500 to the dollar.'[4]
- **Iranian Calendar and fiscal period** : 21 March-20 March

6) Communications

- **Railroads**: 4,601 km total; 4,509 km 1.432-meter gauge, 92 km 1.676-meter gauge; 730 km under construction from Bafq to Bandar Abbas.
- **Highways**: 140,072 km total; 46,866 km gravel and crushed stone; 49,440 km improved earth; 42,566 km bituminous and bituminous-treated surfaces; 1,200 km (est.) rural road network.
- **Inland waterways**: 904 km; the Arvand rud (Shatt al Arab) is usually navigable by maritime traffic for about 130 km, but closed since September 1980 because of Iran-Iraq war.
- **Ports:** Abadan (largely destroyed in fighting during 1980-88 war), Bandar Beheshti, Bandar-e Abbas, Bandar-e Bushehr, Bandar-e Khomeyni, Bandar-e Shahid Rajai, Khorramshahr (largely destroyed in fighting during 1980-88 war.

7) Landscape

Of the vast area of 165 million hectares, only 17 million hectares are cultivated land. Of this, 4 million hectares are under irrigated farming and the remaining 13 million under dry farming. Soil patterns vary widely. The abundant Mountain soils are shallow layers over bedrock, with a high proportion of gravel and sand. Natural erosion moves the finer soils

into valleys where the agricultural land is formed and also used for pottery and brick making.

'Difficulties of dry farming; soil erosion; abundant sand and gravel land; lack of 'soil' in central parts and shallow soil in other parts; poor soil condition in terms of soil structure and lack of organic materials and living creatures, salty soil and so on means that the situation of farmland in this country is critical'.[5]
Dr. M.T. Rahmanee[6] then states that:

'Increasing use of soil for brick production and trends in use of bricks for buildings is worrying.' He goes on to suggest that instead of clay (mud) bricks, sand-lime or sand-cement bricks and blocks should be used.

8) Earthquake

Iran is located on the Alpine Seismic Belt. It could be said that all parts of Iran (without exception) are earthquake prone.[7] There has been an average of one earthquake per year in Iran with a magnitude of 6 Richter or more in the last 80 years. In the same period there has been 11 earthquakes with the magnitude of 7 Richter or more. 'Most of the earthquakes in the last decade have happened in less populated rural areas with some exceptions. No doubt that if any of these earthquakes happened in highly populated urban areas the scale of disaster would have been tremendous'[8]

9) Natural Endowment

In addition to oil reserves of an estimated 55 billion barrels, Iran has 14 trillion cubic metres of natural gas resources, second only to the former Soviet Union and constituting 17% of the world reserves. In addition to oil and gas, there are considerable reserves of Copper 1.2 billion tonnes (second only to Chile), Iron 988 million tonnes, Coal, Zinc 45 million tonnes, Lead 15 million tonnes.

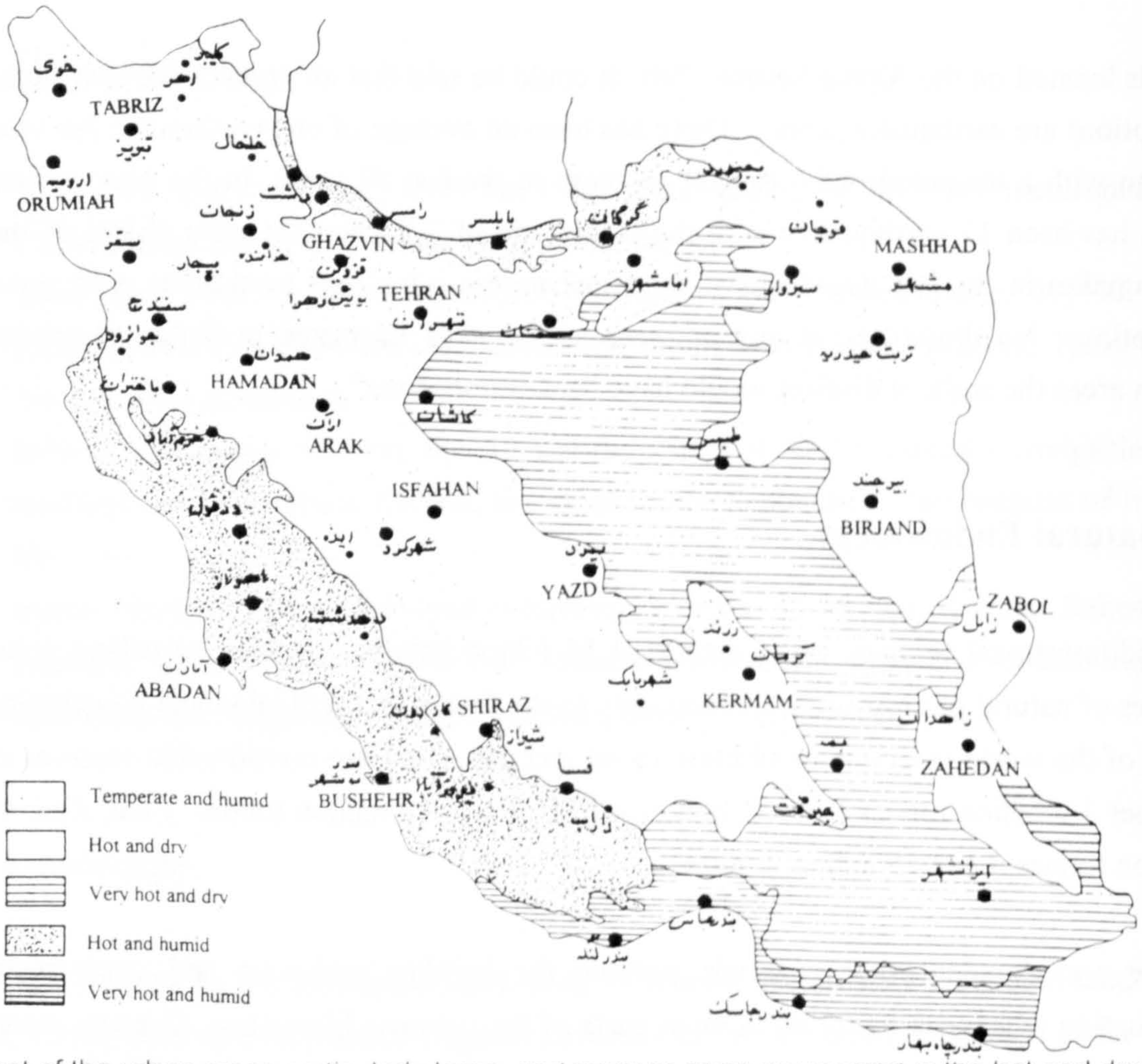
There are abundant raw materials suitable for building materials and components production which can be found in most parts of the country. Limestone, Gypsum stone, Asbestos, and different marble and other stones for cladding and other building purposes are currently exploited for local use and also for export. Cement factories with 12 million

12 million tonnes annual production are using local materials, and a five year programme to double the capacity is also based on available local raw materials.[9]

As in the Oil sector most of these mines are exploited for export. The major problem in exploitation of these mines, as in the economic development of the country as a whole, is the lack of relationships between different sectors of the industry. This absence of an integrated structure is the result of a strategy dependent on foreign (largely Western) markets.

'Now the question is that with such industries (established to serve the western market) what can we do? What are the ways to reduce this reliance on foreign markets and establish internal coherence and integrated relationships between different sectors of the economy, and the community as a whole.'[10]

Figure Ax1: 1. **Summer climatic zones**



Most of the urban areas particularly large, and medium cities are located in the hot and dry climatic zone including Shiraz.

Source: BHRC

10) Statistical data on the participation of the construction industry in the Iranian economy.[11]

Table Ax1: 1, Gross Capital formation in constant price of the year 1974

in Billion rialsYear	1982/83	1983/84	1984/86	1986/87
Agriculture	34.5	62.2	54.7	45.9
Petrol & Gas	44.7	39.3	28.9	20.8
Industry & mine	47.2	81.8	79.6	57.4
Water & power	27.0	38.5	50.9	44.5
Construction (building)	**217.4**	**287.7**	**268.1**	**245.8**
Residential	**197.8**	**271.9**	**251.1**	**232.9**
Non-residential	**19.6**	**15.8**	**17.0**	**12.9**
Services	220	339.9	298.3	251.7
Total	**618.5**	**859.6**	**769.7**	**638.4**

statistics on CI as a whole to include building and civil engineering works. From the above table construction here means residential and non residential buildings nevertheless the share of building in total gross capital formation is shown between %35-%38.5

Table Ax1: 2, The share of building in total gross capital formation 1982-87

Year	1982/83	1983/84	1984/86	1986/87
Percent	%35	%33.4	%35	%38.5

The fact that about %90 of the residential buildings are built by unorganised or traditional sector. shows the importance of this sector and how significant effect can have the increasing of the efficiency of the sector to the whole economy and the CI.

Table Ax1: T3, Gross capital formation in current price

in Billion rials.Year	1982/83	83/84	84/85	85/86
Agriculture	96.7	188.5	167.7	144.3
Petrol & Gas	140.9	147.1	121.9	91.8
Industry & Mine	158.5	227.0	231.8	143.1
Water & Power	129.4	162.3	140.7	98.5
Construction	**768.6**	**1252.6**	**1321.5**	**1276.4**
Residential	**698.1**	**1186.8**	**241.1**	**1212.5**
Non-residential	**70.5**	**65.8**	**80.4**	**63.9**
Services	592.9	967.1	900.5	783.2
Total	**1887.0**	**2994.6**	**2884.1**	**2537.3**

Table Ax1: 4, National Accounts Gross capital formation in current prices

Year	82/83	83/84	84/85	85/86
Machinery	**530.8**	**943.9**	**928.8**	**731.7**
Public Sector	400.2	446.2	375.7	347.2
Private Sector	130.6	497.7	553.1	384.5
Construction	**1356.2**	**2000.7**	**1955.3**	**1805.6**
Public Sector	684.7	828.2	692.2	571.2
Private Sector	671.5	1172.5	1363.1	1234.4
Total	**1887**	**2944.6**	**2884.1**	**2337.3**

11) Statistical data on employment in the construction industry.

Table Ax1: 5, The number of construction employees in different sectors of CI (moderm +traditional sectors) .

Description	No. of employees	Percent
Building (Residential & Non-residential)	1097250	%90.9
Road, Airport, Shipyard, Railways	15274	%1.3
Dam	1668	%0.1
Well & Ghanat digging and Maintenance	11006	%0.9
Electrical, Mechanical	50568	%4.2
Office workers	22896	%1.9
Other related activities	7897	%0.7

These figures are derived from three consecutive general censuses and do not account for foreign workers. It is important to mention that there has been an influx of Afghan nationals crossing the border for job in construction as unskilled labour since 1970 the number of these refugee workers increased with the war, political and economic condition in Afghanistan. The number of refugees are estimated at about three million but although there is no statistic on actual number involved in construction work but it is believed to be about 2.5 million.

Table Ax1: T, The share of different Jobs in CI in 1977 and 1987

Description	1977	1987
CI Employees	100	100
Academics and specialised Consultants	2.9	1.1
Engineers. technicians	2.5	0.72
Building trades and unskilled labour	67.4	86.6
Decorators and Painters	3.1	1.96
Plumbers and welders	2.99	2.27
Electricians	1.1	1.6
Transport Workers	1.7	1.68
Window Glaziers	0.11	0.11
Others	18.2	3.96

From the total employees in CI 91 percent work in private sector and 9 percent are government employees. In private sector 35.5 percent are independent self employed individuals, 60.4 percent are employees and 3.9 percent are entrepreneurs.

Table Ax1: 7, Construction worker's wage indicator, on the basis of 1974-1975 =100

Year	Total skilled and unskilled	Skilled Labour	Unskilled Labour	Housing
1977	208.2	211.9	204.3	163.1
1978	282.2	290.7	273.9	255.2
1979	233.8	253	312	224
1980	392.6	403.6	380.8	221.6
1981	469	435.2	487.5	227.2
1982	541.1	504.8	587.5	242
1983	652.7	588.6	732.5	275.3
1984	861.1	998.0	735.9	335.1
1985	956.9	1846.8	835.1	378.5
1986	982.2	1138.5	881.9	393
1987	1003.7	1149.6	910.0	406.8

To show the importance of the employment in CI the below chart is only a superficial indicator because government statistics conventions separates civil engineering and building the word *sakhteman* (`construction') here means building and consists of private sector domestic and commercial building.

Table Ax1: 8 Number of employees in different sectors of the economy (in thousands) and the share of each sector in percent of the total employment.

Sector	1966/67		1976/77		1986/87	
Agriculture	3169	%46.2	2992	%34	3191	%29
Mining & Manufacture	1294	%18.9	1762	%20	1483	%13.5
Building	**510**	**%7.4**	**1189**	**%12.5**	**1206**	**%11**
Water & Power	53	%0.8	62	%7	91	%0.8
Services	1706	%24.8	2720	%29.9	4669	%42.4
Others	127	%1.9	75	%0.9	360	%3.3
Total	**6858**	**%100**	**8799**	**%100**	**11002**	**%100**

CI has been always looked upon as a good source of employment generation. Provision of employment in the CI seems to be the quickest and easiest way of generating work for unemployed, but many economic development experts are against provision of jobs in the city attracting rural workers damaging agriculture and creating problems associated with rapid and extensive rural-urban migration.

12) End notes

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APPENDIX 2

The Decline of Oil Revenue: in the context of the construction industry in Iran.

1) Introduction

Since the discovery of oil in Iran, in 1891[1] oil revenue has become a key factor in the economy of the country. As a result Iran has became more and more a country of vital interest to multinational oil companies, as well as Western governments, provoking their systematic intervention in the domestic affairs of the country. Although there has always been this notion in Iran that any important event has a link with oil, the public of our country, as well as elsewhere, have been deprived of the underlying realities about oil, Thus their judgements have been based on myths and distortions or old and invalid impressions.

The development of the world oil industry and changes in the pattern of energy and the oil market have directly affected and have caused changes in the political economy and industry, and this has been reflected in technological development and other qualitative and quantitative changes in the life of the people in Iran. For instance during my 25 years practice in the construction industry in Iran I have been a close witness of drastic changes in its technology, structure and capacity, caused by fluctuation of the oil revenue.

In the case of the modern construction industry in the Middle Eastern oil exporting countries is in some general aspects similar to the rest of the third world, however it has similarities in some other characteristics, with the developed countries. In fact it is formed in a quite different way to the rest of the third world countries with regard to the availability of 'petrodollars'. For instance, similar to industrialised countries the reliance on capital equipment seems the natural and logical, result of high wages and relative shortage of labour caused by the allocation of tremendous amounts of money to the construction sector. At the same time because of routine problems similar to the rest of developing countries, very little construction equipment is manufactured inside the country, causing the disastrous dependence of the industry on foreign exchange which can have a crippling effect in times of shortage.

A basic, theoretical framework to elucidate the mechanism of an otherwise complex political economy of the oil exporting countries, has been developed by a few

economists[2]. This framework helps to understand the nature of these changes, but at a more elementary level serious mistakes can be avoided by careful consideration of social, cultural, geographical and other factors.

OPEC's share of the world oil market declined from 36.5 percent in 1973 to 16.3 in 1985 and is continuing to decline. The price of oil declined from $ 40 per barrel in 1981 to just over $ 15 per barrel in 1986 and later on some occasions to nearly $ 12. Changes such as these mean that any valid assessment of the current and future situation in Iran must take into account the changing structure of the world crude oil market.

It is not the intention, nor would it be possible here to give the non-specialist reader an instant and comprehensive treatise on the structure of the world oil market. However by concentrating on the most significant structural developments over recent decades and by looking at the history and growth of the oil industry, this paper attempts to provide relevant insights into Iran's oil industry and its future direction, and how these factors in turn effect the construction industry in Iran.

2) Oil as energy; the life blood of modern industry

Two important human activities, the production and transport of goods have always required relatively large amounts of energy. For thousands of years this energy was exclusively human power. Later animal power was used, but still mass human labour was much more effective than mass animal power in lifting very heavy construction materials, and even for transportation (with the important exception of sailing ships). Two huge steps in generating energy (in a concentrated form) were the invention of the water and wind mills. Although the invention of the steam engine changed the pattern of energy use and a new era of industrialisation started. By the middle of the 19th century concentrated power of as much as 100 HP. became possible. The aggregate horse power of steam engines in the world was estimated at 1,650,000 HP. in 1840 and 70,000,000 HP. by 1900. This growth necessitated the growth in production of coal, as coal began to displace wood as the main fuel. At the outbreak of the first World

Power of: :	In Horse Power
man	0.1 hp
water mill	2 - 5 hp
wind mill =	2 - 8 hp

War in 1914, 1.057 m. tons of coal were mined a year world wide. Coal and lignite constituted over 90 percent of the world's commercial sources of energy.

The invention of the internal combustion engine in 1880 was in some ways the starting point for the rapid development of the oil industry it only assumed real importance after the 1920s. Developments since 1925 are shown in Table Ax 2: 1.

Table Ax 2: 1

World Energy Consumption (million metric tons coal equivalent)

Fuel type	1925	1938	1950	1960	1968
Solid fuels	1230	1292	593	1999	2315
Liquid fuels	197	378	722	1499	2702
Natural Gas	48	100	252	613	1157
Hydroelectricity	10	23	43	86	132
Total	1485	1793	2610	4197	6306

Source: Joel Darmstadter et al., Energy in the world Economy (Baltimore: Johns Hopkins, 1971) Table 4.

The rate of increase of Oil grew very rapidly, 13.7 fold, whereas coal was only 1.8. Coal and lignite grew slowly at 1.5 percent per annum over the whole period. After the 1939-45 war there was a 2.5 percent rise between 1950-1965 but recently, this has dropped sharply to 0.4% in 1965-68. This was partly due to the rapid expansion of the oil industry. The replacement of coal by oil is due to many factors; for instance until today oil is still irreplaceable as a lubricant, as are the many other products of the petrochemical industry, used in the aviation and motor transport. It is more efficient than coal for shunting locomotives and for sea transportation. It is also more appropriate for use within many other industries and because of its fluid nature its transport costs are approximately half compared with coal, especially over long distances. It is more suited than coal for domestic heating and it leaves no ashes. Moreover the cost of exploitation is less than coal.

However, the world's coal reserves are enormous, estimated at 15,000 billion tons. More than half of this figure is minable with present economic trends and current techniques. Calculations based on various assumptions show that both the world and the United States reserves are adequate for at least another 200 years, with the annual extraction of coal gradually rising to eight times the present level.[3]

In the early days of industrialisation, the search for a more appropriate lubricant ended with the re-discovery of mineral oil, or petroleum-rock oil. First in Romania, and shortly

afterwards in the United States oil began to be extracted and sold to industry. After the invention of the internal combustion engine in the 1880's, petroleum became the life blood of modern industry.

3) Iranian Oil And 'majors'

The only industrialised countries having their own petroleum resources were America and Romania in Europe. British industrialists having access to only a little oil in Burma had to turn their eyes outside the confines of the British Empire. Oil was easy to find in Iran from the clear address given by Herodotus. In about 500 BC the first man made oil well was dug to the south of present day Iran in Shush. Herodotus describes how oil, bitumen and salt were extracted and used for different purposes. However the modern history of oil in Iran started with the country's first concession granted by Nasser-ed-Din shah to Julius de Reuter, a British citizen in 1889.[4]

The geology and geography of the country are dominated by the two great Tertiary mountain system of the Zagros and Alburz. The Zagros mountains run close to and parallel with the Persian Gulf and its north-bound extension into Iraq and form Persian Gulf basin. Some of the Iranian fields, particularly those in and bordering on the Gulf, are in gentle domes of the unfolded part of the basin. The earlier and cumulatively more important fields are in the zone of the folded foothills of the Zagros.

> 'The whole basin has a thick sequence of rocks that were deposited more or less continuously from the end of Carboniferous times until the late Tertiary. The sequence consists of thick limestone units with subordinate shells and evaporates. In the 'unfolded' part of the basin, i.e. in the Gulf offshore and surrounding lowlands, production is from Cretaceous sands, all being the same reservoirs that are prolific producers in Kuwait, Emirates, Saudi Arabia, etc.'[5]

As it turned out Reuter's concession was never put into effect. Baron de Reuter died in 1899 and the concession consequently expired at the end of its first ten year.

Ketabchi Khan an Iranian of Armenian origin who had worked his way up in the Iranian government as Director-General of the customs administration ,was in a good enough position to come into ownership of a private Iranian company [6] which had been carrying on exploration for oil successfully after the expiry of de Reuter's Concession. Ketabchi Khan secured from this company for himself, a monopoly of oil rights throughout Iran.

Willam Knox Darcy by the suggestion of Sir Henry Drummond wolf, (formerly British minister in Teheran), sent two geologists to Iran. They visited a district near Shushtar, not far from the zone later so successfully developed by the Anglo-Iranian Oil Company. Ketabchi Khan agreed to sell his rights for a sum said to have been as much as £50'000.

It was necessary, however, to put the matter on a rather firmer basis so far as the Iranian government was concerned. This wasn't particularly easy, as the Russians were also keen to obtain an oil concession in Iran. However, the British government ensured that the concession was granted to D'Arcy enabling him to operate throughout the whole country, Russian influence, though, was later to force the Iranian government to withdraw the five northern provinces of the country from the concession.

> 'Persia's share was hardly spectacular. The government was promised £ 20,000 in cash and £ 20,000 in shares in the first company to be formed by the concessionaire. In addition it was to receive 16 per cent. of the profits made by this or any other company concerned in the concession. As it turned out, however, D' Arcy did not even have to put his hand in his pocket.'[7]

In his visit to Iran in 1901 D' Arcy was able to get from Mozaffar-ed-Din Shah a (*Farman*) or document granting him the exclusive ownership of all Iran's (subsoil products) for a period of sixty years. Later D'Arcy was persuaded by a priest to present this (*Farman*) to the church, arguing that this would enable the church to send missionaries into Iran. D'Arcy handed over the document, unaware that this priest was in fact an agent of the British Secret Service![8] this meant that British official circles were interested in Iran's oil.

On April 4 1909 the Anglo-Persian oil company(later Anglo-Iranian Oil Company AIOC) was formed receiving all the rights granted in the D'Arcy concession.

> 'At the opening meeting of the company Sir John T. Cargill, a member of the boards of both the Burmah Oil Company and the Anglo-Persian, congratulated the former on acquiring one of the richest oil fields in the world, and the British Empire on saving from foreign hands a great natural resource. The chairman acknowledged the valuable assistance received from the Foreign Office and the British Consul in Persia'.[9]

and a world power (AIOC later BP) was born.

After the Second World War because of reducing risks to trade and lower costs of transport, the growth and stabilisation of oil revenues provided a boost to world economy. Oil revenues have played a substantial role in this development. The rapid expansion of the demand for oil in the international market resulted in the continuous discovery of new deposits. After the war four centres -the United States, the Middle East, the Soviet Union and Venezuela- accounted for 85 to 90 percent of the total output.

Table Ax 2: 2

Estimated World Oil Reserves, 1 January 1972(billion barrels)

United States	37.3		
Canada	8.5		
Venezuela	13.9		
Europe	14.2		
		Total Western Hemisphere	**77.3**
Indonesia	10.4		
		Total Asia-pacific	**15.6**
Libya	25.0		
Algeria	12.3		
Egypt	4.0		
Nigeria	11.7		
		Total Africa	**58.9**
Soviet Union	75.0		
China	20.0		
		Total Sino-Soviet	**98.0**
Saudi Arabia	145.3		
Kuwait	66.3		
Iran	55.5		
Iraq	36.0		
Neutral Zone	24.4		
Abu Dhabi	19.0		
Syria	7.3		
Qatar	6.0		
Oman	5.2		
		Total Middle East	**367.4**
		Grand total, World	**631.9**

Source: Oil Gas Journal. 27 December 1971.

The Soviet Union's oil industry was developed primarily for its own needs and those of its satellites in Eastern Europe. In the United States the large number of producers (over 10,000) makes for a certain degree of competition. However, for a variety of reasons, among them a policy since the 1930's of restricting both the domestic output and the imports of almost all the producing states, has kept American production well below the level it would otherwise have attained. The result has been that in recent years the United States imports are still only 20 percent of its total oil consumption.

The worlds oil production is dominated by seven major international oil companies called the 'seven sisters'. Five of these are American Companies: Standard Oil of New Jersey, Standard Oil of California, Socony-Vacuum, The Gulf oil Corporation and the Texas Oil company. Two are British: Royal Dutch Shell Oil company and British Petroleum(formerly Anglo-Iranian oil company or 'BP.'). An eighth, the French Company Francaise des Petroles, generally co-operated with the Seven Sisters.

4) Middle Eastern Oil:

Huge reserves and very low costs of production are two important features of Middle Eastern oil and to a lesser degree that of north Africa. At the beginning of 1972 world reserves of petroleum were estimated at 632 billion barrels, of which 365 billion barrels or 58 percent, were in the Middle East and 42 billion or 7 percent in North Africa.

90 percent of the regional subtotal is located in the Persian Gulf area, which can only reach Western markets through vulnerable channels, in contrast to North African oil, which is within easy reach of Europe. The scarcity of oil meant keeping the west own reserves intact and secure, while first exploiting those areas most at risk. So for example, although commercial production started in 1908 in Egypt shortly after Iran, Egyptian output was held down until recently, while Iran ranked as the worlds fourth largest producer in the 1930,s and 1940,s

Table Ax 2: 3

Production of Crude Oil (thousands of barrels a day)

Country	1938	19491	1961	1971
Abu Dhabi	-	-	-	900
Bahrain	21	28	42	75
Dubai	-	-	-	126
Iran	210	560	1,201	4,514
Iraq	90	80	1,003	1,692
Kuwait	-	250	1,644	2,895
Neutral Zone	-	-	177	551
Oman	-	-	-	291
Qatar	-	2	178	429
Saudi Arabia	1	480	1,393	4,456
Syria	-	-	-	115
Total Middle East	**322**	**1,400**	**5,643**	**16,240**
Algeria	-	-	327	603
Egypt	3	40	71	302
Libya	-	-	17	2.800
Total North Africa *	**3**	**40**	**415**	**3,792**
United States	3,480	5.480	8,174	9,650
Canada	20	60	643	1,336
Venezuela	520	1.320	2,923	3,579
Indonesia	160	120	517	880
Soviet Union	570	650	3,360	7,470
Total World *	**5,595**	**9,750**	**23,547**	**47,800**

Source; Oil and Gas Journal; BP Statistical Review. * Includes other countries not listed.

Iraqi Oil started to flow in 1934, Saudi Arabia and Kuwait after the second world war, Qatar in 1950,s ,and Abu Dhabi, Oman and other emirates in 1960,s.

6) New agreements.

After the nationalisation of Iranian oil and subsequent CIA coup on 19 August 1953 an agreement was signed between major oil companies. This new carve-up for the first time included all Seven Sisters. Although Iran was to own the oil produced, it would be sold to the consortium with the full control of the consortium over production, through their formula of the, Aggregate Programmed Quantity (A.P.Q) * 1

A.P.Q was calculated by listing the needs of each participant, for example as shown in Table below :

Table Ax 2: 4, The share of the Companies in 1954,& APQ in 1966

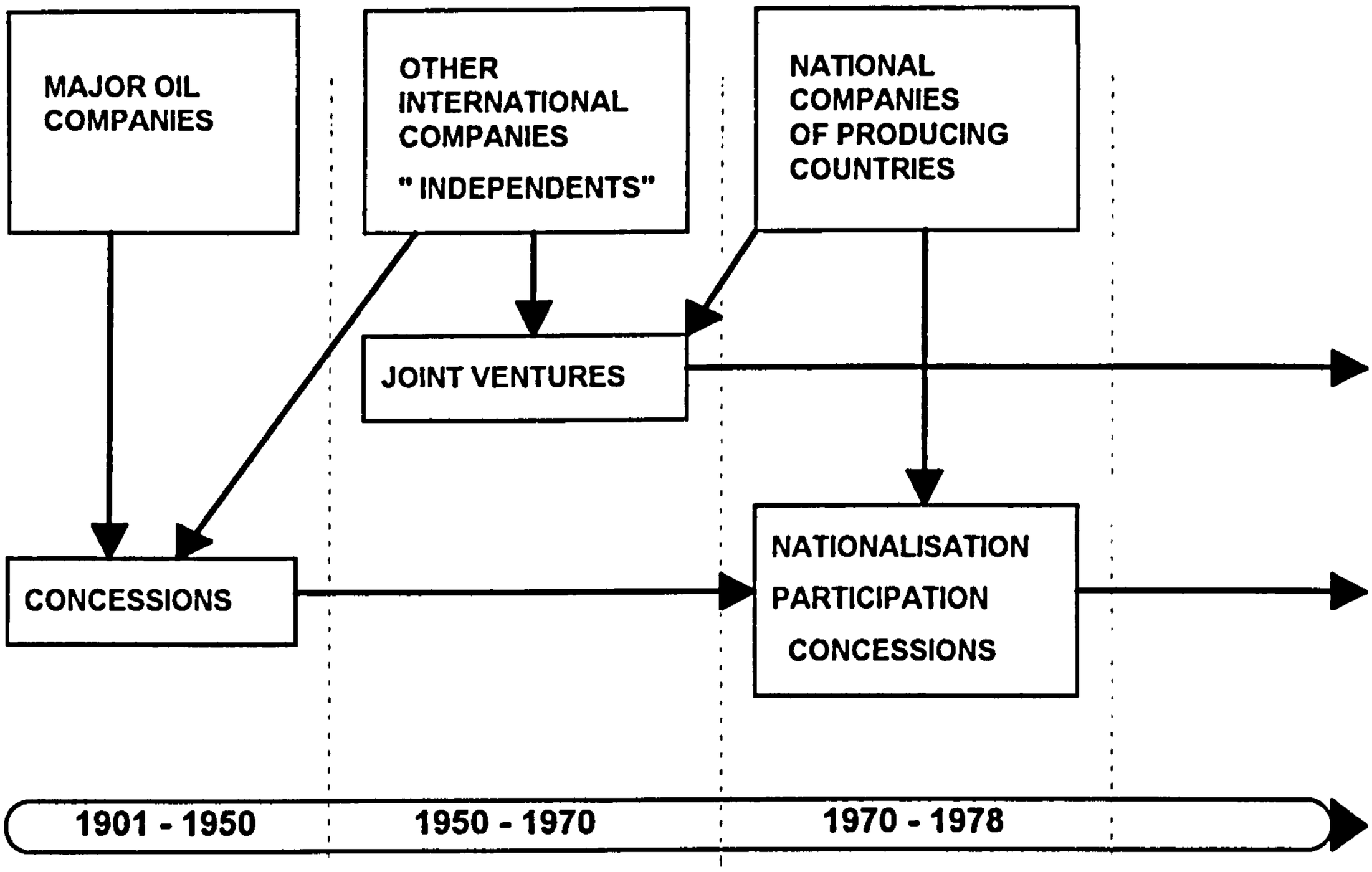
Participants	Share %	1,000 barrels per day required
Indcpendents (Iricon)	5	2,030
BP	40	2,027
Shell	14	2,027
Mobil	7	1,964
CFP	6	1,945
Exxon	7	1,890
Texaco	7	1,712
Gulf	7	1,700
Socal	7	1.644

Source: Anthony Sampson ,The Scven Sisters 1975 P 132

The British Companies (BP 40% & Shell 14%) retained 54% and gave 46% to Americans for sanctioning the coup in 1953.

The next major change occurred in March 1973 when NIOC took over all operations in the consortium area, and the consortium itself became simply a service contractor and crude oil purchasing Agency. The events in Iran triggered off major changes in the relationship of other host governments and oil companies in the Middle East. Resulting major changes in the relationships between oil companies and host governments, are shown in schematic form below:

Figure Ax 2: 1, Schematic Representation Of Relationships Between Oil Companies And Oil Producing Countries 1900-1978



* 2 Source: Changing structures in the world oil market Dr. Ian M. Torrens

7) OPEC. one of the pivotal events in the history of the century

The Arab League, since its foundation in 1945, entertained the idea of creating a petroleum association of Arab countries, But in the first Arab Petroleum Congress in April 1959 the association decided to include the large non-Arab exporters of petroleum, notably Iran and Venezuela. Accordingly the representatives of these countries were invited to Cairo as observers. But in private interviews and discussions in the lobby the possibility of creating an organisation in which all producing countries would participate became the main issue. The outcome was an agreement signed in April 1959 by the Heads of Delegations of the exporting countries, including Iran and Venezuela. This agreement became the basis for the Organisation of Petroleum Exporting Countries (OPEC).[10]

Founder members represented at the Baghdad conference of September 14th, 1960 were Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela. Qatar joined in January 1961, Libya and Indonesia in June 1962, Abu Dhabi in 1967 and Algeria in 1969. Up to 1970, however OPEC had not succeeded either in developing a strategy for taking over the power of the oil companies, or in introducing a mechanism for controlling and regulating the output of oil. There wasn't even any sign of these intentions within OPEC.

'For our part, we do not want the [oil] majors to lose their power and be forced to abandon their roles as a buffer element between the producers and the consumers. We want the present set-up to continue as long as possible and at all costs to avoid any disastrous clash of interests which would shake the foundations of the oil business. (King Faisal spoken by his Oil Minister, Sheikh Yamani, 1969)
It was not until December 1970 at the meeting in Caracas, that OPEC declared its firm intention to control the supply and price of oil produced by its member states. This time it happened to be successful! At this stage the world oil market was very dependant on the Middle Eastern oil. Figures 1 & 2 give a picture of this dependency and high demand for OPEC oil.

This is not the place to go into the complex question of oil pricing. All that need be noted is the rapid increase in the price of crude oil within the short period, since 1970 shown in figure 3.

The mass media in the consuming countries started to portray OPEC , as a giant responsible for expensive oil, cold winters, the recession, unemployment. .....and other bad news. However, it should be noted that the London Oil Policy Group, constituting fourteen of the world's largest oil companies who had been meeting regularly since 1968, also wanted to raise the prise of oil.

'Indeed, by the first quarter of 1979 for six of the major OPEC producers (Saudi Arabia, Iran, Kuwait, Libya, Venezuela and Nigeria) only about 9% of production was traded by government oriented channels. In other words the vertically integrated structure of the industry which had dominated the post 1945 scene was still intact. This was despite the widespread assumption that this structure would disappear in the early 1970's with the take-over of oil production by the host governments by means of a process of nationalisation or creeping participation.'[11]

One might be suspicious and ask fundamental questions, Why when OPEC had been basically ignored both by international oil companies and industrialised Western governments, for the first decade of existence, was it suddenly recognised and given power, and where did this power come from?

> 'The producing nations now have a cartel tolerated by the consuming countries and actively supported by the United States.(MA Adelman, 1972)
>
> 'The control of oil, the lifeblood of an advanced industrial state, by potentates who have no other instrument of power and who are accountable to nobody, morally, politically or legally, is in itself a perversity. It is a perversity in the sense that it defies all rational principles by which the affairs of states and the affairs of humanity ought to be regulated to put into a few irresponsible hands power over life and death of a whole civilisation.' (Hans Morgenthau, 1975)
>
> It is now obvious that this decision [the OPEC price rise of December 1973] was one of the pivotal events in the history of this century. (Henry A. Kissinger 1973)

8) Oil surplus & non-OPEC

In an article by Ahmad Zaki Yamani printed in 'Papers on the Economics of Oil ' in 1979 Yamani discusses 'The changing pattern of world oil supplies'. He introduced new non-OPEC supply with the following statement:

'Another important development in the oil industry during this period is the entry into the oil market of major new oil suppliers other than OPEC countries: they are the United Kingdom, Norway, and Alaska. The combined production from these new sources in 1978 is estimated to reach 3 million b/d, or more than double that of 1977. This production level represents almost 50% of their total long-term producing capacity.

The entry of these new suppliers has tended to create a temporary oversupply situation in the market. However, the growth in production from these areas is expected to taper off during 1979 and the years thereafter. Consequently, their contribution to meet world demand increment will be significantly diminished. This will again make it incumbent upon the member countries of OPEC to shoulder their responsibility in meeting the bulk of a much augmented world demand in the forthcoming years.'[12]

Then after analysing a number of other developments in the field of policy making by industrialised governments, he estimates the supply-demand as shown in the Table Ax 2: 8 for the forthcoming decade.

Table Ax 2: 5: Yamani's estimate of The OPEC share in free world supplies 1977-87

Year	OPEC production (thous. b/d)	OPEC production annual growth (%/ year)	World (outside communist area) total supplies (thous. b/d)	OPEC cumulative production (billion b/d)	Share of OPEC production in world total supplies (%)
1977	31,138	-	49,660	-	62.70
1978	31,168	0.09	51,598	11.4	60.40
1979	32,370	3.85	53,450	11.8	60.56
1980	33,439	3.30	55,369	12.2	60.39
1981	34,857	4.24	57,407	12.7	60.71
1982	36,516	4.75	59,466	13.3	61.40
1983	38,050	4.20	61,660	13.9	61.76
1984	39,860	4.75	63,810	14.5	62.46
1985	41,500	4.11	66,150	15.1	62.73
1986	43,572	4.99	68,522	15.9	63.58
1987	45,630	4.72	70,980	16.6	64.28
Total					137.4

If we compare these figures, with actual OPEC supply, we will notice the dimensions of these unexpected changes. In 1979 OPEC members produced more than 30 million barrels per day (about 1,500 million tons in the year). One year later in 1980 they had to cut back their level of production to 23 million barrels per day and even then failed to find markets in 1981. When their share declined to 22,5 m/b/d. Discussions began in to establish county quotas for OPEC members to produce a total of 18 m/b/d. An agreement was achieved in march 1983 after three weeks of gruelling negotiations culminating in a twelve day meeting in London for a quotas of 12.5m/b/d for 12 Countries and a 5 m/b/d for Saudi Arabia(suing producer with no specific quota), later Saudi Arabia agreed to produce around 2 million barrels per day (less than 20 percent of her capacity).

While even in some of the non-OPEC countries there has been the emergence of under-utilised oil-producing capacity: as for example in the oil producing Canadian province of Alberta, in Alaska as a result of transport difficulties. While other major non-OPEC producers such as Britain, Mexico and the Soviet Union went on increasing their production and export, as a result the share of non-OPEC producers increased significantly.

Table Ax 2: 6:* Sources of energy used in the non-communist world (excluding the OPEC countries in 1973 and 1985)

	1973		1985 [est.]	
	mtoe *	% of total	mtoe	* % of total
Total Energy Use	**4,045**	**100**	**4,300**	**100**
of which				
a) Imports of OPEC Oil	1,480	36.5	70	16.3
b) Other Energy Imports ?	100	2.5	250	5.8
c) Indigenous Production	**2,465**	**60.9**	**3,350**	**77.9**
of which				
i) Oil	760	18.8	1,225	28.5
ii) Natural Gas	765	18.9	775	18.0
iii) Coal	805	19.9	1,025	23.9
iv) Other	135	3.3	325	7.5

*mtoe = million tons oil equivalent. ? Oil, natural gas and coal from the Centrally Planned Economies

Table Ax 2: 9 summarises the quite dramatic changes between 1973 and 1985 in the decline of share of OPEC and the increase of the contribution of other producers and other sorts of energy to total demand.

Table Ax 2: 10 shows how in eleven out of fifteen years more oil was added to reserves than was used. Over the whole period 334.3x10 barrels were used while 509.7x10 barrels were added to the reserves.

Table Ax 2: 7: * Annual additions to reserves, oil use and net growth/decline in reserves, 1970-85 (in 1,000 million barrels)

Year	Reserves at Beginning of Year	Use of Oil in Year	Gross Additions to Reserves in Year	Net Growth(+)or Decline(-) in Reserves
1970	533	17.4	62.4	+45
1971	578	18.3	40.3	+22
1972	600	19.3	-3.7	-23
1973	577	21.2	35.2	+14
1974	591	21.2	32.2	+11
1975	602	20.2	31.2	+11
1976	613	21.9	3.9	-18
1977	595	22.6	15.7	-7
1978	588	22.9	44.9	+22
1979	610	23.7	21.7	-2
1980	608	22.8	33.8	+11
1981	619	21.3	67.3	+47
1982	665	20.1	30.1	+10
1983	675	20.0	21.1	+1
1984	676	20.6	43.6	+23
1985	699	20.8	30.0	+10
Total	-334.3	509.7	+177	

Sources: Oil and Gas Journal, 1970-85; World Oil, 1970-83; De Golyer and Mac Naughton's Annual Survey of the Oil Industry, 1975-83.

The swift expansion in the 19th century of the Russian oil industry was earnestly desired by European traders who saw Russian oil as an alternative to the monopoly which Rockefeller Standard Oil Company had established in Europe. Under the oil concession system which the Tzarist regime was content to accept.

Foreign companies mainly from the United States and United Kingdom were involved in the exploitation and development of oil in Baku in the Caucasus, in return for the payment of royalties by the oil companies, However this arrangement was terminated by the Soviet Revolution of 1917.

Although Soviet policy makers preferred using coal in the main industrial areas of Moscow and Leningrad, from the point of view of the USSR's need to earn foreign exchange to facilitate development plans, they grasped the opportunity of securing 15% of the world market ensuring that they were second only to the United States in supplying oil to Western Europe at the outbreak of the Second World war in 1939.

In 1946 the Soviet Union initiated a massive re-construction of its economy. One of the main aims was the rapid expansion of the country's oil and gas resources. This started with the development of the area between the Volga and Urals known as the 'Second

Baku' and continued later in Soviet Central Asia and in Western Siberia termed 'Third Baku' where huge new resources of oil were discovered.

The old and new areas have together yielded well over 600 million tons of oil per year since 1980, 20 percent greater than that of the United States. This success on such a large scale has reduced what was perceived as a serious potential threat to southern neighbouring countries such as Iran, Iraq or even Kuwait and the Persian Gulf's Sheikhdoms. Now the only policy of trading energy is of gas from Iran, with the Soviet Union acting as middleman in its export to Europe, in addition to its own export of gas from Siberia.

After its Iranian troubles in the early 1950 BP. adopted a policy of world wide diversification in exploration, refining and marketing. The discovery of oil at Prud hoe Bay oil field, the largest ever discovered in North America, followed by the discovery of Forties, the first commercial oil field in the British sector of the North Sea, have occupied most of BP's energies since then. Although the infrastructure and production cost of the North Sea oil was very high, and of Alaska oil even higher the huge financial resources needed came from the increase in the price of oil during 1970,s and both fields finally came to production and have been increasing. 'The American oilmen now bracketed the British with the Norwegians as being the 'blue eyed Arabs' and the Sheikhs of the north'.[13]

More than thirty giant fields and over 200 other fields have already been discovered in the North Sea region. Peter Odell[14] believes that, the prospect of the North Sea field being capable of producing well over half of Western Europe's declining oil needs year by year for the rest of the century are good. Indeed, he believes that this does not exhaust the potential availability of European oil, and goes on to argue that appropriate political and economic decisions are needed to achieve a pricing system for energy in Europe related to the cost of producing indigenous energy. More over every major oil-importing country has been taking a new look at the possibility of indigenous oil production. With the facilities of the new offshore techniques large quantities of oil and gas are expected to be produced.

As shown in Figure Ax 2: 2 the world potentially petroliferous offshore areas are several times larger than the onshore areas that almost all world's production has come.

Figure Ax2: 2, The world potentally petroferous offshore Oil.

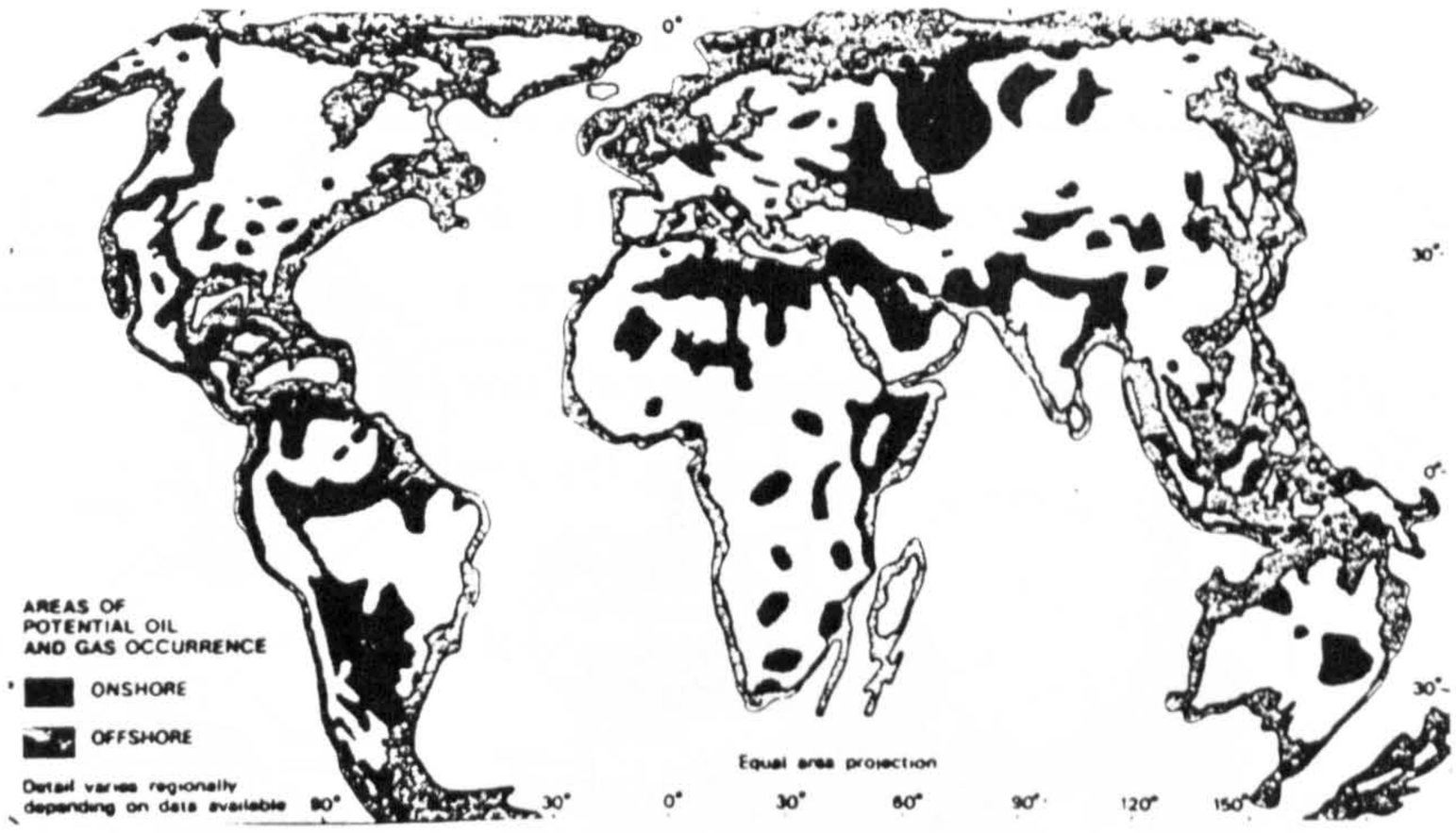
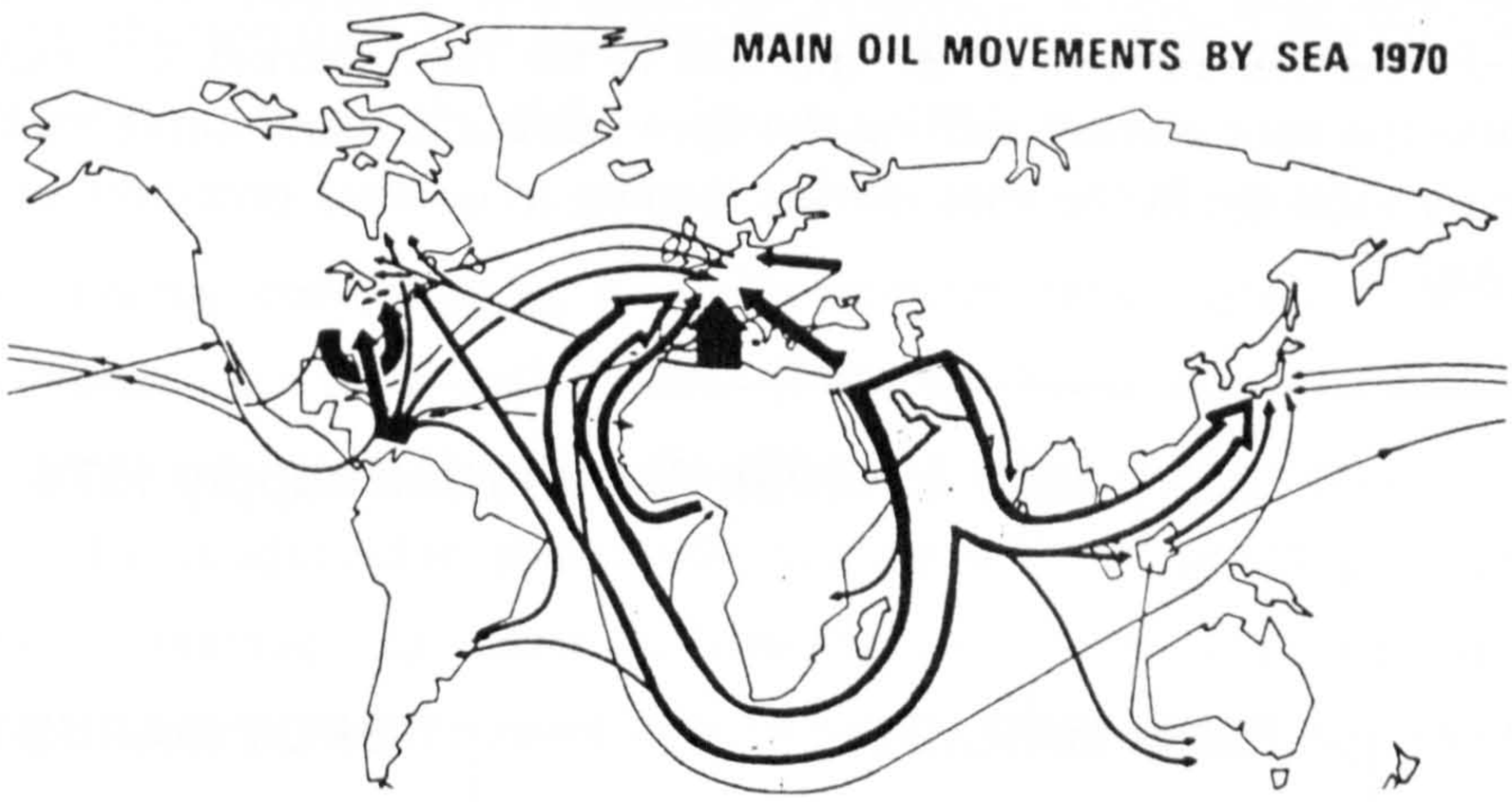


Figure Ax2: 3 shows the importance of the Middle Eastern oil in 1970s, while this pattern is not valid any more, the possible future of the oil market with a regional basis is shown

FigureAx2: 3: The importance of the Middle Eastern oil in 1970s

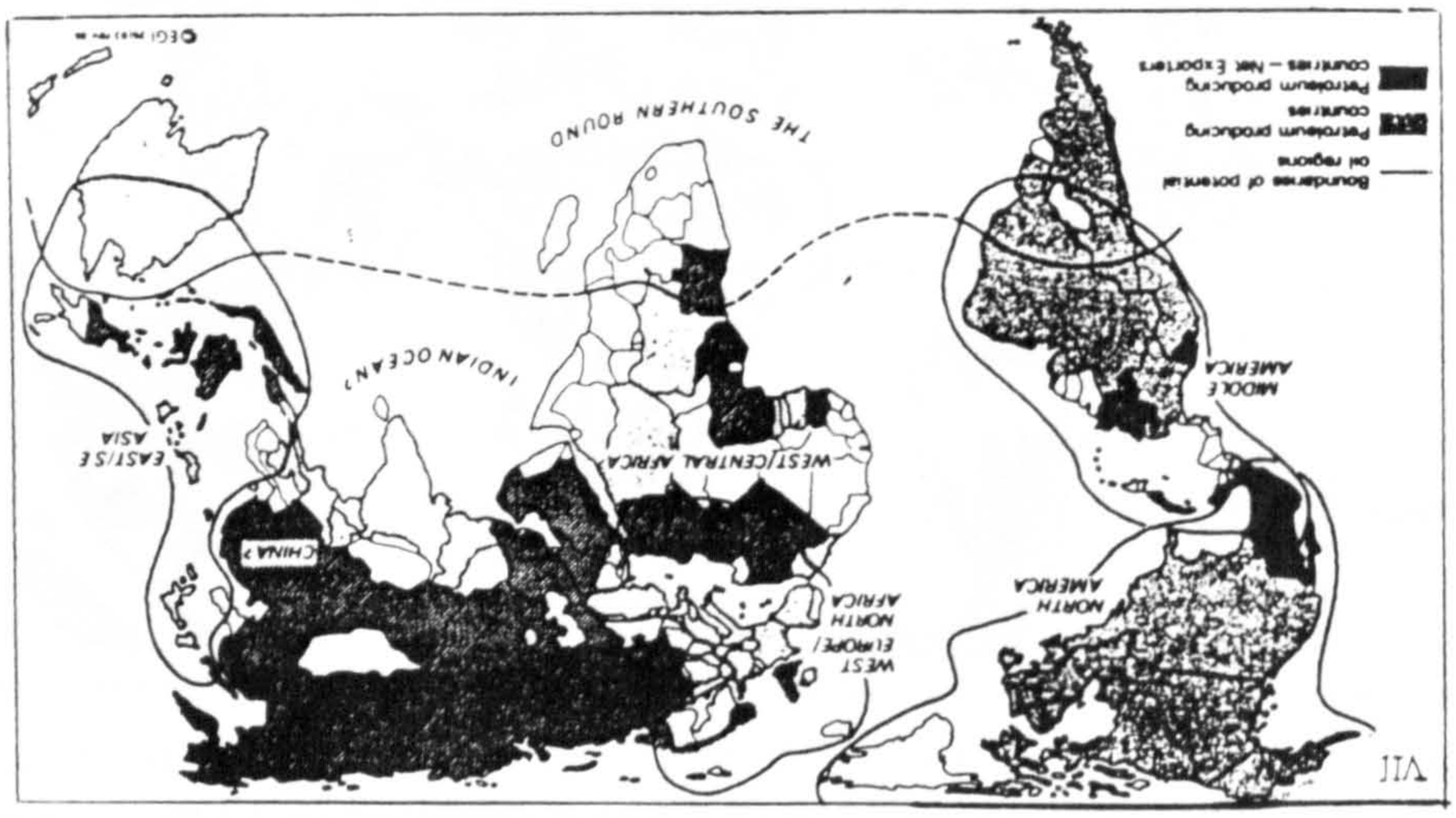


in Figure Ax 2: 4.

9) The problem of keeping the price up

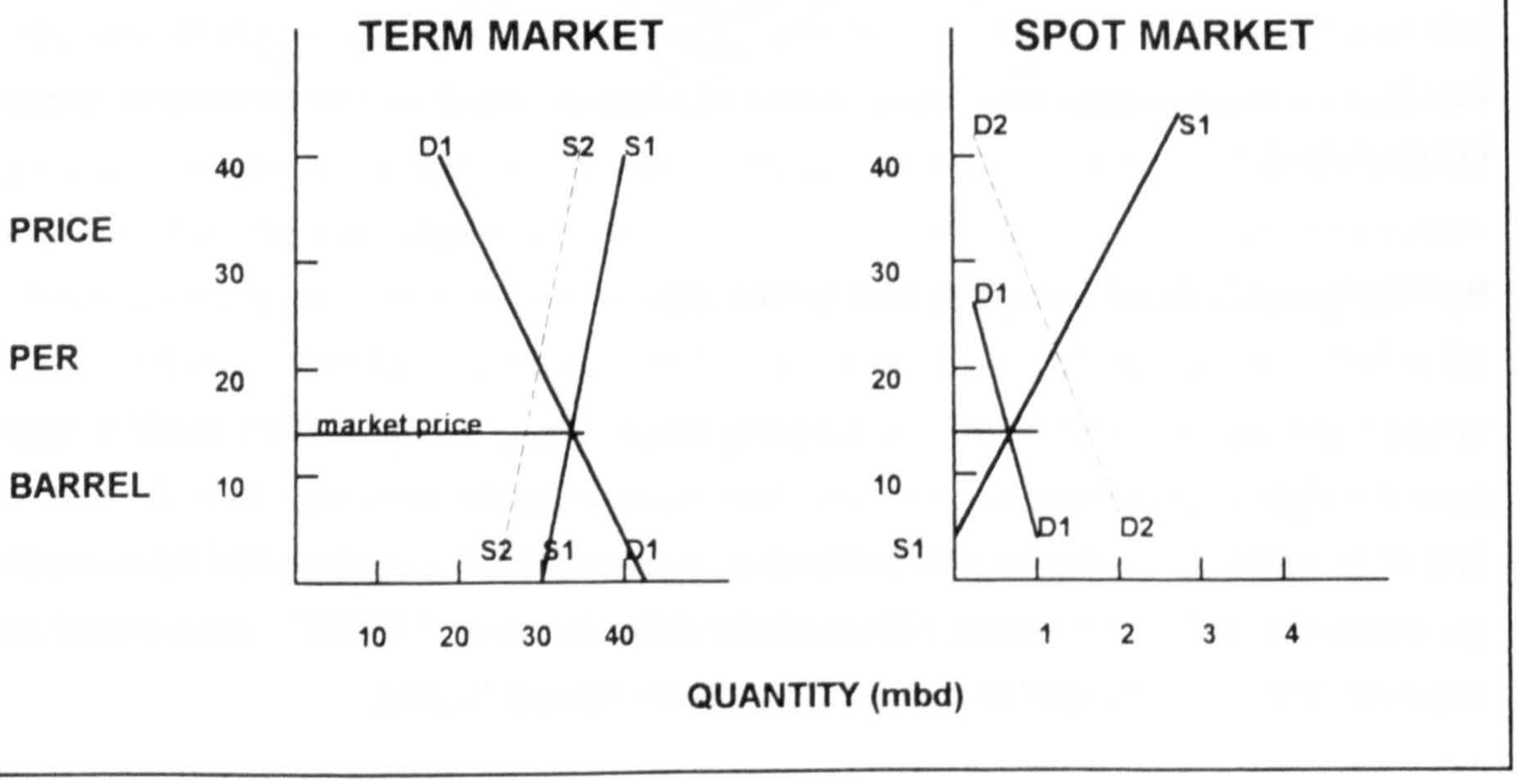
While there was and still is little or no acceptance, that a group of third world countries have the right to join together to secure their interests in the same way as is the case with O.E.C.D. and E.E.C.; the Intentional Energy Agency (IEA) was instructed by its member governments to direct its main efforts to minimise the use of OPEC oil-no matter what the cost. This aim was spelled out in I.E.A's 1980 Annual Report.

Figure Ax 2: 4: The future oil market with a regional basis



'The Iranian oil strike and revolution meant that between the third quarter of 1978 and January 1979 Iran's production fell by some 5 mbd. Therefore the supply curve in the term market shifted from S1 S1 to S2 S2 although the shift was not by the full 5 mbd because other OPEC members increased their production to offset the fall by round 3.7 mbd. As a result of the shortfall in the term market, the excess demand spilled into the spot market shifting the spot market demand curve to D2 D2. This generated a shortage in the spot market leading to upward pressures of price'[15]. see Figure. Ax2: 5

Figure Ax2: 5; Crude demand and supply 1978



OPEC now is used to control the prices in a level, as mentioned earlier. This price level is that which is necessary for the Western oil industry to prosper. But the danger to the survival of OPEC lies in the present weak international oil market and the increasingly available substitution to OPEC oil. There is a tendency for members to disobey the quotas determined by the group. In this situation the 'imposed' Iraq-Iran war, (later called the 'tanker war' and recently 'oil war') was a heaven sent event for those trying to keep the price up and control the Persian Gulf supply.

In his book Oil and Power Sheikh R. Ali argues :

> 'The six Arab nations making up the GCC (Gulf Co-operation Council) sit on one-third of the world's oil reserves. Recent attacks on oil tankers have not only greatly increased the cost of insurance, but have also made its availability more difficult'.[16]

These increased costs help to keep the price of Western producers, with their more expensive production costs, such as in the North Sea, more competitive. Thus by reducing oil production from Iran and Iraq and other producers in the Persian Gulf, a sort of control is put on over-supply oil from the region.

Industrialised energy using-nations, who are investing large sums of capital to develop indigenous energy resources, will do any thing to ensure that the oil price does not collapse. This is especially the case for those involved with expensive exploitation. Meanwhile OPEC is advised to stick to the 'ceiling' and the agreed quotas. For instance, Saudi Arabia's continues to allow its exports to fall, by the summer of 1985 oil production was down to a little more than two million barrels per day. From 10 m/b/d in 1980![17]

Since 1979 the share of OPEC supplying the non communist market has sharply declined. In 1985 the OPEC countries exported less than half the amount they exported in 1973, Over all however there has been a drastic change in the shape of demand for OPEC oil. Prior to 1973 this had showed a growth of about 7.5 percent per annum over 25 years, It then dropped to less than 1.5 percent during the period 1973-79. After 1979 slow re-growth has again been replaced by a declining rate to about 5 percent per annum.

The solidarity of OPEC in a situation in which the demand for OPEC oil is continuing to be reduced by the expansion of resources and production of Western non OPEC countries is critical. Thus it is necessary to keep the price at a relatively high level to

make their production economical in the light of the investment to develop new resources.

The main objective of OPEC is to restrict their member countries' total production of oil to the volume that was estimated to be needed to equate world supply with the world demand after taking non-OPEC production into account This policy caused halving OPEC's contribution to world oil supplies and of course OPEC countries had to follow this policy under political pressure. They expected non-OPEC producers, who were more vulnerable to price decline, to co-operate and reduce their output and help to re-balance supply with demand. (They claimed the Britain and the North sea late comers, politically perhaps more appropriate comparing the United States and Soviet Union). They also expected other non-OPEC oil-exporting countries in the third world as Mexico, Egypt, Oman, Malaysia and Angola to co-operate. OPEC appeared to believe that its decision to ease their production and export a little, and thus not to threaten existing prices. And that this would so frighten other producers that they would more or less co-operate.

These expectations and pressure from OPEC were not realised, so the price of oil fell from $ 28 in January 1986 to just over $ 15 per barrel in 1985 OPEC countries refusal to further reductions caused a further decline to about $ 13 per barrel and even to $ 10 for North Sea Brent Crude and Texas Intermediate Grade in April 1986.

Looking for evidences in the literature recently published on oil, I found chapter 6 of 'OPEC And The World Market by A M EL-Mokadem, D Hawdon, C Robinson and P J Stevens' similar views to my own .these are summed up by the following quote:

> 'The role of the international oil companies in the world oil market and their relationship with OPEC from the early 1970,s to the present, has been subject to a great deal of discussion, and a considerable amount of controversy. Whereas before, the companies were criticised for gaining too much, during the 1970,s they were attacked because they were losing too much and too easily. One particular theory which gained a certain amount of credence at this time was the theory of a conspiracy between the major oil companies and OPEC to raise oil prices.
>
> Peter Odell suggested that the majors, observing that their profits had stagnated throughout the 1960,s took a conscious decision around 1968 to try to upgrade profits. With changing market and other circumstances in favour of the producing countries the oil companies decided that the only way of upgrading profits was to conspire with the producing countries in their attempts to raise prices. Thus, as OPEC members raised their

prices, in a rising demand situation the oil companies were able to pass on these higher prices to maintain their proportional margins with the result that their overall profits rose. Moreover, higher prices increased the profitability of their investment in higher cost alternative energy sources.

Advocates of the 'conspiracy' theory usually base their case on the presence of a motive to commit the crime. This amounted to 'circumstantial' evidence covering the period 1960-1974, and 'supporting' evidence in the late seventies. The motive was to upgrade profits and to reduce dependency on Middle East oil as its political future grew more uncertain. Circumstantial evidence was to be found in the companies attempts to diversify their interests both geographically and functionally. Geographically, it is certainly true that the rate of discovery of crude oil outside the Middle East, which had been low and static through the 1930's, started to rise in the late 1950's, reaching a relatively very high level in the early 1970's only four billion barrels below that of Middle Eastern discoveries. At the same time companies were diversifying out of oil into other energy sources, and occasionally in non-related field. Conoco, Occidental, Gulf and Exxon all moved into Coal; Gulf, Exxon, Conoco, Sohio, Kerr-McGee moved into uranium mining; Gulf and Shell moved into nuclear plant construction; while Exxon moved into fuel fabrication.

Moreover, statistics of companies profits in the 1970,s gave initial support to the conspiracy hypothesis. Profits of the Chase Manhattan's group of oil companies rose by a mere 45 per cent from 1967 to mid-1972, but started to rise at a spectacular rate after 1972. In less than two years from 1972 to 1974, profits increased by roughly 150 per cent.

To prove the existence of and explicit plan of conspiracy between the major companies and OPEC requires hard evidence which at present the authors are not aware of. Of course, any such evidence would be hidden'.

Having made their strategic investment in higher cost alternative energy sources it its also likely that the oil companies decided to take the necessary steps-under alternative scenarios-to ensure the profitability of their higher cost investments. The scenario of rising prices in the future must have entered into their calculations. Moreover, company profits have risen nowhere near as fast as consumer country governments' tax revenues. Should we interpret this as implying a conspiracy by the consumer's governments with OPEC. to raise prices? This would be much easier to prove, particularly with reference to the US government. Oppenhiem has documented how the Nixon Administration may

have encouraged OPEC to raise prices during the 1970,s. To reject the hypothesis of conspiracy. Turner says.

> 'Any company which encouraged OPEC to raise prices would have been taking a major gamble. It is by no means clear that diversification was sufficiently developed by companies at that time to make it logical to push for higher world energy prices, particularly since the cost of producing new energy sources was obviously going to be very much higher than the 10 cent per barrel for producing Middle East oil, which still only cost the companies an average of $1.05 per barrel in 1970 after all payment to host governments had been made.'

Turner argues that it would have made more sense for the majors to have encouraged high-priced oil if other sources of energy had been available to them, but this in fact was not the case in the early 1970,s.

Tuner goes on to argue,

> 'It would, therefore, have been suicidal for Gulf to encourage a policy which priced its oil out of world markets on the assumption that the stimulus thus given its coal activities could somehow compensate for the loss of income. Even if they had backed such a strategy, they would have found themselves in the precarious position of expanding activities which could be made profitless whenever OPEC decided to reduce prices toward the level of marginal operating costs. Unless companies like Gulf and guarantees in advance that parent governments would underpin high-cost investments against such a threat, (the floor price concept), they would have found themselves in an impossible situation.'

Although we disagree with some parts of this argument, Odell specifically notifies that the Gulf States will have little share in the future of the oil market.

> 'One could argue that the major exporting countries of the Gulf have themselves created the conditions which necessarily exclude them from the future world of oil. . . . . in a world which, with a much lower growth rate in oil use, has alternative oil supply options open to it. This is especially true when the economic element in the argument is coupled with the fears for the security of the oil supply potential of the region as a result of issues such as the Arab/Israeli dispute, the conflicts and potential conflicts between contiguous oil-rich countries of the region, and the rise of Islamic militancy.[18]

10). Conclusion

It is vital for the future of the Iranian economy that we come to some understanding of how the world oil industry will develop. Oil revenues have been central to the Gulf Oil producing economies for the past three decades and any marked fluctuation in the oil markets will obviously have a significant effect on these economies.

In the 1970's during a period of relatively high oil revenues, Iran spent between 30% and 40% of these 'petrodollars' on its construction industry. One could almost call it a 'Construction-Economy'. Now, in the context of a protracted imposed war and drastic decline in oil revenue, construction has all but stopped, the available revenue now going towards the war effort. Before drawing some conclusions, perhaps it would be well to take a historical view, and to remind our selves that oil is only part of a long and complicated development:

Although we are still in the era where oil is dominant it is clear that new forms are jostling to take over this leading position and that nuclear, solar or wind energy-or indeed a combination of them-will soon be dominant. The question is not if this will happen, but when.

I would contend that the major oil companies foresaw the demise of oil and prepared for it in a number of ways. Firstly they have under taken expensive research and development into new energy resources and systems. More interesting though is the very subtle way they have increased the price of oil during the last fifteen years as a way of preparing the market for other energy forms and of financing the new Western oil fields. They have done this through OPEC, which the Western companies not only tolerated but supported, through the encouragement of various economically de-stabilising conflicts, notably the Israeli-Arab war and the imposed Iraq-Iran war and through the myth of oil scarcity. It was not until the early 1970s that the so called shortage of oil was mentioned and the myth was bolstered to such an extent that the price of $ 1.6 per barrel in 1970 was soon left far behind.

The conventional wisdom in the west is that the huge rise in the price of oil was engineered by the oil rich Arab countries. What, after all, did the Western countries stand to gain by having their fuel costs increase? I will examine the question of how, if at all, the Arab economies benefited later. But, why should the Western governments want higher oil prices? The Seven Sisters companies had been involved in expensive oil

exploration for some time and although this exploratory work had born fruit, in Alaska and the North Sea for example, the reserves they had discovered were very expensive to extract. Middle East oil is largely onshore oil and quite cheap to extract.

The price at which Middle East oil could be sold was prohibitively low as far as the new, more difficult fields, were concerned. Higher prices were obviously more attractive to the Western Oil Companies as high prices would enable them to sell their oil at a profit. And indeed profits from non-OPEC oil have soared, and have depended on high prices. When prices began to fall again recently it was the viability of these new field which was jeopardised, not of the Gulf oil fields. The attraction of higher prices and bigger profits is increased when we consider the huge sums which the companies were spending on research and development into new energy forms.

The preparation of those energy forms which were to replace oil had to be financed by oil itself. Indeed the consolidation of a higher bench mark for oil would make nuclear energy, for example, more financially viable, neutralising one of the arguments used by some of the oil companies domestic opponents in the anti-nuclear movement.

Now that we have considered what the major oil companies stood to gain by higher oil prices, what of the Gulf producing states? Did they not gain too? The Gulf States certainly earned very large sums of 'petro-dollars' from selling their commodity. However, in the absence of any significant industrial base in the Gulf States, these dollars had to be re-cycled to the West in order to buy manufactured goods. The Gulf States spent most of what they earned on goods and services, keeping vast sums of petro-dollars flowing round the West's economic system, and more recently even greater amounts have flooded back to the west in Weapons payments. In this latter respect, as far as the Western economies are concerned, the Iraq-Iran war was heaven sent.

A proportion of Iran's oil revenues were of course spent within Iran. Most of this money, as mentioned earlier, was spent on the construction industry and caused the serious economic and social imbalances already outlined. This policy also produced, in the absence of native heavy industries to supply the construction industry, an essentially imported construction industry.

It can be seen from this paper that the Gulf countries have not been able to control either their own oil or, indeed the limited financial benefits derived from that oil. We know from history what happened when Iran attempted to wrest control of the oil industry away

from the Western companies. Musaddiq had massive popular support for his nationalisation programme, and yet the CIA was able to replace him with someone more pliable. Today we have essentially the same relationship between exploiting Western companies and the exploited Gulf States, only the methods have become more subtle.

In the 19th Century when West Africa's energy resource, slaves, were no longer required, the area was left economically dependent and socially disrupted. In order to avoid a similar experience, it is necessary to remove Iran's dependence on oil as a trading commodity and to develop it as the basis of an integrated, industrial network. We need to destroy the illusion that some of our policy makers have that we own a golden goose that will lay eggs for ever. The oil market is changing and the goose may soon be extinct. Before it dies we must use its remaining usefulness to restructure our economy. We must start to look at oil, not as a trading commodity, but as a source of energy, a tool in building our industrial base. This will obviously include a construction industry which is serviced by a native industrial infrastructure.

It is perhaps time to relate the developments in the world oil market to those in Iranian industry. What was happening in the Iranian construction industry, for example, during the oil boom?

The oil revenue explosion in Iran coincided with the start of the Fifth Economic plan (1973-78). However this was mainly a shopping list of various construction projects, and under a regime of economic despotism, such a plan could only be at best an empty propaganda ploy and at worst a terrible waste of resources The economic background to the 1973 price explosion had been fairly sedate. Growth in GNP between 1962 and 1973 of 5% to 6% was steady. In manufacturing, construction and non oil mining, the latter including revenue from the sale of gas to the Soviet Union , annual growth of around 10% -11% was achieved. Service industries increased by 8%-9%, agriculture by 2% and oil revenue by 20% per year.

The growth in GNP after 1973, although very large, is less interesting than the differing rates of growth in the non oil sectors. The Construction Industry rocketed and would have grown even faster had it not been for the shortage of skilled workers , such as plumbers, bricklayers and even managers ,and more fundamentally, a shortage owing to inadequate sea ports, of building materials such as cement, steel, bricks etc. The Construction Industry had a permanently large share of the massively increased oil revenues. These revenues, which had been 40'000 million rials in 1963 rose to 133'330

million rials in 1973. GNP showed a similar massive increase from $4'323 million in 1963 to $ 49'365 million in 1973. In addition to housing, roads and urban infrastructure, money was earmarked for the areas such as agriculture, but even here it was spent on construction projects such as huge dams. Most of these projects tended to be prestigious schemes of dubious value and were heavily dependent on foreign resources.

Although Iranian industry in general grew quickly during the post 1973 period, and in fact contributed 18,7% of GNP in 1977-78, the construction fever created by the oil revenue explosion was so intense that between 1974 and 1977 the share of construction in GNP almost outstripped that of manufacturing itself. This rapid growth in the Construction Industry had serious social implications. The share of labour taken up by the Construction Industry increased markedly. This led to a large migration of farmers to the cities, caused a paralysis in agriculture and tremendous urban problems. The rapid rising labour demand led to a rise in the wages of construction workers from 100 rials a day in 1972 to 500 a day in 1973. This rapid increase resulted in turning to equipment based construction technology and a dependency on imported construction equipment. This was an added factor in drawing manpower away from agriculture to the cities. Materials and equipment were imported and with them modern technology introduced and employed. The development of our construction industry was rushed and developed a linear way with very weak roots in the national economy and related Industry.

This very brief description gives some idea of what was happening in the Construction Industry, built as it was up by petrodollars to serve petrolic despotism. Although one could argue that it almost died with the stopping of its life blood (petro dollars), what is actually left behind? We have shown that the changing pattern of the world energy and oil market means that a return of petrodollars is a false hope. Bearing that in mind, how are we to use the remains of our Construction Industry to develop a dynamic and healthy Construction industry appropriate to Iranian needs?

11) End notes

[1] Sutton. Elwell L. P., Persian Oil 1955 p12 - 13

[2] Katuzian. H., The Political Economy Of Modern Iran. 1981. pp244 - 253

[3] Issawi. Charles, Oil, The Middle East. 1972. p12

[4] Op. cit.Sutton, Elwell L. P.

[5] The British Petroleum Company Ltd., Our Industry Petroleum. 1977 p502

[6] Op. cit.Sutton.

[7] Op. cit.Sutton.

[8] Op. cit.Sutton.

[9] Op. cit.Sutton.

[10] Rouhani. fuad, A History of OPEC., 1971 p76

[11] El Mokadem. A.M., Howden. D., Robinson. C., Steven P. J., Opec and the World Oil Market., 1984 pp36-37

[12] Abdel Fadil Mahmood, Papers on the Economics of Oil. 1979 p23

[13] Op. cit. Sampson Anthony.

[14] Odell. Peter. R., Oil And World Power.1986 pp 230 - 280

[15] Op. cit. El Mokadem. A.M. et al, 1984 pp38-39

[16] Sheik R. Ali., Oil And Power.

[17] El Mokadem. A.M.et al,1984

[18] Op.cit. Odell.

APPENDIX 3
Development Plans before the Islamic Revolution, and broad reasons for the failure of industrialisation in Iran.

1 Development Plans before the Islamic Revolution,

a) The First Development Plan 1949-1955

The Allied forces invaded Iran in September 1941 and the occupation continued until a few months after the war ended in 1945. It is believed:

> 'It has been observed that the economic impact of the occupation was devastating. The Allied forces needed many items for their own consumption(i.e. food, tobacco, etc.). They effectively forced the Iranian government to put the country's resources at their disposal. This was carried out by means of monetary `policy', which included the devaluation of the Iranian currency, (the rate of exchange was $1.0=17.1 rials in 1941, this was changed to $1.0=32.5 rials in 1942), the extension of credit to Russia and Britain, and the (imposed) expansion of money supply. In plain language, 'the whole thing - the devaluation, the printing of money and the lending to Britain and Russia - was a case of armed robbery against a desperately weak and poor nation'[1].

Partly as a result of the ravages of the war, to all intentions and purposes the implementation of the First plan really never got under way. The first two years were mainly devoted to the setting up of the Plan Organisation and related administrative matters. Moreover, the nationalisation of the oil industry in March 1951 and the ensuing crisis, cut the Plan Organisation finances to the bone. The First Plan was altogether crippled, because of the economic hardship, the government even failed to reach an agreement with the International Bank of Reconstruction and Development (IBRD) for a loan.

A survey was carried out of the Plan Organisation's activities since its establishment in 1954. According to this survey the actual expenditure effected by the Plan Organisation from July 1949 to September 1954 was about 4180 million rials (128.6 million dollars in 1942 exchange rates). This meant that only 20 percent of the contemplated expenditure had been effected in that period.

During this period the expenditure on development projects in different sectors of the economy were as follows:

Table Ax3: 1; The expenditure on development projects 1949-1954

Transport and Communications	37.1 percent.
Industries and Mines	28.2 percent.
Agriculture	24.1 percent.
Social Welfare	5.2 percent.
Oil industry development	5.0 percent.

b)The Second Seven-Year Development Plan.(1955-1962)

During the second seven year plan the pace begun to accelerate. As public development expenditure rose there was an increasing volume of work for Iranian contractors. With no restrictions on new entrants into the construction industry, the number of such contractors increased rapidly. Toward the end of the Second Plan the Government accordingly saw itself obliged to introduce for the first time a system for classifying and qualifying local contractors. While foreign contractors continued to carry out major civil works, particularly dams and industrial construction, there were a growing number of Iranian contractors capable of doing road and major building construction.[2]

Concerning the content of the plan K Mofid[3] has this to say:

> '... to use the word 'plan' is somewhat misleading, as the `plan' **was simply a list of projects** on which funds, presumed to be available, were to be used. The `plan' said nothing about how these investments were to be used. It also said nothing about how these expenditures were to be co-ordinated with those of the rest of government, nor did it concern itself with the economic policies of the government, nor with the private sector'.

In this period, the Iranian government received the sum of $3,407 million in foreign exchange, $ 2,129 million of it was from oil revenue and the rest was from investment. This figure does not include the amount of foreign exchange received from exports on non-oil profits. The following chart is an account of the sectoral distribution of expenditure under the Second Plan.

In the Agriculture Sector 17.7% of the 23.46% (i.e. 75 percent of the investment) was spent on irrigation work, mainly on the construction of three large dams and canal networks. Expenditure in industry and mines was used for the

Table Ax3: 2; Sectoral distribution of actual expenditure by the public sector under the Second-Plan (1955-62) (Billion Rials: At Current Market Prices)

SECTOR	AMOUNT	PERCENT
Agriculture and Irrigation Irrigation	23.46 (17.7)	31.2 (23.5)
Industry and Mines	8.82	11.7
Transport and communications	29.94	39.8
Social Affairs Regional Development	13.00 (12.00)	17.3 (16.O)
Total	**72.00**	**100.0**

Derived from: Kamran Mofid Development Planning in Iran from Monarchy to Islamic Republic. 1987 Table 2.3 p43

completion of construction and the extension of state-owned factories, including for example two large cement factories (in Loshan and Doroud) and a chemical fertiliser plant in Shiraz. Road construction absorbed the largest share of expenditure on transportation and communication. The intention was to construct or improve 10,700 kilometres of roads with 10.6 billion rials. In fact only 5503 kilometres were completed at the cost of 18.2 billion rials. The expenditure on railway projects went towards the construction of the Tehran-Mashhad railway and the extension of the Tehran-Mianeh railway to Tabriz. In the Social Affairs Sector the main expenditure was on Regional Development, which consisted of medium and small sized building projects in different regions of the country.

c) The Third Development Plan (1962-1967)

During the Plan period (1962-67) Iran received $3,644 million in oil revenues and $580.7 in foreign loans and credits, as well as $916 million from non-oil exports. This gives a total of $5141 million in correspond to 389 billion rials with the rate of $1.=75.75rial.[4]

In the Agriculture Sector the share of Irrigation was 44.9 per cent of the total expenditure for this sector. It is important to mention here that the Third Plan called for a change of emphasis away from the large dams of the Second Plan to smaller dams and canals, *Ghanat* development, and deep wells. However yet again the construction of six new major dams began, and by the end of 1966 three of them *Sefid Rud, Zayandeh Rud,* and *Aras Rud* were completed.

Table Ax3: 3; Sectoral distribution of actual expenditure by the public sectorunder the Third-Plan (1962-67); (Billion Rials: At Current Market Prices)

SECTOR	AMOUNT	PERCENT
Agriculture and Irrigation Irrigation	47.3 (21.7)	23.3 (10.6)
Industry and Mining	17.10	8.3
Power and Fuel	32.00	15.6
Transport and communications	53.80	26.3
Housing and Public Buildings	12.20	6.0
Social Affairs	42.20	20.7
Total	**204.60**	**100.0**

Derived from: Kamran Mofid Development Planning in Iran from Monarchy to Islamic Republic. 1987 Table 2.4 p50

In the Transport and Communication Sector, road construction absorbed 67 per cent of the total expenditure. Contrary to initial Plan objectives, emphasis was placed on the construction of main roads rather than much needed regional rural roads. In Industry and Mining, although a change of policy was declared to minimise direct public investment in industry, while providing help and assistance to the private sector, particularly favouring of small and medium-scale industries, in reality no such change took place that was not the case. The government carried on investing in state-owned capital intensive projects industries, such as the construction of the steel mill in Isfahan, two large industrial complexes of the machine-tool plant in Arak and in Tabriz, a tractor-making factory , and in the aluminium industry. In addition there were some joint ventures between the Iranian government and foreign companies. With Allied Chemicals for example to produce chemicals mostly for export, and with B.F. Goodrich in order to produce polyvinyl chloride (PVC), detergent and caustic soda for domestic use. These projects not only absorbed 9.6 billion dollars, 56 percent of the total expenditure of this sector in the Third Plan, but the bulk of allocations in the Fourth Plan as well.

During the third plan; the construction industry became rapidly overcrowded despite the rapid expansion of construction demand stimulated by rising development expenditures, and a diminishing share of foreign contractors in the construction market.[5]

d) The Fourth Development Plan 1968-1972

Undoubtedly Iranian Construction is capable of implementing the tasks of the Fourth Five Year Plan. The challenge does not appear in the volume of performance but in a better economy and quality in general. A wide space for improvement is available there, to this end the level of Iranian construction which is already achieved provides an excellent opportunity for facilitating for the setting up of targets similar to those in developed countries. However there is one important difference. While most efforts in

developed countries are focused on capital intensive methods, under Iranian conditions (at least for the near future) a sound equilibrium between labour intensive methods and application of modern equipment and plants must be devised. This difficult task which cannot be left to simple improvisation) requires deep analysis, study and research. Some of the most relevant development problems implying rationalisation and gradual industrialisation may be summarised in the following groups:

a) Completion and promulgation of building regulations including anti-seismic provisions. Establishment of a regional building code. Popular building instructions for rural areas aiming at the upgrading of self-help housing standards, specially as regards improved earthquake resistance of structure;

b) Adoption of modular system and dimensional co-ordination;

c) Promotion of standardisation of building materials, elements and prefabricated components in order to accelerate the systematic promulgation of national standard specifications for all types of locally manufactured materials;

d) Improvement of statistical coverage of building materials industries and construction in general.[6]

During the five year period of the Fourth Plan the total investment of public and private sector was planned at 810 billion rials, of which 443.5 billion rials (%55) was planned to be invested by the government in the public Sector and 366.5 billion rials (%45) by the private sector. At the end of the period the actual expenditure in the public sector was 554.5 billion rials divided between different sectors (public sectors) as shown in the Table below.

' while nothing was said about the size of the private sector programme',[7]... 'and the plan was by and large open-ended in terms of private investment and the policies necessary for calling forth the planned private response'. As can be noted, the priority in investment was given to Industry and mining and then to transport and communication.

The government priorities and also the nature of projects in different sectors were very much similar to the third plan. Investment in Industry and Mines showed again a tendency towards capital intensive industries such as the steel Mill, machine tool manufacturing, and aluminium smelting, petrochemical and chemical industries, and then

mechanical and electrical industries. To note the degree of importance of the investment on these sectors, see Table below.

Table Ax3: 4; Gross Domestic Fixed Capital Formation 1968-72 at constant 1959 prices; Billion rials at market prices.

Year	1968	1969	1970.	1971	1972	Average annual growth
Gross domestic fixed capital formation	126	132	140	179	212	13.9
Machinery and Equipment	45	49	52	66	81	15.8
Construction	81	83	88	113	131	12.7
Share of machinery & equipment in total	36%	37%	37%	37%	38%	
Share of construction in total	64%	63%	63%	63%	62%	

Looking at the information given in the Table above, it is evident that in this period construction absorbed a much higher share of the total Gross Domestic Fixed Capital Formation (GDFCF), about 63 per cent of the total. This is partly due to the direct construction of public buildings such as military and ministerial buildings, and partly to the share of building construction in other sectors such as factory buildings in The Industry and Mines sector, schools in the Education sector or hospitals in the Health sector. Irrespective of the general conclusions concerning the effects of the fourth development plan, it is important to mention here the remarkable absorptive capacity of the modern sector of the domestic construction industry and its ability to expand.

Table Ax3: 5; Sectoral distribution of planned and actual expenditure by the public sector under the Fourth Plan 1968-72; (Billion Rials: At Current Market Prices)

SECTOR	Planned AMOUNT	PER CENT	Realised AMOUNT	PER CENT
Agriculture	60.5	13.2	46.7	8.4
Industry and Mining	98.9	21.6	115.6	20.9
Oil and Gas	26.3	5.8	61.7	11.1
Water	48.5	10.6	45.3	8.2
Power	38.0	8.3	42.2	7.6
Transport and communications	79.6	17.4	84.3	15.2
Telecommunications	20.3	4.5	46.5	8.4
Rural development	8.8	1.9	10.3	1.91
Urban development	7.0	1.5	9.1	1.6
Public housing & construction	**23.0**	**5.0**	**43.0**	**7.8**
Education	19.4	4.3	19.0	3.4
Culture	1.8	0.4	1.5	0.3
Tourism	3.6	0.8	3.5	0.6
Health	12.4	2.7	15.7	2.8
Social Welfare	4.9	1.1	5.7	1.0
Statistics and other	4.1	0.9	4.4	0.8
Total	**457.1**	100.0	**554.5**	100.0

'By early 1972 there were reported to be about 800 Iranian general contractors including 350 individual proprietorships of which 200 were characterised as small, and 450 companies. This number excludes individual artisans engaged in building, some 60 companies doing specialised work such as plumbing and electrical installation, and people active only as sub-contractors. Of the 450 companies, 180 belong to the Syndicate of Iranian Contractors and are said to account for most of the business volume of prime contractors in the organised construction sector.'[8]

e) The Fifth Development Plan. 1973-1977

The announcement of the World oil prices increase by OPEC at the Tehran conference on 23d of December 1973 meant that the country's financial resources were going to quadruple in just over two months. In fact the governments revenue per barrel of oil jumped from $1.85 to $7.0 in 1973, and to $10.21 by the end of 1974. For the nation it was good news but for the modern sector of construction industry as a whole, it meant an unprecedented expansion of an already too high workload, lower competition for individual companies and assured profits for all.

This drastic increase in the oil price, immediately made the Shah feel over-confident, and he made a flurry of promises to Iranians, which in turn led to a high and rising level of expectations. Moreover the Shah's over confidence, and in his own eyes at least, his increased status on the political scene as a result of his apparent confronting of the West on the oil price issue, led him to a more despotic approach in his decision-making. As K Mofid states:

> 'The confidence factor also led to more centralisation of power and decision-making, arguably the opposite of what should have taken place. In the face of an increasingly complex economy, and in what was to follow, efficiency requirements would have been best achieved by increasing delegation of authority at all levels. The confidence factor in effect was to reduce such delegation, as the Shah relied increasingly on his own decision-making powers, a tragic mistake that came to haunt him only two years after the (period of) oil boom.'[9]

The Shah promised 'the great civilisation' that was to bring about a national state of well being through industrialisation. This was to be achieved within the lifetime of one generation and would lead to the full regeneration of Iran's ancient glory. This was all to be implemented through the strategy of a 'big-push' in development planning financed by oil revenues. The original Development Plan which had already started in March 1973 was abandoned in favour of a totally revised Plan. The original Fifth Plan was in itself an ambitious plan, but the revised one was totally unrealistic and damaging.

The shear dictatorial appetite of the Shah accompanied by the state of euphoric expectation in the country, which he himself created, meant that the Shah could easily dismiss the warnings of the Planning Division of Plan and Budget Organisation (PBO) concerning the dangers of adopting a 'big push' strategy of development. We do not intend to discuss development theories and the problems of the 'big push' strategy here. Our interest is in relation to the construction industry, its ability to implement the plan and the way it was finally affected by the 'big push' strategy.[10]

PBO identified shortages of manpower as one of the most serious (practical) problems for the implementation of such a strategy adopted in the revised Fifth Plan. The following Table is a summary of the shortages of 721,200 skilled, semi-skilled and unskilled labour.

Table Ax3: 6; Projected Demand and Supply of Manpower by Occupations during the Fifth Plan, 1973-77 (1000's persons.)

Category	Demand	Supply	Shortage.
Architects, town planners, civil engineers	**7.8**	**4.0**	**3.8**
Electrical and electronic engineers	5.5	2.8	2.7
Mechanical engineers	6.9	4.2	2.7
Chemical, mining and metallurgical engineers	2.0	1.0	1.0
Other engineers	14.2	8.3	5.9
Senior medical personnel	8.5	7.2	1.3
Other medical personnel	35.6	14.3	21.3
Educational personnel	287.4	230.0	57.4
Higher Educational personnel	22.5	21.0	1.5
Technicians	116.6	75.0	41.6
Other technical & vocational personnel	8.0	4.0	4.0
Managerial administrative and sales personnel	185.0	185.0	
Mining drilling and extracting workers	23.0	15.0	8.0
Transport workers	41.0	41.0	
Skilled and semi-skilled industrial workers	520.0	230.0	290.0
Skilled construction workers	**290.0**	**20.0**	**270.0**
Unskilled workers.	**538.0**	**528.0**	**10.0**

Source: Plan and Budget Organisation of Iran (PBO) [11]

For the construction industry the shortage of 3800 architects and civil engineers was not the central problem, given the availability of money and the management capacity of the Iranian contractors and consultants to hire foreign expatriate. Similarly the shortage of unskilled workers was not a problem as it first appeared because of the influx of workers

from Afghanistan. These workers, with similar language and culture, could easily fit in on any construction site and their salary did not differ from their Iranian counterparts.

The shortage of 270,000 skilled workers appears more significant. Skilled workers were not available in sufficient numbers in neighbouring countries and for those that were available there was the problem of language. In the case of skilled labour language difference is more important and as are the technical problems of incompatibility in terms of technology.[12] **This shortage was not overcome in the plan period and affected both the industry and the client. Poor quality of work, low productivity, problem of management and long delays were amongst the most important effects.**

e 1) Production of cement and steel in the Fifth Development Plan

The importance of cement and steel as the key construction materials for the modern sector have been recognised. It has considerably affected the industry's capacity to carry out development projects. The Table below shows the figures of production and imports of the cement, steel, and aluminium during the years 1970 to 1978

Table Ax3: 7; Iran's use (production and import) of cement.

(Thousand tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Cement production	2575	2850	3392	3451	4628	5421	5955	6323	6228
Cement import	55	80	58	303	738	1230	1376	2963	1690
Total use	**2630**	**2930**	**3450**	**3754**	**5466**	**6651**	**7331**	**9286**	**7918**

The sharp increase of both production and import of cement starts in 1972, in fact between 1972 and 1977 cement production increased by 86.4 per cent, and imports in the same period increased by almost three fold, with the exception of 1977 which shows almost the increase by six fold. In all the use of cement in the industry increased from 2,630 tons, in 1970 to the peak of 9,286 tons in 1977, an increase of 3.5 fold,(an annual average increase of 50 per cent.) This also indicates the degree of expansion of the construction industry.

Table Ax3: 8; Iran's use (production and import) of steel 1970 -1978.

(Thousand tons)

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Steel production	-	-	-	200	567	551	550	550	780
Steel import	218	306	288	254	208	504	272	584	986
Total use	218	306	288	454	775	1055	822	1134	1766

Steel production started in 1973, initially with 200 thousand tons and increased to 567 thousand tons in one year (183.5 per cent), but on average the annual increase was 45.1 per cent. Considering the fact that almost all the produced and imported steel was used by the construction industry, the use of steel in the industry increased from 218 to 1766 thousand tons in that period, (an annual average increase of about 100 per cent)

'Ministries, their deputies and the officials within the Supervision and Co-ordination Division of the PBO, all acted as if money was the binding constraint on Iran's development, when in fact human capital and infra-structural resources should have guided the allocation of investment funds'.

2) Broad reasons for the failure of industrialisation in Iran.

Both before and after the 1979 revolution decision-makers based their economic development plans on industrialisation of the country through the importation of technology. This carried with it a neglect of indigenous potentials such as agriculture and other sectors of the economy. The broad reasons for the failure of industrialisation in Iran could be summed up in the following way.:

1 Over-dependence on oil revenue: According to K Mofid [13], 'The adoption of an import substitution strategy of development in the early 1960s was a wrong strategy of development, given the country's vast oil/ gas resources and its heavy reliance on oil revenues as a means of providing the necessary foreign exchange requirements for development'. He argues that 'an oil exporting country is very much different form 'ordinary' developing countries'. Unlike most other developing countries, which try to reduce their reliance on primary exports and foreign loans or aid, through the promotion

of the export of various manufactured products (not raw material such as oil or a single agricultural product such as coffee) which in turn pay for a portion of their imports of capital goods, the country continued to rely heavily and almost exclusively on oil revenues. He argues that 'This unique situation could not have been possible in other developing countries, similar to Iran in productivity and efficiency, but with no oil revenues'. He then points out central causes for the failure of industrialisation, which are central to this chapter: **efficiency (productivity), and secondly, human development.** He states:

> 'Therefore (as a result of abundant oil revenue), the real constraints to development, i.e. the shortage of skilled and semi-skilled labour (to work with the imported technology), lack of socio-economic infrastructure, etc. were brushed aside and much emphasis was paid to disbursements of oil funds with no regard to efficiency. In all, no 'check and mate' approach was applied, and thus, **inefficiencies were allowed to exist and also to get augmented.'**

2. Inappropriate technology: K. Mofid argues that another source of difficulties in the adaptation of new technologies was the lack of correspondence between the imported technology and existing indigenous resources. As Robert Solo[14] has noted, the technologies developed in the advanced countries have evolved in a social and physical environment which differs significantly from that of a developing society. These differences make the blanket importation of such technologies into the developing countries clearly inappropriate. K Mofid states:

> 'Clearly there exist major differences in the physical, cultural, religious, historical and socio-political aspects of Iran and the Iranians, to those of the places from where technology was imported, so that the problem of **'inappropriate technology' may well have arisen in the case of Iran.'**

He then points out that the transfer of technology from advanced to developing countries is not necessarily doomed to failure, illustrating this by giving successful examples of countries such as Japan or other 'Newly Industrialised countries' of the Far East. He then says 'problems arise, however, when an attempt is made to import advanced technology with no serious attempt to provide a hospitable environment for its efficient use'.

3. Certain aspects of cultural characteristics, can also be identified as another contributory factor. Solo argues that value systems have profound economic implications that cannot be ignored. 'Taqdir (fatalism), bazaar mentality (i.e. quick profits), and **despotism,** as Katuzian[15] has observed, are among the important cultural constraints to

development. Despotism, he argues, affects both commercial relationships and attempts at industrialisation in many adverse ways.

Katuzian, giving a thorough analysis of the nature of despotism in Iran, introduces historical evidence that, 'The turning wheel of government in the traditional Iranian community has been : Dictatorship - uprising and sedition - Dictatorship'. He goes on to argue that: Government has been separated from the community in the traditional Iranian society and has been, not just at the head but rather high above the community. Consequently, in the final analysis, the government has never had a solid , continuos base and a point of reliance within the community and for this reason it has never enjoyed political validity among the people and has not lawfully represented them. Thus all social rights and privileges have ultimately been in the monopoly of the government. This is, such rights had the status of concessions that the government can withhold or annul at will at any moment. In other words, the power of the government was not conditioned by any law, tradition, agreement, etc. and this is exactly the normal meaning of the term 'dictatorship', meaning autocracy, despotism.

Katuzian argues that division between government and society leads to social unrest, uprising and sedition. This is because this basic division, ' which is the cause and result of the unlawfulness of the government and its monopoly of social rights, necessarily cause the society to view the government as a foreign power and 'rule of force' and reject it.' He then points to an important socio-economic factor which he calls ' Nations Responsibility'. Every freedom develops a 'responsibility' and every 'right' develops a 'duty'. In a society where no freedom and rights (except that which government confers as a concession that can be withdrawn at will) exist , **no feelings of 'duty' and 'responsibility' develop,** nor are accepted. In such a society the nation (i.e., the entire community) is essentially at odds with the government. This means that even at times when there is no possibility of uprising and sedition, people's obedience to government is based merely on need and expedience (and, in final analysis, of fear) not on acceptance and consent.[16]

4 Foreign intervention It is a conventional view among Iranians, shared with researchers and historians[17], that the Anglo-Russian rivalry and collusion in Iran during the Qajar period and later, particularly during and up to the Nationalisation of oil in 1951 and the events that followed it, had a major negative impact on Iran's historical, cultural, economic and industrial development. K Mofid argues that 'superpower politics deprived Iran of an opportunity to build strong and coherent socio-political and economic

institutions which are so vital for a successful drive towards development and modernisation.' He continues to argue that, although in both First and Second World Wars Iran had declared its neutrality, nonetheless, the foreign powers adhering to their own interests invaded the country. These and other actions, such as the CIA-inspired coup against Dr Mossadeq in 1953, disrupted an indigenous process of development, leading to the further underdevelopment of institutions, with their profound harmful consequences on the development process. With regard to foreign firms operating in the country the majority of foreign firms and personnel had one thing in mind; to make as much money as they could in the shortest possible time.'

All these serves to demonstrate that the inefficiencies are the result of underdeveloped institutions which themselves are the result of economic and socio-political factors. Or put another way, that development does not materialise simply through the purchase of advanced technology. It is for reasons such as the above that, we believe , economists such as E. F. Schumacher are absolutely right in saying that, 'development does not start with goods, it starts with people and their education, organisation, and discipline'.

3) End notes

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1 Katuzian H, The Political Economyof Modern Iran: Despotism and Pseudo-Modernism.1926-1979, (London 1981) pp. 141-144.

2 Op cit IBRD report Vol. III Appendix 2 p1

3 Op cit. Mofid K, p41

4 With the devaluation of Iranin currency in 1957 from 32.5 to 75.75 rials to one US dollar meant a considerable rise in rial revenues of the government by 7.1 billion rials.

5 Op cit IBRD report Vol. III Appendix 2 p2

6 Spillane James J., The Housing Production Process in Iran; thesis; New York Univesity 1973 pp 88-89

7 Mofid op cit. p60

8 Op.cit. IBRD report.

9 Op. cit. Mofid. K also for futher information on the issue see pp89-100

10 The plan in turn was greatly affected the construction industry both in positive sense such as providing training in all levels and increasing its capacity in general and also in negative sense as the decrease in productivity as a result of lack of competition increase in cost of labour and general chaos in the social aspects of the work environment and weak management.

11 Quoted as Mofid op cit. p96

12 Brick laying and plastering for instance are quite different in Iran, and it is quite impossible to employ an Indian or even British tradesman for these jobs in Iran for simple reasons such as the quality of brick and gypsum let alone the more complicated reasons of the compatibility in management.

13 Mofid. Kamran, Development Planning in Iran From Monarchy to Islamic Republic. 1987 pp 172-173 see also 270-274

14 Solo. Robert, The Capacity to Assimilate an Advanced Technology: The American Economic Review; Vol. 56, No. 2 May 1966 pp 91-97

15 Katuzian H., 'The Aridiosolatic Society: A Model of Long-Term Social and Economic Development in Iran': in International Journal of Middle Eastern Studies Vol. 15 1983 -pp 259-283.

16 Katuzian. H. Prof., 'Democracy, Dictatorship and Nation's Responsibility'. Kayhan International; Aug. 5 . 1993 pp 7-13

17 For further reading on this subject consult the works of E. G. Browne, Peter Avery, Charles Issawi, H. Katuzian, and Esmaiel Raein.

Appendix 4

Implications of productivity improvement.

1. Productivity and Development.

Productivity is known be the major indicator of the difference between countries' economic performances, and is also claimed to be at the heart of economic development. But what do we mean by economic development or the term 'development' in its wider meaning including as it does economic, social, cultural, technological, and political considerations? For our purpose perhaps it is easier to understand the meaning directly in relation to developing countries. In this context we are in agreement with Streeten[1] who argues:

> 'Development is not about index numbers of national income, it is not about savings, ratios and capital coefficients: it is about and for people. Development must therefore begin by identifying human needs. Thus the objective of development is to raise the level of living of the mass of the people and to provide all human beings with the opportunity to develop their potential.'

This belief is shared by most development economists today, such as Todaro who, in defining economic development, states:

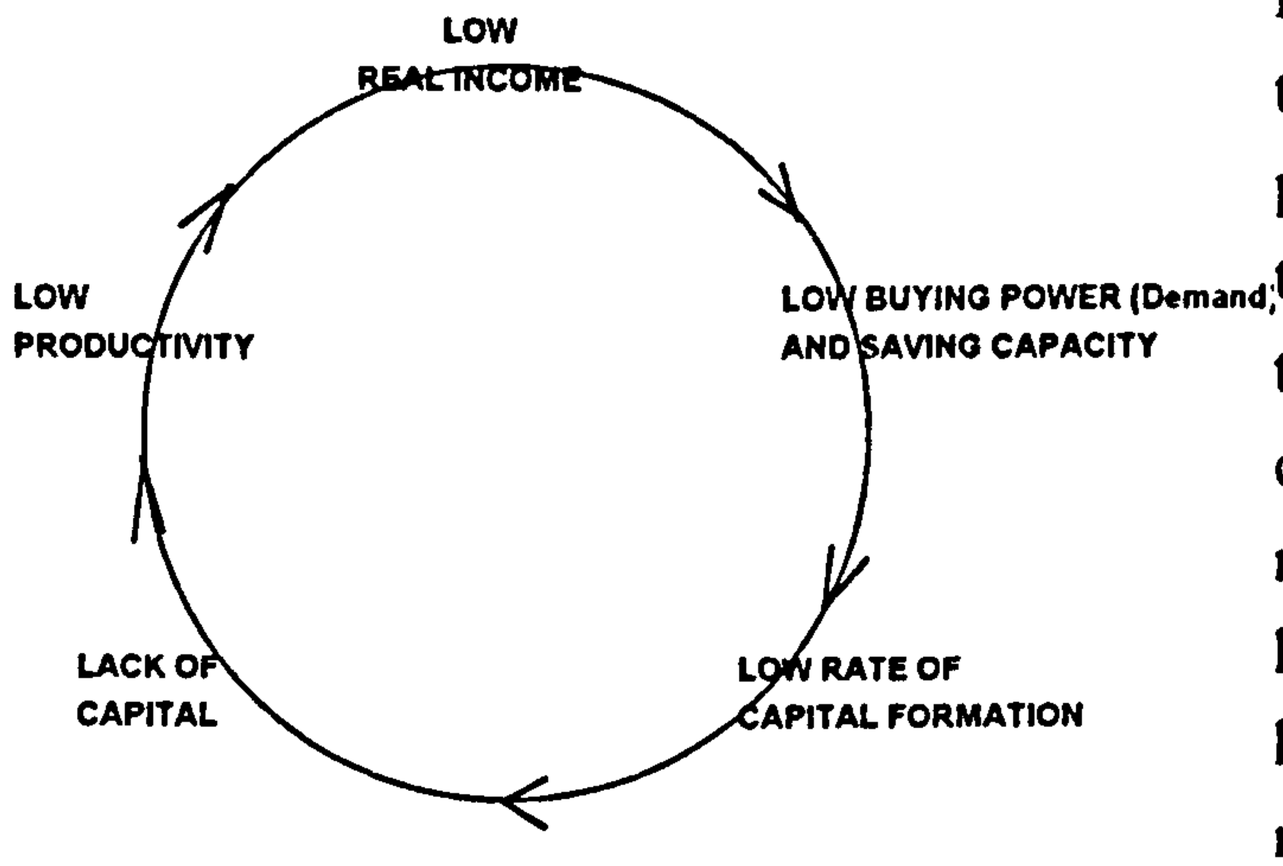
> 'Development economics is a distinct yet very important extension of both traditional economics and political economy. While necessarily also concerned with efficient resource allocation and the steady growth of aggregate output over time, development economics focuses primarily on those economic, social, and institutional mechanisms necessary to bring about rapid and large scale improvements in levels of living for the masses of poor people in the Third World.'[2]

There are a wide range of competing theories indicating different approaches to social and economic development. In fact controversy exists in basic ideological, theoretical, and empirical issues which implies that little consensus can emerge from such conflicting views. Thus it is fair to say that 'development economics has no universally accepted doctrine or paradigm, instead we have a continually evolving pattern of insights and understandings'.[3] This body of accumulated experience together provide the basis for examining the possibilities of the contemporary development of developing countries.

As to the ways of reaching development goals, literature on economic development over the past 40 years has been constantly evolving and changing, though at the same time is

dominated by four major strands of thought: '(1) the linear stages of a growth model, (2) theories and patterns of structural change, (3) the international dependence revolution, and (4) the neo-classical, free market counter-revolution.'[4] But as the ultimate goal of development they all claim to be aiming at raising living standards by increasing the production of food, shelter and other commodities on the one hand, whilst, on the other, increasing people's level of income so as to make as these products affordable.

Figure Ax4:1 THE CIRCLE OF POVERTY



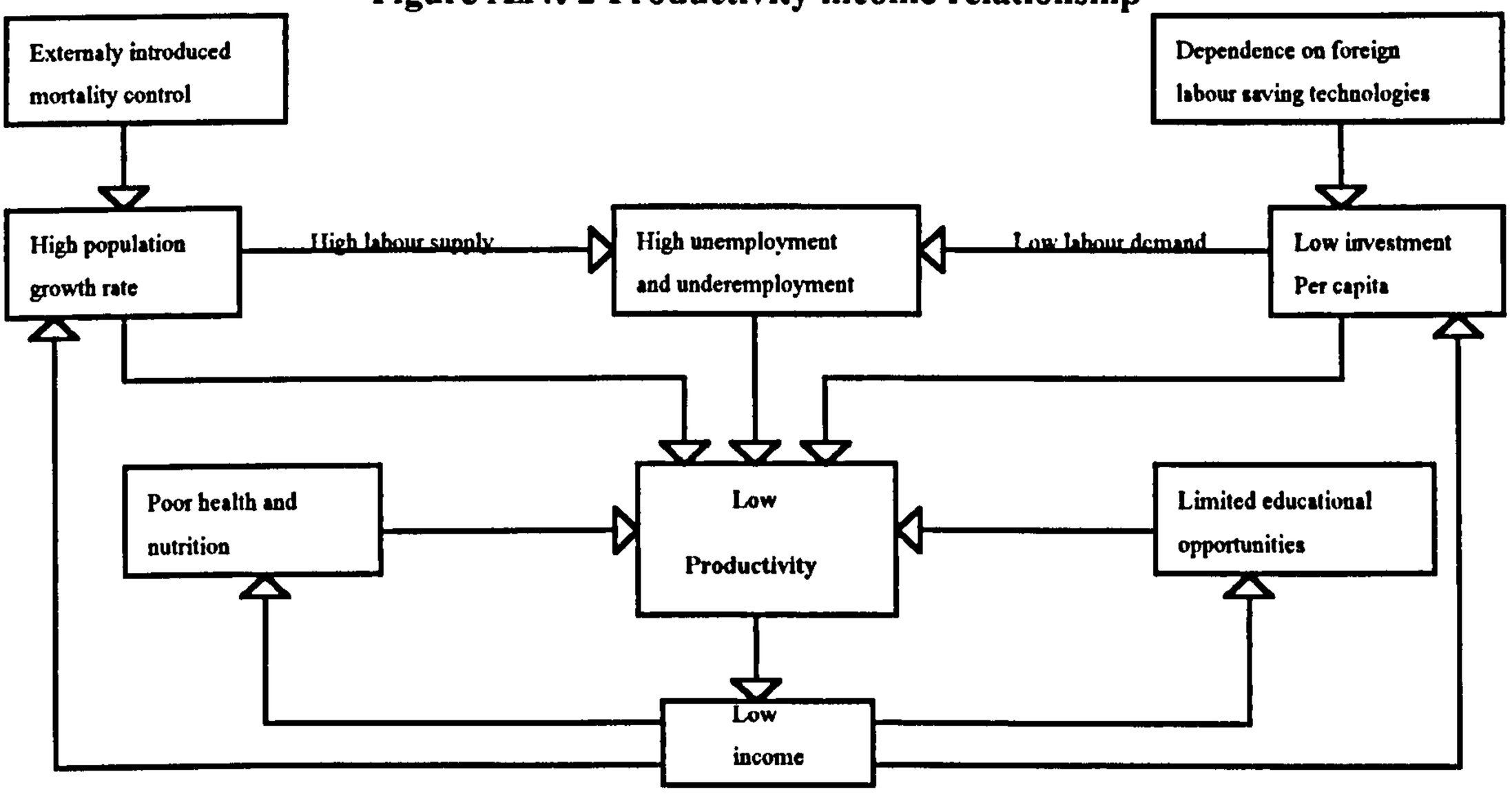
Mountjoy [5]in explaining the circle of poverty in poor countries explains that 'On the supply side, there is the small capacity to save , resulting from the low level of real income. The low real income is a reflection of low productivity ,which in turn is due largely to the lack of capital. The lack of capital is a result of the low rate of capital formation, which in turn is due to the small capacity to save and so the circle is complete'. Although it is difficult and sometimes risky to generalise the diverse set of nations that make up the so called developing countries, development economists have attempted to classify common characteristics of a so called developing countries. 'Of course there must be differences between developing countries. . . . [but} to maintain that no common ground exists is to make any discussion outside or across the frontiers of a single country meaningless'[6] According to Todaro these common characteristics are:

1. Low levels of living.
2. Low levels of productivity.
3. High rates of population growth and dependency burdens.
4. High and rising levels of unemployment and underemployment.
5. Significant dependence on agricultural production and primary product exports.
6. Dominance, dependence, and vulnerability in international relations.

The productivity - income relationship and also the relationship between low level of income and underdevelopment as portrayed by Todaro (with slight modification) is shown in the following diagrams. (Figures Ax4: 2 and Ax4: 3)

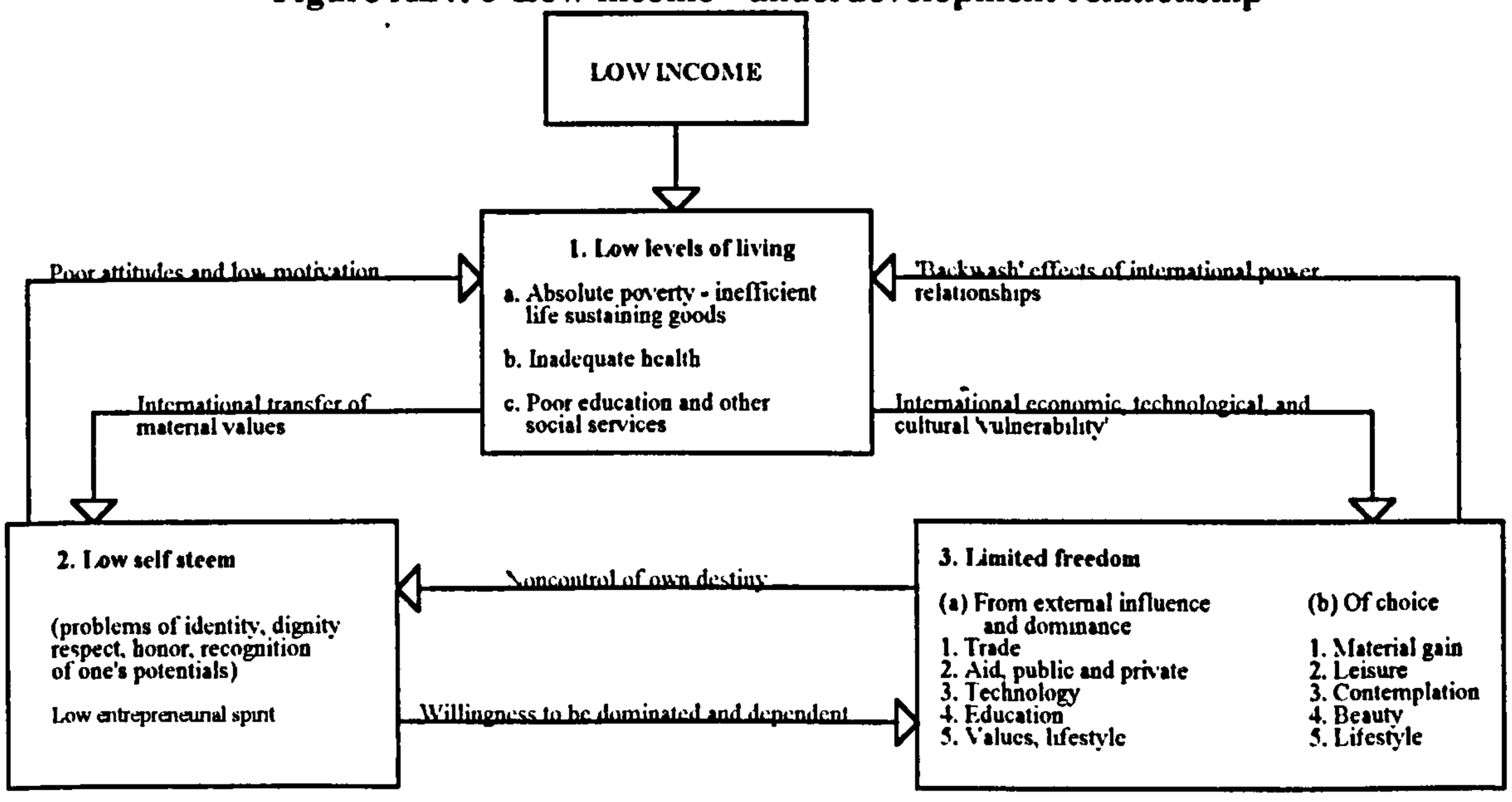
Todaro in agreement with his counterpart Mountjoy notes that the arrows in the productivity - income relationship diagram 'forms a series of continuous "loops", indicating that a process of "circular causation", or vicious circles, is in operation'. Low incomes result in low savings, which means low investment, limited labour demand, high unemployment, low productivity and therefore low incomes.

Figure Ax4: 2 Productivity income relationship



We may conclude, therefore, ' that low levels of productivity are self - reinforcing social and economic phenomena in Third World countries and, as such, are the principal manifestations of and contributors to their underdevelopment. Myrdal's well-known theory of 'circular cumulative causation' in underdeveloped countries is based on these mutually reinforcing interactions between low living levels and low productivity.'[7]

Figure Ax4: 3 Low income - underdevelopment relationship



2. Productivity and appropriate technology

Iranian textiles were exported to Europe and the quality was such that on 18th October 1666 Charles II wore Iranian cloth when deciding to abandon French fashion[8]. Various local industries such as silk, carpets, even metal goods (knives and swords) were produced in excess of the local market and were exported to various countries in the world including Europe.[9] The aftermath of the industrial revolution, high productivity in British textiles, as a result of new machines powered by steam, enabled British textiles to invade the Iranian market and this pattern was followed by other commodities. In 1820 Mirza Saleh Shirazi, an student, who was sent to Europe by Prince Abbas Mirza, a popular figure in Qajar dynasty, to study industry and commerce. He attempted to make a picture of the industrial situation of those days in Britain. In his report he describes the situation as follows:

> 'There was a turning wheel powered by steam, powerful enough to turn several wheels of the textile loom. As a result of the use of this machine labour is reduced by two thirds. Low price textiles which come to the Iranian market, and destroy our national textile industry, are the products of these machines.'[10]

The history of this period is in fact the history of a un-declared war which is still going on. It marked the beginning of the process that defeated indigenous technologies. These concepts (indigenous technologies), have been reintroduced and modified in modern times with different names such as; Appropriate technology, Intermediate technology, Soft technology, Non-Violent technology or other technologies such as; Radical, Self-help, Democratic, People's, Progressive, Low cost, Autonomous, Utopian, Liberating and Convivial.

It is said that modern technology has been created by - and demands - of people who are; individualistic, selfish, tough, greedy and success oriented. (Taylor 1972) Indeed these have, so far, been the characteristics of the dominant values in the West. Our history, as well as the history of many other 'ancient' developing countries, cannot afford to forget that soft, sympathetic, and tender values, together with their 'soft technology', and the story of their defeat by so many of the opposite values of the Europeans.

'Appropriate' is probably the most common term used in the literature. This claims that the outlines of Third World development can be planned according to its precepts.

Schumacher [11] describes it as simple and small scale technology which emerges from traditional methods and utilises local resources. The International Labour Organisation [12] characterises it as 'labour intensive technologies'. Reddy [13] suggests self-reliance and environmental harmony are the criteria of appropriateness. Morawetz[14] describes it as a set of techniques which make optimum use of available resources in a given environment. Concerning building technology, Spence[15] thinks that the choice of technology depends on the 'software' (organisation methods and legislation, etc.) alongside the 'hardware' (materials properties, performance and equipment) Fathy[16] thinks that appropriateness depends on the use of natural, locally available materials, traditional building methods and forms, based on scientific principles, when considering social and cultural requirements. Clearly, the appropriateness of a building technology for example, depends on the environment in which it is applied, so it will inevitably vary greatly from one society to another. 'There is no single technology appropriate to developing countries since each country, or group of countries, has its own special conditions'.[17]

Schumacher draws the rather idealistic picture of a desirable society which would be decentralised to self-sufficient communities in which the people have the pleasure and satisfaction of creative work and produce basic or defined products with simple tools within a steady-state economy. This society might be all well and good within artificial enclosures, but it is not possible in the real world. History has revealed that there is only one valid economy and it is the dominant one.

> 'Closer analysis of this vision shows that small is not always beautiful, rural self-sufficiency is not always idyllic, not all sectors of economic activity are amenable to craft production, cultural stability is not always desirable, and one person's need may be another person's greed. It is concluded that the principles of the appropriate technology movement are based by Western academics with emphasis on individual freedom and by the values of Western middle-class ,'back to the land', 'do it yourself' and 'arts and crafts' movement. It is suggested that an attempt be made to derive an acculturate theory of appropriate technology.'[18]

Clarke[19] contrasted 'hard' modern technology with 'soft technology' using 35 characteristics, many of which overlap. In essence, he advocated an environmentally friendly technology that is economical in its use of resources; relatively labour intensive production in small-scale, craft-based industries; a decentralised, village-based, communal lifestyle that encourages cultural diversity and is based on participatory democracy; a steady state economy with local strength and a reduction in world trade. Satisfying work and a reduction in the distinction between work and leisure,

popularisation and demystification of science and technology would be associated with soft technology. Soft technology would use renewable energy and would use modest and diverse energy sources.

This 'Soft technology' in fact already existed in many countries in the so called third but it was defeated and destroyed by the 'hard ones'. A great number of politicians, decision-makers and intellectuals in the third world would like to tell their Western counterparts: "No, thanks, not for me. In fact, it is your turn to get a bit soft if you are as interested as you claim in reducing the gap - and in making the world 'one world' again. Or alternatively perhaps it is our turn to get as hard as possible ?" This is a natural feeling if not a 'logical' conclusion for both the people, and some of the decision makers, particularly in a divided world full of hostilities and in the environment of international politics of 'The New World Order'.[20]

Orthodox economics would define appropriate technology in terms of being that which was optimal, given the price of labour and capital. Hence different technologies are appropriate in different countries.[21] It is quite safe to consider Appropriate Technology, but with small 'a & t', because appropriateness is never opposed to common sense and so is the small scale. A small child is beautiful only when there is hope for her growth. You can have a big healthy child only if you are prepared to grow a small one.

To stretch the child is a metaphor for the growth of an indigenous or endogenous industry in a country.

The current interest in small-scale enterprise in developing countries contrasts with the attempts at stimulating development in the 1960's, by the citing of big 'modern' prestigious industries in these areas.'[22]The crucial role of small business in the establishment of new industries is now recognised both in developed and developing countries. In developing countries much is being said about their potential for growth, in contrast to large imported firms, because they help to mitigate the problems of dependency and foreign control.

3. Employment and productivity

The most disputed issue in relation to productivity increase has been its effect on employment. Increase in productivity, whether by means of better management, industrialisation, mechanisation, automation or robotics, initially will mean redundancies. An increasingly efficient market economy has invariably come into conflict with the idea of full employment. There are others who argue that what is important is that the plans for economic growth must include the growth in demand. If the benefit of higher productivity in one sector, for instance the building industry, are transferred to the client in the form of a reduction in price, more need can be translated into demand. This boosting of demand generates more employment until those needs are fulfilled. As needs keep soaring in most developing countries, then the improvement in productivity would not necessarily lead to unemployment, but in fact to the very opposite.

Even when considering some Western countries where the number of houses are greater than the number of households, economists argue that surplus labour in one sector would be utilised in others. This must be done whilst avoiding the problems experienced by Iran in the 1970s, when the share of labour taken up by the Construction Industry increased markedly. This led to a large migration of farmers to the cities and caused both a paralysis in agriculture and tremendous urban problems.

'During the past 15 years, the country's population has doubled and reached some 60 million .....Within the next 10 to 15 years, the country's young generation will be ready to enter the job market.'[23] By that time, and with such a young population, it seems obvious that the present unemployment problem will become a severe unemployment dilemma. On the other hand, bearing in mind our experience in the 1970s, there is a strong argument against the creation of jobs for unskilled labour in the construction sector in urban areas.

In developing countries where the rate of unemployment is high any proposal in relation to improvement of productivity must take the employment situation into account. For instance Acosta Domingo[24] is very much concerned about the risk of destroying jobs in the Venezuelan construction industry. He states:

> 'As a developing country Venezuela has abundant unqualified and cheap labour available. Unemployment problems are intensified when increased mechanisation and labour substitution are the main strategies to improve productivity. Increased

mechanisation is not appropriate when less capital intensive techniques are available or may be developed. Moreover, given the high costs of imported machinery (Venezuela imports over 96% of its capital goods) , heavy capital investments and increased mechanisation may cause drops in capital productivity and increases in capital costs that could offset any productivity gains and cost savings obtained by the replacement of labour.'[25]

Domingo considers an increase in productivity in the construction companies through better management more appropriate than the introduction of less labour intensive technologies. Although his approach could prove effective in the modern sector of the modern CI, it might not prove quite so effective in the case of housing construction, because of the limited role of the modern sector in housing. However, one cannot deny the potential value of a special scheme to improve the management skills of individual 'owner contractors' and *memars* in the traditional/ conventional (T/ C) sector.

The low productivity of labour in the T/ C sector not only causes increasing costs and subsequently less demand, which in turn can eventually result in rising unemployment, it can also cause more employment directly through the need for more labour per unit output. But in the long turn this too can result in more unemployment. Todaro believes ' . . . . .because urban wages are typically much higher than average rural incomes, every urban job created may induce three or four new job seekers to migrate from the countryside.'[26] Job creation policies designed to reduce unemployment can in fact cause unemployment to rise.

There are many examples where social considerations have conflicted with industrial development. There is an interesting example in the construction history of Britain which dates back to the 14th century. Cooney[27] pointed out, that there had been a four century delay in the establishment of sawmills in this country compared to some other European countries. Despite claims that this delay was caused through considering the livelihood of sawmen, the underling reason is more likely to have been the policy of the timber merchants to import sawnwood.[28]

This is an example of a recurring problem, the old story of conflicting interests and the role of middlemen at the national and international levels. However this author believes that improvements in technology should be encouraged when they are appropriate. Traditional building technologies are largely based on site-based crafts and therefore highly labour intensive. Working on a construction site as a labourer is a last choice and only for those who can bear the severe strain. At present this unskilled labour force is

constituted partly by nearly 2 million Afghan immigrants and partly by rural people travelling to the city and working on a temporary basis. This is obviously a factor in swelling rural-urban migration. It would be appropriate to encourage technologies which while obviously increasing productivity could at the same time be implemented, managed, and developed within our indigenous building organisation.

It is argued that productivity increase is often associated with increases in employment in developing countries. Escobar found that in manufacturing industry in Venezuela an increase in productivity has produced more demand and resulted in the creation of more jobs[29]. Later Acosta Domingo reached the same conclusion in the construction industry in Venezuela[30]. However in many parts of the Third World, where unemployment and poverty are striking, the story is different. Dr. E.F. Schumacher when speaking about unemployment in India says;

> 'When speaking of unemployment I mean the non-utilisation or gross under-utilisation of available labour. We may think of a productivity scale that extends from zero, i.e. the productivity of a totally unemployed person, to 100 percent i.e. the productivity of a fully , and most effectively, occupied person. The crucial question for any poor society is how to move up on this scale. When considering productivity in any society it is not sufficient to take account of those who are employed or self employed and to leave out of the reckoning all those who are unemployed and whose productivity therefore is zero.'[31]

So the simple utilisation of labour is only the starting point, the second step is the total utilisation of labour, labour being used efficiently and effectively. An example of a lopsided approach was the full employment policy in the USSR, and its resulting low growth in productivity and poor economic performance. Economists in the West argue that the history of industrially developed countries has revealed that increases in productivity, although causing initial unemployment, have through the generation of excess labour, contributed to other areas and sectors of the economy. This is how the loss of 5000 jobs in British Telecom is justified by British management on the grounds of efficiency and the national prosperity.

4. Distribution of the benefits of higher productivity

The attitude of workers (and employers) towards efficiency and higher productivity mainly depends on what they expect to get out of it. It is not only the question of wages,

which should be considered by employees, but productivity and efficiency of the worker. It is not only a moral question that 'everybody agrees that workers as a whole should share in the benefits from higher productivity, and it is evident, at least in the more highly developed countries, that they have in fact done so.'[32]The main question concerns the benefit of higher productivity for society as a whole. There are three distinct points of view:

1)- It is argued that if higher productivity is translated into lower costs and lower prices in a competitive market, industry will be strengthened as efficiency increases. As a result of the lowering of prices more demand is directed towards industry and this in turn creates new job opportunities. 'Reduction in costs is one of the best means of increasing the market for construction and thereby promoting stabilisation of construction at high levels of production'[33]

2)- From the point of view of equity, the argument is that to the extent that higher productivity is translated into lower prices, all of society shares in the benefits including workers themselves, civil servants, as well as other wage earners.

3)- In many cases, particularly in developing countries where the most arduous and disagreeable building jobs are a long way from being mechanised, higher productivity calls for an increased effort on the part of workers. The workers must be adequately compensated for their greater efforts. Unless they receive some increase in wages, it will be difficult to convince them that in fact they are sharing the benefits of higher productivity.

4)- There is another point of view that argues that 'higher productivity means 'Mercedes car' for the contractor, nothing for the consumer, and tears for the workers'[34]. This can be very true for the consumers in an atmosphere of poor competition. For the workers it can also be true in developing countries where labour is not organised. Moreover in the in the case of the building industry, particularly in developing countries, there is an additional excuse or reason for not paying bonuses. With the special conditions of uncertainty and high risk in most developing countries, contractor can come to a kind of assessment of productivity only when the project is finished, and by that time the labour force has changed several times.

However, higher productivity results in a benefit somewhere, for someone. The task is balancing the relative importance of the main potential beneficiaries: Customer, worker,

contractor and the building industry. A stronger and healthier construction industry with higher levels of employment must be balanced against, lower prices for consumers and higher wages for workers against higher profits for contractors. This balancing act is essentially a task for all the parties involved but the industry should take the initiative and make its case public..

5. Productivity and natural environment

In addition to Keynes' concerns economic efficiency, social justice, and individual liberty, the regional and global environment must of course be paramount in our considerations, as it is clear that past ignorance is affecting the quality of all our lives. The intensive exploitation of nature without concern for the fragile eco-systems of life on earth, has already caused tremendous damage.

'Since the Islamic Revolution in 1979, Iran's environment has been severely damaged by industry, urbanisation due to rapid population growth, the Iraqi imposed war and most of all, like many other parts of the world, certain peoples' greed, as well as poverty.' (Nikzad M[35]).To this must be added the negligence of government in our over centralised state. We regularly read or hear that as a consequence of dumping chemical pollutants in this or that river in our country, large populations of fish and birds have died. The Department of the Environment headed by a vice president is the sole active government body in charge of environmental protection. There are no NGO institution concerned with environmental issues. The main problems in the area of environmental protection can be summed up as follows:

1) Although one of the preconditions for the establishment of a factory is obtaining permission for safe-environmental treatment and a guarantee from the owners not to violate the regulations of the Department of the Environment, in practice these rules are ignored, and in most cases guilty owners of those factories are not prosecuted or punished.

2) Many Iranian factories are not equipped with proper waste treatment systems.

3) There are no regular inspections by the Environment Department's experts of industrial units to ensure they maintain safety standards.

The problem that in our feasibility and cost benefit studies we do not include environmental costs. This negligence is universal. 'At present most economic activity takes little account of the costs it imposes on its surroundings. Factories pollute rivers as if the rising water flowed past them for free, power stations burn coal without charging customers for the effects of carbon dioxide belched into the atmosphere, loggers destroy forests without a care for the impact on the soil or the climate. These costs are for others to pick up - neighbours, citizens of other countries, and future generations.'[36]

Nikzad[37] states that while Five Year Development Plans are being implemented and huge infrastructural and industrial projects are being undertaken, care must be taken that every project advances in accordance with environmentally sound regulations. 'Those responsible should implement and observe environmental protection regulations. If we don't do so, tomorrow will be too late to reverse the negative impact of industrial pollution on our lives.' Nikzad in praising Japan for being relatively successful in industrialising without destroying its natural environment states that; 'Employing Japan's safe-environment methods and experience would be a step in the right direction'. We should industrialise our country, he says, 'but not at the price of contaminating or destroying our natural habitat'.

However, we must learn more from the mistakes of the West than Nikzad suggests. The industrialised world is to blame for two hundred years of environmental degradation; global warming, ozone thinning, acid rain, and toxic and radio-active waste. The scale of this exploitation of nature is frightening and it is all done to maintain a lifestyle which seventy percent of the world's population cannot afford. Of course it is good news when in Britain, for instance, politicians are prepared to quit trivial habits[38]:

'Never again to leave the light on in my attic' Jonathan Porritt, Friends of the Earth Director.
'I intend to walk more and drive less' Chris Patten as the ex Secretary of State for the Environment.
'I love my bike, I am going to try to use my car less.' Joyce Quin Labour MP.
'I will no longer use pretty pink toilet paper 'Bryan Gould Labour MP as ex Shadow Environment Spokesman.

These comments seem to be born out of a collective environmental guilty conscience. Isn't our guilt really the final acknowledgement that we took it all for granted. The world is beautiful and a place to live and enjoy life. It is filled with fascinating places and

creatures that should be a reward for being alive, not a source of gloom and shame.[39] The environmental damage is not confined to the West, according to the Mayor of Tehran, every citizen in the capital inhales half a gram of lead daily in addition to other pollutants in the air. Besides air pollution, Tehran has severe noise pollution which is not being mentioned in the media. The crowding of different industrial workshops by the expansion of residential districts, has had its mental effects on the people of Tehran.[40]This is a kind of punishment for our negligence.

Despite all these (guilty) conscious politicians, with their goodwill gestures, when it comes to the real world the story is different. Third world countries are being blamed for polluting the environment, yet they are the ones who are going to suffer and it appears there's nothing we can do. A good example of this are the educational and documentary programmes on the BBC[41], in which the good guys are the Western governments, with their high-tech, 'expensive' equipment and expertise rescuing mother nature, who are suffering from the actions of the bad guys and their desperate rulers trying weirdly to provide jobs for them in the third world. These sinful creatures increasingly adding to their population, and causing more pollution, want the same quality of life as us very few, good sacrificing guys. Of course, they could have it if they voluntarily reduced their population equal to our level. Are they serious? Do they really want to increase their consumption by 50 times? It is a matter of fact that an American is consuming 50 times more than a citizen of Indian continent. Do Asians really want to pollute 50 times more? Imagine if the Chinese want to do the same. Obviously they do not deserve it anyway, since they lag behind in the scientific and technological achievements of the West. Moreover these crazy people don't know that they are the ones who are going to suffer, not us. Here are two clips from the BBC programme 'Hotting up'(17th Feb. 1994) as an evidence to this attitude.

> This clip takes a look at the potential impact of the developing world, and in particular India, on climatic change. Droughts persist in Rajistan, and so there is a need to reduce their dependence on growing food. India's development policy is one of growth to provide jobs for its people. One coal mine and power station site provides images of this policy. An interview with Maneka Ghandhi, an Environment Minister, sets out the dilemmas faced by developing countries. Politicians of India have more pressing priorities than global warming.
>
> France's nuclear energy is one possible way to avoid global warming. The changing policy of Sweden is examined; Sweden is shutting down its nuclear generation plants and moving to combined heat and power. The key is to increase

efficiency. In the USA, efficiency is also being researched and ideas for planting forests are also being examined.

Nematzadeh, the Minister of Heavy Industry speaking in a seminar on 'the methods and problems of industrial waste treatment' reported government's efforts for minimising water pollution as a result of industrial waste going into rivers, and stated that the lack of knowledge and scientific information on waste treatment is our major problem in trying to limit the pollution of our rivers.

Nematzadeh continued to argue that industrially developed countries, in the last half a century, with their negligence, have caused tremendous global environmental pollution, while developing countries did not. Today their attitude is to sell their treatment equipment at unrealistically high prices. This has subsequently helped to increase the price of third world products competing in world markets.

> Humankind's activity has always had an effect on the environment. But now, when societies are so interconnected economically, we have reached a stage where a decision to exploit resources in one continent can cause drought in another. Environmental imbalance is no respecter of national boundaries. Perhaps our increasing awareness of the fragility of Mother Nature can teach us a lesson. There are many divisions in the modern world, cultural, religious, ideological, the environment transcends these boundaries . . . fostering understanding of our mutual interconnectedness in the rest of our activities on planet Earth.[42]

The global environment is a global issue and needs global co-operation. Sustainable development, at the Earth Summit (1992) was at the top of the agenda. The 'UNDP' was designated as the lead agency in organising the UN's systematic efforts towards capacity - building in the area of the environment and development. Although the environment is an international issue, the reality is that while most environmental problems have a global dimension, solutions invariably lie at national, regional and even individual company levels. The implementation of environmental concerns into realistic projects are crucial at all levels for a truly 'One World' view.

6. Culture and productivity

The many factors affecting productivity taken with the complexity of society, clearly makes the study of productivity a multi-disciplinary and comprehensive one. Iranian society is diverse, developing from a long pre-Islamic history, significant later Islamic

influence and more recently an increasing international influence, not only in a technological sense but also with regards to social and personal relationships. Individual lives are moulded by factors that may not be easily controlled. Many of the aspirations of people are beyond the influence of governments and politicians. However, changes in policies, ideas, morals etc. and the opportunity to voice opposition, many decisions or courses of action are nevertheless constrained in some way. There are legislative and institutional constraints as well as covert cultural determinants which, if not taken into consideration, can act as powerful forces against change and a constraint to development.

The 'one world' we live in is changing very quickly. Ever more rapid communication each day brings news of some recent development in science and technology. Despite periodic recessions the rate of change does not appear to be diminishing. Not only does technology itself change, but also the ways in which it is managed. While these changes may originate in the industrialised countries in order to drive up their already high standard of life, in the less industrialised countries the basic struggle must still be to overcome shortages and poverty.

Technological solutions cannot be identified in isolation from the society in which they are going to be developed and practised. It is important therefore to gain an in-depth understanding of both culture and the technological solutions of the country under study. Increasing productivity should be considered in the context of an improvement of social and cultural conditions.

Over the last four years human development has been taken up as a topic of debate in the parliaments of some developed and developing countries. 'At Tegucigalpa in 1991, the heads of six Central American countries committed themselves to re-allocating a total of 500 million dollars for human development from their national budgets. UNDP (United Nations Development Programme) is now acting on requests from 28 countries to assist them in setting up national human development strategies and goals. Of the 93 countries where programmes have so far been approved for the Fifth Cycle, 79 have a major focus on human development'[43]

Cultural myths which act as constraints to development must be addressed and understood correctly. For instance, there are cultural constraints praising pure science and considering applied knowledge as inferior. The Tehran Institute of Technology established in 1958 changed its name to become a University and its programme from an

applied and technological basis to a more purely scientific one under pressure from students in 1970s! That event anticipated by more than two decades the recent change of name from polytechnics to 'metropolitan universities'. Although there is no harm in a name change, the distancing from an applied to a more theoretical emphasis in all higher education is not appropriate for developing countries. Engineering and science departments in our universities have acted as bodies providing advanced science and technology and little else.

In order to generate rather than adopt appropriate technology it is important to understand the original cultural relationships involved in the creation of new technologies as much as to understand their scientific basis. From the author's experience too much emphasis is still being put on the latter, whilst the former is totally ignored. Ironically there has always been a surplus of scientists of the latter kind who regularly emigrate abroad.

The issue of the 'brain drain' in developing countries has never been thoroughly understood. One of the main ways of eliminating this problem is through necessary amendments to the higher education system. Higher education needs to establish a fundamental and organic connection with society in general and with industries in particular. Universities remain 'isolated castles of science' and are thus sterile in their influence and feedback, and fail to play their role in the research and development of new industries. The problems are both conceptual and institutional. Scientific knowledge gained through higher education is usually wasted because it cannot relate to society. If any development policy is to succeed it needs to focus on the basic needs of ordinary people.

7. Productivity and incentive; the entrepreneurial factor.

Although the basic socio-political and socio-economic structures of a country as well as management practices are fundamental to proper analysis and planning for higher productivity, the human factor - incentive - remains hugely important.

The incentive and the desire to produce better and more, (and for that matter, to produce more efficiently) is an important factor in enhancing productivity. 'Financial reward does motivate people, but it is limited in its capacity to act as an incentive. In the long run, employees have to be given other rewards, as well as recognition and responsibility if

they are to maximise their contribution to an organisation.'[44] In microeconomics different businesses use different types of productivity agreements to encourage employees to become more motivated and so accept greater personal responsibility. This too can increase efficiency.

These methods and policies include: payment by results, bonuses, fringe benefits, flexible working hours, elimination of demarcation between different jobs, and methods for the elimination of time wasting. The high incentive of the private entrepreneur and greater flexibility of the private sector in using these methods can result in better quality and higher productivity. This economic method has been the core of the recent trend of macroeconomics policy involving 'privatisation' in the UK. This trend has now been increasingly followed by other previously socialist countries such as those of Eastern Europe.

This study avoids involvement in deep ideological issues. However, the author tries to explain the deficiencies of authoritarian and bureaucratic approaches in public supply, and the advantages of the high incentive and efficiency of private enterprise within small and medium scale organisations. By definition, a small business entrepreneur is one who is in it for himself; he organises, manages, and assumes the risks. 'In practical terms, he's the man who mortgages his house and everything he owns in order to bet that he knows something that others do not. If he wins the rewards can be fabulous; if he loses, he is wiped out.'[45]

This applies to individuals and their families who 'start up' a company with the knowledge and belief to succeed. They make it happen and grow by direct representation and sheer hard work. They are all small scale ventures, at least at the start. While the scale is relatively small they remain highly productive. When the scale grows larger - and the company becomes a publicly owned investment grade corporation, the entrepreneur often loses his direct control, and productivity can decline. If the management can keep an annual profit of 10-15 percent the company may survive[46]. But in the period of establishment and growth the entrepreneurial spirit is a crucial factor.

> 'The entrepreneurs, in their fervour to succeed, have managed overall to improve the usage of assets at their command and have produced a dynamic upsurge of productivity. Everyone gains.'[47]

7.1. Private supply Vs public supply.

> 'Publicly owned construction and maintenance organisations usually face considerably more constraints for achieving efficiency than do private contractors. For example, unrealistically low salary levels may not motivate staff, limitations on civil service careers may induce complacency, lack of commitment of senior staff, and a reluctance to take risks. Likewise, restrictions on the freedom to hire and fire and the use of public employment as a social or a political tool may frustrate managers; and cumbersome bureaucratic procedures may affect procurement . As an offset for all these constraints, state enterprises are usually protected from bankruptcy. Many governments would rather cover financial losses than liquidate inefficient public enterprises. In such cases, these enterprises become a permanent drain on the national budget[48].

In a study of public enterprise during the years 1963 to 1979, with the exception of the Oil, Gas, Cigarette, and Carpet industries, almost all others had been operating with the help of government subsidy and made a great annual loss.[49] Sowdagar[50] believes that even in those exceptions the reasons for profitability could not be attributed to good management and high productivity, but through the sale of natural assets and other trade relations and commercial factors. However the reason for the loss in the other numerous government owned factories given by Sowdagar was mainly corruption and poor management. In the first two years after the Islamic revolution 715 of the big manufacturing industries were nationalised and were added to 130 pre-revolution publicly owned industries.

Before coming back to our situation more than a decade after the Islamic revolution, it may be helpful to look at the situation of public and private enterprises elsewhere. Somewhere, perhaps, corruption is not a serious issue.

An example of public supply is the case of local authorities Direct Labour Organisations (DLOs) in the UK. Prior to legislation in 1980 (DLOs) were a small but not insignificant sector of the construction industry in the UK., employing around 250,000 operatives and staff. But :

> 'Criticism of the 'service department' concept, by the private construction lobby, The Chartered Institute of Public Finance and Accountancy (CIPFA), and ultimately successive Labour and Conservative governments led to those provisions in Part III of the Local Government Planning, and Land Act 1980 which compelled all authorities employing more than 30 operatives to organise their DLO (s) on a 'trading department' basis.'[51]

Imposing restrictions on DLOs in the UK should be seen as part of the privatisation policies of central government. They were supported by papers and statistics published concerning poor productivity in the direct labour sector as compared with private contractors.[52] There is a common perception that 'civil servants do little and do it badly'[53] Inefficiency and low productivity in state enterprises world-wide was tackled head on in a report by the United Nations Development Programme (UNDP)[54]. They noted that while the majority of government enterprises suffered financial losses, which were covered by subsidies that could have been better used for human development. 'The social opportunity costs have been staggering. If governments had not financed such losses, then total expenditure on health and education in Bangladesh and Poland could have been doubled, and in Argentina it could have been tripled.

Critics of government enterprise, or in the case of public works, Direct Labour, levelled their argument mainly at the idea that the public sector, protected from competition, free from the fear of insolvency and lacking the incentive for higher gain, cannot compete with the private sector in providing an effective service at a reasonable price.

In direct relation to the construction industry O'Brien[55], argues that:

> 'The market for construction was highly competitive with free entry and exit, absence of technical barriers and access to capital'. He went on to argue that construction does not meet any of the criteria for public supply and thus no case can be made for direct labour and the market should be left to the contractors. .This view has been supported by the Economist Intelligence Unit (EIU) which argued, in a report commissioned by the construction employers, that the sporadic nature of construction output made it particularly inappropriate for public supply.'

On the other side of the argument the main areas for justification of direct labour are ideological issues such as: 1) Direct labour tends to have a better safety at work record than the private sector. 2) it is claimed to have a better record in apprentice training and the employment of registered disabled persons than the private sector, and 3) it is highly unionised, unlike the contractual sector, where union membership is patchy and generally low.

The results of the survey of all Local Authorities in the UK of construction by DLOs showed that the scale of work was generally larger for Labour controlled authorities[56].

In economic terms, the advocates of public supply have a strong argument when they cite the flexibility of labour as a counterbalance to the lower productivity of direct labour. It has been claimed that direct labour offers greater flexibility than the contracting system, particularly in the case of non- programmed maintenance and repair work. This point will be of less relevance for direct labour operating on the 'trading department' basis which is essentially modelled on the contractual system. The other main economic advantage of public supply is that it can act as a check on private sector tenders which may be high in the absence of real competition or occasionally on unrealistically low tenders resulting from inaccurate estimating. In turn these low estimates are a result of cut-throat competition which can lead to delays in completion, to claims, and even possible insolvency.

The public enterprise is often the sole option for those projects that private firms are unwilling to undertake. These include the completion of contracts left incomplete owing to insolvency, or other factors. Projects in high risk war zones for instance were executed by 'construction *jihad*'[57] during the Iran - Iraq war. 'During the Iraqi imposed war, the '*jihad gars*' (jihad workers) made remarkable efforts in the battle fronts, mostly in the form of combat engineering and support activities.'[58]

In 1983 Jihad became a Ministry with the approval of the Majlis (parliament) and concentrated its efforts in the area of rural development. At present 40 % of the rural development budget (itself 19% of the total development planning budget goes to the Ministry of Jihad) where it has undoubtedly done a considerable amount of work in rural development :

'Through the efforts of Construction Jihad personnel, 90,000 new jobs have been created in the rural industry sector across the country, which has helped to prevent rural to urban migration. In addition, more than 70% of our villages now have access to electricity, piped water and roads.'(Nikzad. M.1993)[59] One cannot deny the political and social importance of the Construction Jihad but there are justified criticisms in relation to efficiency and productivity. In the same article, whilst praising the Ministry on its anniversary, Nikzad states: 'However, one important fact that should be remembered by the Jihad officials is that they must avoid **bureaucracy which is the biggest single problem in the way of development and progress in this country.**'[60]

The importance of productivity and of incentive in a planned economy is by no means less than its importance in a market economy. However it is argued that the invisible

hands of the market takes care of incentive, while in the planned economy the problem remains to be solved. The recent developments in Eastern Europe and the former Soviet Union, despite the obvious political difficulties in those countries, are due to their profound economic failure. The primary factor behind this economic failure has been the failure to replace market incentives by `social incentives' after the demise of the revolution. Social awareness and co-operation which this author would characterise as 'social incentive' is at its peak during disasters, wars and revolutions and starts to decline after the settlement and normalisation of the situation. The Cold War in fact helped to maintain this incentive for a longer period, but it sharply declined after it's resolution.

'In a survey the Economist states that in the former USSR the private sector produces more than a quarter of farm output on only 3% of the farmland. The average productivity in private farming is then approximately 10 times that of collective farms. Even if the Perestroika reforms only managed to close this gap a part of the way, the gains could be enormous! Such numbers are no basis for pessimism.' (Nuti.).[61]

Or as George Yarrow (Hertford College, Oxford) says: **It is abundantly clear that the centrally planned economies are riddled with incentive failures, and it appears that much of the current debate is focused on improving incentives at the levels of industry and enterprise.** The aim of perestroyka was to effect a shift from hierarchical to market-based methods of economic organisation or in Nuti's graphic phrase , 'From the visible fist of the command economy to the invisible hand of the market'[62].

In different socialist countries there was a varying degree of social ownership, planning, equality and participation in decision-making. In the socialism of the Soviet type, the basic features were: public ownership (mostly state but also collective), centralised planning by administrative bodies and transmission of commands in numerical targets to administrative Units. In tandem with these economic methods, was the communist (or Stalinist) monopoly of political power pervading the state and the economy at all levels.

Drastic changes have of course occurred: 'Glasnost was characterised by the toleration and encouragement of individual and co-operative enterprises, 'the main reason for change is said to be stagnant productivity'[63]

The advantage of planned economy was its ability to fully utilise its labour force and concentrate its limited resources in pursuit of one primary target at a time (like war, and later development of heavy industry). But the simple utilisation of labour is only the

starting point. The second step is the total utilisation of labour efficiently and effectively. The USSR was an example of a lopsided approach in a full employment policy without consideration of productivity, resulting in poor economic performance. However the disadvantage of the planned economy lies in its inability to co-ordinate more complex tasks, or to assess and optimise trade-offs between alternative targets. Most importantly, as Nuti argues, is the inability to innovate and adjust, again as a result of long chain of command and low incentives.

The importance and emphasis on the human factor is not the same in all Western (capitalist) industrialised countries. Because of the substantial accumulation of wealth and its abundant supply of natural resources in the United States for example, the emphasis is on capital investment, hard technology, and research and development efforts. 'Japan places heavy emphasis on the human aspects of productivity, because Japan has no natural resources other than people, Japan has what we call a 'lifetime employment system'. In most corporations once a man gets a job, he tends to stay with the company until he reaches the retirement at age 60. Ups and downs of the economy and temporary set-backs in performance do not necessarily result in the discharge of a man from the corporation. This policy and practice applies to management as well as blue collar workers. The goal of a Japanese organisation is to expand in the future, not to simply seek an immediate return on investment or short-term profits.'[64]

7.2. The privatisation phenomenon and productivity.

Since the late 1970s the pace of privatisation around the globe has accelerated dramatically. From a handful of countries, notably the UK under its conservative administration, the concept has spread to governments of almost all political persuasions, on every continent.[65] The move to market economies is being attempted by the former countries of the Soviet Union and some developing countries, 80 in all.[66] Privatisation of public enterprises and the establishment of banks and other capital markets has been the common feature of the economic reform programmes of recent years. But are these enough to encourage and help people participate in their economies or build the necessary economic structure for sustainable development and economic growth in the future? The main emphasis should be on human development says the United Nations Development Programme (UNDP) Report[67]. For instance, how can markets serve employment better, as the UNDP claims it can. The Human Development Report 1993 takes examples from the industrialising countries of the Far East.

'For the Republic of Korea, one essential starting point in the 1950s was land reform. Over two years, the proportion of farmers who wee owners of land rather than tenants increased from 51% to 94%; over the next 14 years, the labour used per hectare increased by 4.7% a year. Also, besides redistributing assets, these countries made heavy investments in the health, education and skills of their people, so that the work force was ready to exploit technology and new production methods as they were introduced. In that region labour productivity has risen by more than 10% a year, and the unemployment rate consistently stayed below 3%, compared with double -digit unemployment rates in most developing countries - and over 6% in the industrialised world.'

Argentina has privatised more than 51 companies in three years, raising government revenues by 5.6 billion dollars and attracting a large in-flow of foreign investment says the report. In Africa privatisation has been much less significant because of the difficulty in mobilising enough savings for equity investment.

Arguments for privatisation, always focus on the more efficient use of resources and gaining higher productivity. Right wing politicians, in favour of privatisation probably for strategic political reasons to legitimise their policies and gain votes use higher productivity in their promise of improving the economy and higher standards of living. The advantages of privatisation as Peter Lilley, appointed Britain's Financial Secretary in the 1980s puts it are: *1)More efficient use of resources, 2)better protection for the consumer and the environment, and 3) wider share ownership*[68]. In cases 1 and 3 reference is directly given to higher productivity.

1. ***More efficient use of resources:*** Even when a monopoly cannot sensibly be broken up into competing companies, the incentives and disciplines of private enterprise and ownership are of immense value. The profit motive is a powerful spur both to satisfying customers and to the efficient use of resources.

2. ***Better protection for the consumer and the environment***: The only way to ensure single-minded regulation is to ensure that regulation is the sole function of an independent regulator, leaving ownership to the private sector.

3. ***Wider share ownership***: Privatisation has meant that there are more people owning shares in the companies whose product they use. The fact that managers and employees can be, and usually are, shareholders too gives them a direct stake in the

company's success. This is a well worth goal but unfortunately is the last and least to be realised.

Nicholas Ridley, when British Trade Secretary, claimed that a private company operating in an environment of competition achieves higher productivity: "achieving competition remains the key element in any privatisation". Sir Geoffery Howe also made his claim for higher efficiency of private companies: "a private firm must adapt its production - in quality, specification, cost and volume - to what the consumer will buy or go out of business."

Those who argue against privatisation base their claim for public enterprise on the fact that public enterprise serves certain services better and promotes national interest in ways that the private sector will not. They neither claim that higher productivity can be gained in public enterprise nor deny the role of competition in more efficient management of industry. However they do claim that "privatisation in Britain is not expanding competition as its supporters claimed it would - instead, it is sponsoring a series of massive private monopolies or near-monopolies"[69]

Charles Isley of the National Opinion Polls reports a survey result of public opinion on privatisation. The results he maintains;....'show that there was a solid majority of the public who continue to support the public ownership of essential services like water, electricity, gas; defence factories and naval dockyards; basic core industries and local bus services. It was the feeling that the industries that had been privatised by that time, the major one being British Telecom, had been sold too cheaply'.[70]

These were samples in relation to a Western economy pioneering the phenomenon of privatisation in the last two decades. But how do privatisation policies relate to the Third World?

The World Bank and the International Monetary Fund are increasingly in favour of privatisation in the countries of the Third World while they seek a way out of debt crisis. 'Soft loans are now unfashionable as aid: the buzz word in Washington is now 'restructuring'. One form of reducing state spending and borrowing in this process of structural adjustment is to sell off state assets. . . . Privatisation is one way a near bankrupt nation can attract overseas capital.'[71] While right wing governments in Western Europe, such as Britain since 1983 and France from 1986, are in favour of privatisation

probably for strategic political reasons, elsewhere it is a response to pragmatic requirements.

The state owned companies have grown enormously and currently swallow a large part of the annual budget. 'According to the 1373 (March 21 1994 - March 20 1995) Budget bill the expenditures of the state companies and banks and non-profit institutions affiliated to the government in that year will be Rls 56,294 billion, that is more than 70% of the total expenditures.'[72] This becomes a matter of great concern, while in the same period the revenues of the state companies and banks show a considerable loss. 'The revenues of the state companies and banks in the bill are estimated at Rls 47,937 billion. At the same time the same units' expenditures will be Rls 52,300 billion. In other words the state companies and banks' expenditure will be Rls 4,363 billion more than their revenue.'[73]

The buzz phrase in Tehran now is economic adjustment policies. In line with the economic adjustment policies, improvement of the administrative system and reduction of the volume of the government's executive involvement .those monopolies which exist in the laws and regulations shall be cancelled. Reduction of the volume of the government's executive involvement' is the Iranian equivalent for privatisation which has been gradually gaining momentum since 1989 when President Rafsanjani was elected for the first time. Privatisation has become one of the highlights of the 2nd Economic Development Plan of the government. 'The transfer of the government units shall be done in a manner that such companies (state companies) will have been transferred by the end of the second plan at the latest. '[74].

Private, public or mixed economy may suit a particular country for a variety of reasons in different periods of time and stages of development. As the UNDP's Human Development Report argues; it would be naive to assume the historical experience of a particular nation can be replicated by other nations in another period of time, ' but **if there is one message that does emerge, it is that the solution is to focus not merely on capital or on production processes, but on people'.**

7.3. People-friendly Market

It is not enough to simply strike a balance between private and public enterprise, but to create a Market which serves the people, and not people serving the Market. It is

necessary that governments take the idea on board and adjust policies accordingly. 'Markets are, after all, not an end in themselves; they are a means to human development. Unfortunately the process of privatisation in many countries resembles a 'garage sale' of public enterprises to favoured individuals and groups, rather than an integral part of a coherent strategy to encourage private investment, human development and increasing productivity. [75] The following chart by UNDP sums up some basic rules to achieve these ends.

Steps towards people-friendly markets.

People-friendly markets allow people to participate fully in their operation and to share equitably in their benefits. Having markets serve people, rather than people serve markets, requires concrete steps:

1 Preconditions

- Adequate investment in the education, health and skills of people to prepare them for the market.
- An equitable distribution of assets, particularly land in poor agrarian societies.
- Extension of credit to the poor.
- Access to information, particularly about the range of market opportunities.
- Adequate physical infrastructure, especially roads, electricity and tele-communication, and adequate support for R & D.
- A legal framework to protect property rights.
- No barriers to entry, irrespective of race, religion, sex or ethnic origin.
- A liberal trade regime, supported by the dismantling of international trade barriers.

2 Accompanying conditions

- A stable macroeconomics environment, especially ensuring stability in domestic prices and external currency values.
- A comprehensive incentive system, with correct price signals, a fair tax regime and adequate rewards for work and enterprise.
- Freedom from arbitrary government controls and regulations.

3 Corrective actions

- Protection of competition, through anti-monopoly laws and safeguards against financial malpractice.

- Protection of consumers, especially through drug regulations, safety and hygiene standards and honest advertising.
- Protection of workers, through regulated working conditions and minimum wage standards.
- Protection of special groups, particularly women, children, and ethnic minorities.
- Protection of the environment, particularly through incentive systems and by banning pollution or making polluters pay.

4 Social safety nets

- Adequate arrangements to look after the temporary victims of market forces to bring them back into the markets, primarily through human investment, worker retraining and access to credit opportunities - as well as more prominent support for groups such as the disabled and the aged.

To keep the human development ends and the market means in balance, the report warns of the ' seven deadly sins of privatisation' as follows

1. The wrong reason - Many government sales seek only short-term revenue for the national coffers. Such a limited objective is likely to result in long-term losses for consumers and damage to the efficiency of the economy as a whole.

2. The wrong environment - If arbitrary government edicts continue to interfere with efficiency, or if the government provides no anti-trust regulation at all, 'transferring ownership to the private sector is unlikely to achieve much.'

3. Cronism and corruption. Where the disposal of assets is conducted in secrecy or without competitive bidding, corruption and enrichment of government cronies usually follow.

4. Financing budget deficits. Many harassed finance ministers are using the sale of public enterprises as a convenient means of financing their budget deficits. Says the report: 'Selling assets to meet current liabilities is mortgaging the options of future generations.'

5. A poor financial strategy. Too often shares are sold exclusively to foreigners or in a poorly developed stock exchange monopolised by the privileged few. Instead, governments should take care to achieve widespread distribution of shares to

nationals and foreigners alike in a way that maximises revenue and protects the national interest.

6. Poor labour strategies. Governments often err on the side of buying labour co-operation with unrealistic hiring promises or excessive 'golden handshakes' at termination. Instead, they should invite pre-sale labour dialogue and participation in management, in retraining and in lay-off policies and action.

7. No political consensus. Privatisation is a political as well as an economic act and should not be forced through by edict. Government should attempt to build as broad a consensus as possible, and procedures to minimise violent lurches in policy.

The enumeration of these sins is a caution not against privatisation, but against privatising within the wrong framework and without a human development purpose in mind. At the heart of successful market economies, says the report, must be new forms of social and economic participation. 'Creating people-friendly markets will be an essential part of this process, taking advantage of the energy and creativity of people whose contributions and potential we can no longer afford to ignore.'[76]

After a decade of nationalisation and intensive state involvement in the economy since the Islamic revolution of 1979, there has been a change since Mr. Rafsanjani was elected as President in 1989. With a majority of 95 percent, he embarked on a policy of liberalisation of the economy and privatisation. President Rafsanjani won the presidential election last June (1993), in which he received a reduced majority of 63 percent. Although 'President Rafsanjani had declared that his victory was a vote for his economic management policies'[77], many critics attribute his reduced popularity to the effects of the same economic policies.

'We are more concerned with how President Rafsanjani will assign priorities to the nation's political, economic and social agenda for the next four years. Hopefully, the president will remember that he can't have 90 different priorities. In the past four years we saw that life started to become more difficult for the majority of Iranians with run-away inflation and a sort of shock therapy that followed the heels of privatisation programmes and the single-rate system of foreign exchange. Education and health - the two most important priorities for our country of 60 million people - were seemingly put on the back rows as the Rafsanjani administration sought to highlight its ambitious policy of economic liberalisation.'[78]

No doubt the sluggish economy needed a boost when 'almost overnight the government decided to let the market decide',[79]but the opposition believes the situation did not merit such an abrupt and total reversal of past economic policies. They ask: ' with market forces in full gear and liberalisation strategies leading to a huge rise in production, who for heaven's sake is going to buy all these goods? Very fairly said, the majority of our people are becoming used to window- shopping.' [80]The question of building a balanced system for the distribution of wealth and income which was in the forefront of the revolution's principles seems to have died, at least for now.

However there has always been an inevitable conflict between political ideology and economic necessities. President Rafsanjani, aware of this conflict, pleaded for support in his inauguration speech on 4th August 1993, saying ' I declare in the presence of the country's elders that there is a serious need for co-operation and understanding to bring about progress and social justice.' Some critics believe that 'like so many other leaders Rafsanjani is caught in the middle of choosing a proper balance between state and private enterprise'[81]. The problem as the UNDP put it, is not simply maintaining a balance between public and private sectors but how the market can help people participate in their economies or to build sustainable development in the context of a particular developing country. If market forces are necessary to arouse a sluggish economy, when they run out of control they can have devastating effects on the life of the masses and lead to social unrest.

Advocates of mixed economy argue for the necessity of both public and private enterprise. Shonfield[82] defines the system as follows:

> 'A mixed economy is one in which prices and supplies of goods and services are largely determined by market process. At the same time the state and its agencies have a large capacity for economic intervention, which is used in an endeavour to secure objectives that the market would, it is believed, not achieve automatically or not fast enough to meet the requirements of public policy.'

Another important point Shonfield makes to further clarify the way in which mixed economies operate is that:

> '...governments and their agencies may intervene either to accelerate a market process, or to delay it or to bias the market in a certain direction by means of subsidies or taxes or by direct regulation.....What is novel about its contemporary

form is that it attempts increasingly to make some explicit allowance for the social costs of the market process to set against private gains'.

A very important point mentioned in the UNDP report is their concern about the increasing role of big contractors and the growing use of temporary and sub-contracted workers by these big firms. This reflects the discouraging and difficult conditions for start-up loans for small firms and the inevitable discouraging effect on smaller firms, which are the primary job creators particularly in developing countries.

7.4. The small firm

The small firm is now regarded by many economists and governments, both in the developed and developing world, as offering better prospects than the large firm for increasing national wealth and providing employment. The author believes that encouragement, help and promotion of small firms is the sole vehicle for the implementation of the so called idea of the 'people friendly' market. Moreover in developing countries these avoid the problems of imported technology and subsequent foreign control with its elimination of self reliance. As small business usually grows from informal indigenous industries the case of inappropriate technology would be eliminated.

'Many LCD's are embarking upon policies which give greater emphasis to indigenous small-scale development. The prime beneficiaries of such policies are those employed, rather than the owners of capital. It is also argued that small-scale enterprise develops more naturally from the informal sector which predominates in many less developed countries and places less demands upon provision of costly infrastructure.'[83]

While the government is involved in the large scale, heavy industries of cement and steel production, and the former nationalised companies are gradually privatised, if the policy of mass housing is going to be implemented through big companies (possibly by joint ventures with foreign companies), then the market would be far from 'people-friendly'. Mass housing policies by big companies will strongly damage the whole existing traditional/ conventional building industry and the delicate small scale *memar* system.

8. Summary and Conclusion

Improvement of productivity

1. Productivity improvements are now understood to be the result of varying determinants: physical, cultural, and political. This means that advances in technology, even if the key issue in some cases, cannot be properly implemented without the necessary changes in social and economic institutions and values. In this respect the process of growth and the study of productivity is very much related to the social sciences: sociology; psychology; behavioural relations and management sciences. On the workshop floor or building site, increases in productivity depend to a large extent on management and training, which in turn helps the utilisation of knowledge and technological know-how in cutting production costs.

2. As to the ways of reaching goals, the literature on economic development over the past 40 years has been constantly evolving and changing. As the ultimate goal of development is commonly claimed to be aimed at raising living standard by increasing the production of food, shelter and other commodities. On the one hand, with the consequent increase in the people's income this in turn makes these products affordable. Development economists such as; Mountjoy[84], Myrdal[85], and Todaro[86] clearly indicate that low real incomes are a reflection of low productivity, that low levels of productivity are self - reinforcing social and economic phenomena in Third World countries and, as such, are the principal manifestations of and contributors to their underdevelopment.'

Appropriate technology and employment

1. While improvement of technology is considered to be one of the major ways for achieving higher productivity, in developing counties the question of appropriateness remains a crucial one. It is quite safe to consider Appropriate Technology, but with small 'a & t'. Small scale appropriateness is never opposed to common sense. On the matter of scale we would like to add that it is a relative dimension. A small factory in one country may be considered as huge in scale in another.

2. In the West, the most disputed issue in relation to productivity increases have been their effect on employment. It is believed that as needs rise in most developing countries, then the improvement in productivity would not lead to more unemployment, but in-fact for a considerable period of time the very opposite. The attitude of workers (and employers) towards greater efficiency and higher productivity mainly depends on what they expect to get out of it. The main question concerns the benefit of higher productivity for society as a whole. There are three distinct points of view: 1) It is argued that if higher productivity is translated into lower costs and lower prices in a competitive market, industry will be strengthened as efficiency increases. As a result of the lowering of prices more demand is directed towards the industry and this in turn creates new job opportunities. 2)From the point of view of equity, the argument is that to the extent that higher productivity is translated into lower prices, all of society shares in the benefits, including the workers themselves. 3) In many cases where the most arduous and disagreeable building jobs are a long way from being mechanised, higher productivity calls for an increased effort on the part of workers. The workers must be adequately compensated for their greater efforts.

The environment

1. The intensive exploitation of nature without concern for the fragile eco-systems of life on earth, has already caused tremendous damage. Humankind's activity has always had an effect on the environment. But now, when societies are so interconnected economically, we have reached a stage where a decision to exploit resources in one continent can cause drought in another. Environmental imbalance is no respecter of national boundaries. Perhaps our increasing awareness of the fragility of Mother Nature can teach us a lesson. There are many divisions in the modern world: cultural, religious, ideological. The environment transcends these boundaries and sets us the problem of how to foster understanding of our mutual interconnectedness.

2. Although the environment is an international issue, and industrially developed countries are indebted to and should help the industrially developing world in this matter, the reality remains that while most environmental problems have a global dimension, solutions invariably lie at national, local and even individual level. The integration of environmental concerns into development plans and projects are crucial at all levels for a truly 'One World' view.

The human factor

- Although the basic socio-political and socio-economic structures of a country, as well as management practices, are fundamental to proper analysis and planning for higher productivity, the human factor - incentives - remains important. The incentive or the desire to produce more, (and for that matter, produce more efficiently) is an important factor in enhancing productivity. In microeconomics different businesses use different types of productivity agreements to encourage employees to become more highly motivated, to accept more responsibility to perform better. These policies and methods can include: payment by results, bonuses, fringe benefits, flexible working hours, elimination of demarcation between different jobs, and methods for the elimination of time wasting. The higher incentives of the private entrepreneur and greater flexibility of the private sector in using these methods can result in better product quality and higher productivity. This has been at the core of recent policy involving 'privatisation' in the UK. This trend has now been followed by other countries.

The state

1. This study tries to avoid involvement in deep ideological issues. However, being aware of deficiencies of authoritarian and bureaucratic approaches to public supply in Iran, we advocate the advantages of the higher incentives and a greater efficiency of private enterprises within reasonably small and medium scale organisations. In the first two years after the Islamic revolution 715 of the big manufacturing industries were nationalised and added to 130 pre revolution publicly owned industries. In a study of public enterprises during the years 1963 to 1979, almost all nationalised industries had been operating with the help of government subsidy and had still made a great annual losses.[87] Inefficiency and low productivity in state enterprises are generally a world-wide phenomena. A report by the United Nations Development Programme (UNDP)[88] noted that the majority of government enterprises suffered financial losses, which were covered by subsidies that could have been better used for human development. The social opportunity costs have been staggering. If governments had not financed such losses, then total expenditure for instance, on health and education in Bangladesh and Poland could have been doubled, and in Argentina tripled.

2. On the other side of the argument the main areas for justification of state control are ideological issues such as: 1) 'Direct labour' (opposed to contract method) tends to have a better safety at work record than in the private sector. 2) They claim to have a better record in apprentice training and the employment of registered disabled persons than the private sector. 3) The labour force is highly unionised, unlike the contractual sector, where union membership is patchy and generally low. The public enterprise is often the sole option for those projects that private firms are unwilling to undertake. Projects in high risk war zones for instance, were executed by 'construction *jihad*' during the Iran - Iraq war. At present 40 % of the rural development budget (itself 19% of the total development planning budget) goes to the Ministry of Jihad. It has undoubtedly done a considerable amount of work in rural development. One cannot deny the political and social importance of the Construction Jihad but there are justified criticisms in relation to efficiency and productivity.

The people

The move to market economy is being attempted by the former countries of the Soviet Union and some developing countries, 80 in all. But is this enough to encourage people to participate in the growth of their economies and to build the necessary structures for sustainable development and economic growth in the future? The main emphasis should be on human development. Private, public or mixed economy may suit a particular country for a variety of reasons in different periods of time and stages of development. As the UNDP's Human Development Report argues; it would be naive to assume the historical experience of a particular nation can be replicated by other nations in another period of time, '**But if there is one message that does emerge, it is that the solution is to focus not merely on capital or on production processes, but on people**'. It is not enough to simply strike a balance between private and public enterprise, but to create a market which serves the people. It is necessary that governments take the idea on board and adjust their policies accordingly.

Unfortunately the process of privatisation in many countries may resemble the sale of the 'family silver', rather than an integral part of a coherent strategy to encourage private investment, human development and increasing productivity. Having markets serve people, rather than people serve markets, requires concrete steps based on sound policies. Government policies should keep the human development ends and the market means in balance. Preconditions to privatisation should be considered such as: adequate

investment in education, health and skills training, and the availability of credit to the poor and so on. Other important conditions accompanying privatisation such as maintaining a steady economic environment, stability in domestic prices and external currency values are essential. Corrective actions should be considered during the process such as: proper formulation of the rules of competition, through anti-monopoly laws and safeguards against financial malpractice. And finally some arrangement to look after the victims of market forces, to enable them recover, primarily through retraining, advice and access to specified credit facilities.

A very important issue raised in the UNDP report, is their concern about the increasing role of big contractors and their growing use of temporary workers and the use of the sub-contractor. This reflects the discouraging and difficult conditions for many smaller firms who are the primary job creators, particularly in developing countries. The small firm is now regarded by many economists and governments as offering better prospects than the large firm for increasing national wealth and providing employment. The author believes that encouragement, help and promotion of small firms is the sole vehicle for the implementation of the idea of the 'people friendly' market. Moreover in developing countries these avoid the problems of imported technology and subsequent foreign control with its elimination of self reliance. As small businesses usually grow from informal indigenous industries the case for inappropriate technology would be eliminated.

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However any attempt to establish a sawmill was obstructed by sawmen who rioted. Two mills built by a Yorkshire man called Stansfield first in Bingley and later in London (1760), built with the encouragement of the Society of Art, were destroyed by organised riots of sawmen. Stansfield then emigrated to the USA where he managed to establish his mill. The anger of sawmen and their riot against the establishment of sawmills is understandable. What is strange however, is the alleged act of parliament. Parliament did not ordinarily act in the interests of working men in those times, so why did it not scotch the rumour and say plainly that sawmills were permitted? Cooney's suspicion is that merchant importers of timbers, who would have had the economic power to furnish political changes, started the rumour. Their better political connections would have enabled them to conspire with the right people.

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APPENDIX 5

Some additional information on the questionnaire survey in Iran

1. General considerations in the design of the questionnaire

Basic goals in the design of questionnaire were relevance, accuracy and practicality. 1) to obtain the necessary information relevant to the study, 2) to collect the information with maximum reliability and validity, 3) and to consider the problems and possibilities for the execution of the survey in the particular circumstances and conditions.

Considering the method of survey conduct, and to keep the motivation of the respondents, the wording, the sequence and the format was important. To this end certain criteria were set to be observed.

- The questionnaire must consider confidentiality of the respondents. To this end it was noted that the respondents did not need to name themselves or their company

- The questions must not be embarrassing or difficult to answer.

- Although it was envisaged to give necessary definitions by the author prior to the distribution of the questionnaire necessary explanation and instructions in how to fill in the questionnaire were given on each question.

- The questionnaire must not be lengthy and preferably be limited to two pages of A4 paper.

- Considering the cultural aspects it was decided that the questionnaire be designed originally in Persian, instead of being designed in English then translated. However, here we present the questionnaire in Persian with its original format and then the English translation.

2. The questionnaire in Persian

۶- آیا از بلوک سیمانی جهت دیوارهای باربر استفاده می‌کنید یا استفاده از آنرا توصیه می‌نمائید؟

☐ بله ☐ نه

در صورتیکه پاسخ منفی است بکدام دلایل؛ لطفاً سه دلیل عمده مشخص نموده و برحسب اهمیت از ۳ تا ۱ نمره بدهید (شماره ۳ را به عمده‌ترین دلیل بدهید.)

عدم امکان بافت دیوار سیمانی (ثابت بودن بلوک ۱۰ سانتی) ☐	مغایرت با نقشه (از نظر ابعاد و نوع کار) ☐	اشکال در ایجاد جهت لوله کشی و سیم کشی (جازنی در آن مشکل است) ☐
دیوار بلوکی ترک می‌خورد ☐	بلوک‌ها خوب خشک نمی‌شوند ☐	ساختمان بلوکی در نظر مردم نامرغوب است ☐
غیره ☐ لطفاً نام ببرید		

۷- آیا از عایق آماده (نظیر ایزوگام، ایزوسیل، مونیران ...) جهت عایق کاری دیوار و سقف استفاده می‌کنید و یا کاربرد آنرا توصیه می‌نمائید؟ بله ☐ نه ☐ در صورتیکه پاسخ منفی است سه دلیل عمده مشخص نموده برحسب اهمیت از ۳ تا ۱ نمره بدهید. (شماره ۳ را به عمده‌ترین دلیل بدهید.)

عدم اطمینان بکیفیت آن ☐	مغایرت با نقشه و مشخصات قرارداد ☐	عدم پذیرش صاحب کار ☐
عدم دسترسی ☐ گرانی ☐ غیره ☐ لطفاً نام ببرید		

۸- آیا تاکنون در امر احداث واداره "کارخانه تولیدی مصالح و یا اجزاء ساختمان" شرکت داشته اید؟ درصورتی که پاسخ مثبت است از مشکلات ذیل به ترتیب برحسب عمده بودن ۵ مشکل عمده را مشخص نموده به سخت‌ترین آنها بالاترین نمره ۵ بدهید و به سهل‌ترین مسئله نمره یک ۱ بدهید

تهیه زمین برای کارخانه ☐	تحصیل موافقت اصولی ☐	تحصیل وام و منابع مالی ☐	اشکال در تامین کادر فنی ☐
تامین ماشین آلات سالمت داخل ☐	تامین ماشین آلات خارجی (وارداتی) ☐		تامین مواد اولیه مورد نیاز تولید ☐
عدم اطمینان نسبت به نوسان بازار مصرف ☐	عدم اطلاع و تردید در مورد انتخاب نوع تکنولوژی ☐		تردید در انتخاب تکنولوژی ☐
غیره ☐ لطفاً نام ببرید			

۹- اگر فرض کنیم که تیرآهن و آجر و تیرچه و بلوک هردو در دسترس و میسر باشد و بها و تمام شده سقف "تیرآهن و طاق ضربی" و سقف "تیرچه و بلوک" هم عدداً مساوی باشد کدام نوع سقف را اجراء و یا اجراء آنرا توصیه می‌کنید.

سقف تیرآهن و طاق ضربی ☐	سقف تیرچه و بلوک ☐
به چه دلیل؟ لطفاً مرقوم فرمائید	

بنام خدا

منظور از طرح این پرسش نامه تعیین عوامل مخل در "بازدهی تولید" و بررسی کاربرد "اجزاء پیش-ساخته" در روش های متداول ساختمان میباشد. با تکمیل این پرسشنامه کمک ارزشمندی به انجام این بررسی خواهید فرمود. ذکر نام شخص، موسسه، شرکت و یا محل کار ضروری نیست.

باتشکر

لطفاً پاسخ ها را در محل های مناسب با علامت ☑ مشخص فرمائید.

۱- تخصص: معمار تجربی ☐ مهندس ساختمان ☐ مهندس معمار ☐
مهندس تاسیسات ☐ تکنسین ☐ غیره ☐ لطفاً نام ببرید .....

۲- نوع کار: طراحی ساختمان ☐ پیمانکاری ☐ حق العمل کاری ☐ تولید مصالح ☐
غیره ☐ لطفاً نام ببرید .....

۳- لطفاً نوع ساختمان هائی که ظرف ۵ سال گذشته در اجراء آنها بنحوی مشارکت داشته و یا دارید مشخص فرمائید: خانه شخصی تک واحدی ☐ مجتمع مسکونی ده واحد ☐
مجتمع مسکونی ده تا سی واحد ☐ مجتمع مسکونی سی واحد ببالا ☐ کارخانه ☐
انبار ☐ ساختمان تجاری ☐ ساختمان اداری ☐ دبستان و دبیرستان ☐
درمانگاه ☐ بیمارستان ☐ غیره ☐ لطفاً نام ببرید .....

۴- بنظر شما در ۵ سال اخیر کدامیک از عوامل ذیل بیشتر مخل و مسئول افت و کاهش "بازدهی تولید" در ساختمان سازی بوده، و باعث شده که منابع (مصالح، کارگر، وقت..) بیشتری در ساختمان صرف شود. لطفاً از عوامل نامبرده زیر چهار عامل عمده را مشخص نموده و سپس بترتیب اهمیت از ۴ تا ۱ نمره بدهید (نمره ۴ را به مهمترین عامل و بترتیب ۱ را به کم اهمیت ترین بدهید)

سردی هوای زمستان ☐	گرمی هوای تابستان ☐	کم کاری کارگران ☐	عدم استفاده از ماشین آلات ☐
تلفات مصالح ☐	بدقولی و عدم حضور بموقع اکیپ های کاری ☐	کمبود و تاخیر در تهیه مصالح ☐	

غیره ☐ لطفاً نام ببرید .....

۵- آیا در پروژه های خود "روب چوبی پیش ساخته" بکار برده و یا کاربرد آنرا توصیه می نمائید؟
بله ☐ نه ☐
در صورتیکه جواب منفی است، بکدام دلایل ذیل: لطفاً به ترتیب اهمیت به سه دلیل عمده نمره بدهید به مهمترین دلیل نمره ۳ و بترتیب تا کم اهمیت ترین، شماره ۱ بدهید.

عدم دسترسی ☐	مغایرت با نقشه و مشخصات ☐	نداشتن تضمین حسن انجام کار ☐	عدم پذیرش صاحب کار ☐

غیره ☐ لطفاً نام ببرید .....

3. The English translation of the questionnaire.

The purpose of this survey is to study factors affecting site productivity, and application of the building components in the conventional Iranian Building Technology.

You will help a great deal by filling in this form. thank you.

You need not to name yourself or your firm

serial No.

Please tick where appropriate.[]

1: Your title

1 Memar (Master Builder) [] 2 Civil Engineer [] 3 Architect []
4 Service Engineer [] 5 technician []
6 Other[] Please state:

2: Your position

1 Consultant/Designer [] 2 Building Contractor []
3 Haghol amal kar [] 4.Material producer []
5 Other.[] please state:

3: Which building projects; last 5 years

1 Single unit owner built house. [] 2 Public or private housing 2 to 10 units []
3 Public or private housing 11 to 30 units [] 4 Public or private housing 31 plus units[] 5 Factories []
6 Warehouses [] 7 Commercial others [] 8 Offices[] 9 Schools[] 10 Health clinics []
12 11 Hospitals [] Other Buildings [] Please state:

please tick, and give grade where appropriate.

4: Site Productivity; last 5 years

Which factors have been most influence on and responsible for the decrease in site Productivity in building projects that you have been involved in recent 5 years.

Please tick the four of most significant factors and then give them grades from 4 to 1, according to degree of importance in descending order.(the most important factor gets 4 and the less important 1)

1 Cold season [] [ ] 2 Hot season [] [ ] 3 Labour's low performance [] [ ]
4 Insufficient use of machinery.[] [ ] 5 Lack of discipline of working groups [] [ ]
6 Shortage of materials & and subsequent delay in supply [] [ ]
7 Other [] please state:

Building Components use; last 5 years.

5: Prefabricated doors

Have you used or specified Prefabricated Doors? 1Yes [] 2 NO.[]

If your answer is negative, tick the three most important reasons and then give them grades 3 to 1 in descending order.(the most important reason gets 3 and the less important 1.)

3 Not available [] [ ] 4 Not specified [] [ ] 5 Lack of guarantee [] [ ] 6 Rejection by client [] [ ]
7 Other.[] please state:

6: Concrete blocks.

Have you used or specified concrete blocks for load bearing walls?

1 Yes.[] 2 No.[]

If your answer is negative, please tick the three most important reasons, and then give them grades 3to 1 in descending order.(the most important reason gets 3 and the less important 1.)

3 It is not possible to build 30 cm. thick wall with the only available 20x20x40cm. blocks [] [ ]
4 Not specified [] [ ] 5 Problem of grooving for pipes [] [ ] 6 Block walls tend to crack [] [ ]
7 Blocks are not made properly [] [ ]
8 Buildings which are made by concrete blocks are considered of low quality [] [ ]
9 Other [] please state:

7: Tanking materials.

Do you use or specify materials other than "jute-cloth and tar", such as Isoran, Isoseal, Isogumm etc.?

1 Yes [] 2No []

If your answer is negative, please tick the three most important reasons, and then give them grades 3 to 1 in descending order.(the most important reason gets 3 and the less important 1.)

3 Uncertainty about the quality [] [ ] 4 Not specified [] [ ] 5 Rejection by client [] [ ] 6 Not available [] [ ]
7 Too costy [] [ ] 8 Other [] please state:

8: Building Components manufacture; last 5 years.

Have you been involved in the establishment of a new enterprise for the production of building materials or components in recent 5 years?
if your reply is positive, which problems were most difficult to solve in the establishment of the firm.

Please tick the five most difficult factors and then give them grades 5 to 1 in descending order.(the most difficult factor gets 5 and the less difficult 1)

1 Land provision [] [ ]	2 Government permission [] [ ]	3 Loan and financial provision [] [ ]
4 Provision of technical manpower [] [ ]		5 Provision of the machinery made in Iran [] [ ]
6 Provision of imported machinery [] [ ]		7 Ensuring the provision of primary materials [] [ ]
8 Uncertainty about the market [] [ ]		9 Deciding which product to produce [] [ ]
10 Deciding about the technology to employ [] [ ]		
11 Other [] please state:		

9: The use of Joist - Block.

Which type of roofing do you prefer to use or specify.

1 I beam and jack arch [] 2 Joist - Block []
For what reasons? please state one or two of the most important reasons on the line below:
. . . . . .

4. Additional information

Table Ax5: 1 Cross tabulation: Reasons why door sets were not used /by Title

Title\ position	Not available	Not specified	lack of guarantee	Client's rejection	Other	Row total/ (percent.)
Memar	11	22	24	14	2	27; 31.0
Engineer	11	31	33	23	3	36; 41.4
Architect	2	4	8	7	2	8; 9.2
Service Eng.	3	4	6	3	1	6; 6.9
Technician	3	6	9	7	0	10; 11.5
Column total/ percent	30 34.5	67 77.0	80 92.0	54 62.1	8 9.2	87; 100.0

Table Ax5: 2 Cross tabulation: Reasons why wall blocks were not used

\Title Block use	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total/ (percent.)
Limitation in wall thickness	11	11	3	0	4	29 25.9
Not specified	15	21	6	3	7	52 46.4
Grooving problem	12	24	7	4	10	57 50.9
Tendency of wall to crack	8	10	3	2	6	29 25.9
Not made properly	15	38	8	5	12	78 69.6
Building's bad sale	17	18	5	3	13	56 50.0
Other	0	8	0	0	2	10 8.9
column total percent	28 25.0	46 41.1	13 11.6	7 6.3	18 16.1	112 100.0

Table Ax5: 3. Cross tabulation: Reasons why roofing membrane were not used

\Title R.M. use	*Memar*	Engineer	Architect	Service Engineer	Technician	Row total/ (percent.)
Uncertain quality	17	31	8	4	10	70 74.5
Not specified	9	9	5	3	4	30 31.9
Client's rejection	15	19	4	3	8	49 52.1
Not available	8	12	5	2	9	36 38.3
Too costly	9	26	4	5	10	54 57.4
Other	1	4	0	0	1	6 6.4
column total percent	24 25.5	41 43.6	9 9.6	6 6.4	14 14.9	94 100.0

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