

**THE REPRODUCTION OF 'GOVERNMENT
DEPENDENCY' AND HIGH-TECH START-UPS
IN DAEDEOK, SOUTH KOREA**

Thesis submitted for the degree of PhD

by

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ABSTRACT

This thesis focuses on exploring the behaviours of high-tech start-up firms in response to the policy interventions undertaken to promote regional innovation in South Korea since 1997. High-tech start-ups and their technological entrepreneurship are increasingly considered by policy makers and academics to play a crucial role in the generation of innovation and economic development. However, this study started from a basic concern of why government intervention does not necessarily result in an increase of regional innovation capacity.

To explain this concern, which comes from the researcher's personal observation in the field, this thesis attempts to construct a new conceptual framework of 'government dependency' and to apply this to 'Daedeok', a region in South Korea, to explore the reproduction of this kind of dependency. This conceptual framework was developed by remodeling path dependency theories through a systemic and interactive lens. The empirical study used secondary data analysis and qualitative interviews of start-up founders to delineate the emergence of a new development path and the extent to which dependency was reproduced in the Daedeok regional innovation system.

The research findings from this empirical study reveal that the perception of risk held by founders of start-up firms was lowered by a belief in their technology and the government's risk sharing policy. Such perceptions generated a regional development path of policy reliance in the case region. The emergence of this path gained momentum due to its practical benefits to business. As a consequence, policy reliance was connected to behavioural persistence of benefit-seeking. Empirical analysis suggested that 'reliance' and 'persistence' were the crucial factors in the production and reproduction of the government dependency. Some firms accepted dependency as reliance, but others regarded it as policy utilization. Thus, a critical juncture could not be clearly identified in actors' behaviour. It was also unclear if dependency had hindered innovation, but it

was shown that the regional and institutional contexts strongly influenced the reproduction process. The thesis concludes that the construct of government dependency can also provide useful insights into policy learning as well as the success of government interventions.

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LIST OF ABBREVIATIONS

BT – Bio Technology
CBO – Collateralized Bond Obligation
CDMA – Code Division Multiple Access
CEOs – Chief Executive Officers
DCGF – Daejeon Credit Guarantee Foundation
DHIPF – Daejeon Hightech Industry Promotion foundation
DMC – Daejeon Metropolitan City
DSSC – Daejeon Small & Medium Business Support Centre
DST – Daedeok Science Town
DTV – Daedeok Techno Valley
ETRI – Electronics and Telecommunications Research Institute
EVA – ETRI Venture Association
GRDP – Gross Regional Domestic Product
HCI – Heavy and Chemical Industry
IMF – International Monetary Fund
IPO – Initial Public Offering
IR – Investor Relation
IT – Information Technology
KAIST – Korea Advanced Institute of Science and Technology
KIET – Korea Institute for Industrial Economics and Trade
KIST – Korea Institute of Science and Technology
KISTEP – Korea Institute of Science & Technology Evaluation and Planning
KITA – Korea International Trade Association
KOSDAQ – Korea Security Dealers Association Automated Quotation system
KOVA – Korea Venture Association
KRISS – Korea Research Institute of Standardization and Science
KSEF – Korea Science and Engineering Foundation
KTCGF – Korea Technology Credit Guarantee Fund
MIC – Ministry of Information and Communication
MOFE – Ministry of Finance and Economy
MOST – Ministry of Science and Technology
MOCIE – Ministry of Commerce, Industry and Energy
NADAQ – National Association of Securities Dealers Automated Quotation system
NIS – National Innovation System
PBS – Project Base System
PRIs – Public Research Institutes
R&D – Research and Development
RIS – Regional Innovation System
S&T – Science and Technology
SMBA – Small and Medium Business Administration
SMEs – Small and Medium-sized Enterprises
TIC – Technology Innovation Centre
VC – Venture Capital

1 INTRODUCTION

1.1 Research aim and background

The broad research aim of this thesis is to contribute to our knowledge about regional development processes, and to explore the role of high-technology start-up businesses in economic readjustment. In particular, it seeks to explain why government intervention does not necessarily result in an increase of regional innovation capacity. High-tech based start-up firms and their entrepreneurship have been widely recognised to play critical role in regional innovation and national economic development. Therefore, policy makers in many countries have been very keen on intervening to promote high-tech start-ups in various ways. Policy intervention seems to have a wide range of impacts on regional innovation both intended and unintended. This thesis is interested in the impact of policy support for start-ups in promoting spatial development and strengthening regional innovation capacity.

Silicon Valley has come to represent a 'successful' model of creating and funding high technology businesses, and also promoting regional development. Much literature has focused on identifying the formula of this success (Miller and Cote, 1987; Saxenian, 1994; Rosenberg, 2002). Many countries tried to implant the Silicon Valley concept into selected geographical spaces, but these experiments often produced disappointing results in terms of national and/or regional innovation. This demonstrates that the ingredients of successful story in a specific locality can not necessarily guarantee the same success in another locality. Behind Silicon Valley's success, the local strengths and the business friendly culture have more frequently been cited rather than government policy intervention. This implies that policy intervention does not also necessarily guarantee the cultivation of regional innovation. Policy interventions by governments in the process of innovation have been justified in terms of market failure and/or system failure. However, at the same time, policy support or regulations can cause different problems or inefficiencies at any time. In particular, there have been concerns that direct financial

support to start-ups may weaken entrepreneurship and deepen dependency on government policy. In this regard, it seems to be quite important to understand the responses of start-ups to policy support for both academic and practical purposes.

This thesis focuses on investigating the policy responses of high-tech start-ups in terms of regional development particularly in Daedeok, South Korea (hereafter referred to as just Korea). This research was partly motivated by the researcher's own working experiences in a local authority in Korea for fifteen years. However, more importantly, Daedeok is expected as a relevant study area in that there is a large-scale science park and considerable number of spin-offs from it, and there have been quite long efforts of policy support to promote innovative activities such as R&D and start-ups.

The Korean economy has experienced many fundamental changes over the last three decades. Particularly since the outbreak of an IMF economic crisis in 1997, the Korean government has struggled to find a new impetus for sustainable economic development. In this situation, high-tech start-ups emerged as a promising actor to replace the dominant role of the traditional *chaebols* (large conglomerates) and the perceived weaknesses in the performance of the national economy. The government began to prepare legislative frameworks and develop several assistance schemes to foster technology based new start-ups. Start-up support policy in Korea needs to be reviewed in association with other interrelated policies. In case of Daedeok, start-up phenomenon needs to be understood in the context of science and technology policy over the last three decades. 'Daedeok' has a quite unique position in terms of both national and regional innovation in Korea that mainly comes from the existence of Daedeok Science Town (DST), a large-scale research and development centre built by the central government. DST has been part of a national innovation system since the early 1970s when it was transplanted in Daejeon Metropolitan City (DMC). DST has been backed by the national government through the subsidy of R&D, and as a consequence, many resources for innovation became more concentrated in Daedeok compared to other periphery regions.

Generally speaking, the agglomeration of R&D resources is seen to offer positive potential for regional innovation. However, in 2001, the city council of Daejeon began to regard the DST as an 'island' of economic activity (Daedeok Valley Master Plan, 2001), and believed that there was a lack of close cooperation between start-ups and PRIs (Public Research Institutes); a lack of local positive spill-over effects with Seoul still providing the major markets for the companies in Daedeok; a lack of new industrial inward investment needed to create a more diversified regional economy; and a lack of firms in the region to provide private capital, such as venture capitalists. To address these problems, Daedeok Valley Master Plan (2001) emphasised the importance of securing more budget and policy support from the central government. On the one hand, it seems to be an easy and natural solution considering the fiscal and power relations between the central government and local authorities in Korea. But on the other hand, an interesting phenomenon can be found that there has already been relatively large policy concentration on Daedeok, particularly in the field of R&D and related infrastructure investment. According to a linear model of innovation, the more resources that are put in to the process of innovation, the more innovation that should be produced. Then, a few significant questions can be asked why such advantageous factors and continuous policy support have not been sufficiently connected to regional innovation? Why has continuous policy support not necessarily resulted in an increase of regional innovation capacity? Is it really because policy support for Daedeok has not been sufficiently provided? This study tries to answer these questions through the investigation of policy responses of spin-off start-ups in Daedeok.

1.2 Research objectives and questions

Today, most of policy measures, particularly 'interactive' policy tools from systems approach, aim to change actor's behaviour in principle (Diez *at al*, 2000). Policy can affect the innovative behaviour of firms directly via subsidies or indirectly via the provision of public infrastructure and institutions. In a neo-classical linear model, subsidising R&D has been emphasised as an input to the innovation process. This type of intervention can affect the innovative behaviour of firms directly by influencing

choices based on the cost/benefit calculations of agents. However, according to the systems approach, innovation cannot be easily promoted by just increasing input factors. Supportive policy from this systemic perspective mainly aims for more dynamic and long lasting effects on innovative behaviour even after the support stops (Nauwelaers *et al*, 2002).

The provision of financial support has been the most common and powerful policy measure considered by policy makers. However, as Stiglitz (1999) argues, external incentives can modify short-term behaviour of actors, but they usually override the intrinsic motivation system rather than change it. Thus, when the 'extrinsic incentives' are removed, behaviour reverts to the previous motives. Sometimes, direct government support can also cause unexpected inefficiency or dependency on government which might be connected to moral hazard, grant-seeking behaviour and loss of entrepreneurship. O'Farrell (1990) points out that 'government-induced distortions' in the marketplace and the dependency on government subsidies can undermine the willingness and ability of regional firms to form relationships with outside firms. This dependency can be connected to the lack of entrepreneurship. He terms this '*grantpreneurship*'. He also argues that the '*grantpreneur*' mentality is widespread and suggests: "*if you can't compete without grants, you won't compete with them*" (O'Farrell and Hitchens, 1988, p. 410; O'Farrell, 1990, p. 16). According to O'Farrell, "*public policy appears inadvertently to have reinforced market failure to some extent by cushioning profits via grants, subsidies and preferential purchasing thereby reducing the incentive to change...*" (O'Farrell, 1990, p. 24).

As many studies in other fields like welfare policy have pointed out, government support can weaken welfare recipient's self-reliance and deepen dependency on continuous support (Cox, 2004; Ebbinghaus, 2005). This lesson seems to be also valid in start-up business sector. Start-ups have been understood as crucial actors in the innovation system at national and regional levels. The promotion of technological entrepreneurship has been recognized as a significant policy tool to increase regional innovation capacity. Many countries are interested in facilitating new firm formation by supportive policy

measures. In the linear model perspective, policy makers can expect higher levels of start-ups by increasing support. However, policy intervention can often produce serious distortions of market mechanisms. Direct financial policy support for start-ups may paradoxically result in the loss of entrepreneurship in their business.

This study attempts to address this problematic phenomenon in terms of the dependency of start-up firms on policy support. This study is grounded on such a systemic approach to innovation as a basic frame for understanding the innovation process. At the same time, it highlights the role of a region as the space where innovation takes place. In this regard, territorial and systemic dimension of innovation is emphasised in this study. This thesis is, most importantly, anchored in path dependency theory as a theoretical lens to see the reproduction of start-up firm's responses induced by policy intervention, particularly in terms of regional innovation capacity. Basically this thesis accepts that a wide range of behavioural responses to supportive policies can exist somewhere between two extremes of fully independent (self-reliance) and fully dependent response. Thus, it assumes that policy support for start-ups can bring about some extent of reliance on it and this reliance may become the source of persistence in their behavioural dependency on it.

In line with this, the research objectives of this thesis are:

- To construct a conceptual framework that allows an examination of regional development through a lens of path dependency theory, and also addresses regional innovation behaviour through a systemic approach;
- To apply this framework to a study region in Korea to explore the reproduction of dependency on policy support by understanding the processes of reliance and persistence.

Considering these research objectives, two primary research questions are raised:

- How and why has the reliance of start-up firms been produced in the process of starting their business?

- How have start-up firms responded to support measures of government in getting on their business and why they came to respond in that way?

The empirical research setting specifically focuses on 'Daedeok' in Korea. The impact of economic readjustment varies from country to country depending on the national economic, social, political structures, and as mentioned above, certainly dramatic structural changes have occurred in Korea since the financial crisis in 1997. The economic transition has not only caused severe economic disruption but also made numerous impacts on Korean society. One of notable changes since 1997 was that high-tech start-ups began to emerge as a main actor in the Korean economy. As stated already, this study started with the identification of an empirical concern that originated from the researcher's personal observations of practice. In order to address these observations, a conceptual framework of 'government dependency' was produced on the basis of various theoretical discussions and the modification of classical path dependency approach. This is operationalized through the two concepts of 'reliance' and 'persistence'. The reliance on government support by start-ups was investigated through an examination of the change in 'risk perception' held by start-up entrepreneurs. At the same time, the persistence of this reliance was examined through the continuous benefit seeking, a self-reinforcing expectation held by the entrepreneurs.

In order to examine the primary questions through empirical research, four more specific sub-questions are raised:

- What makes potential high-tech entrepreneurs become start-up founders?
- How has policy support influenced changes in the perception of risk during the process of start-up?
- What sort of entrepreneurial responses have been induced by this change in risk perception?
- How have these responses been reproduced as a form of behavioural persistence in their business history?

The conceptual framework was applied to the empirical world to answer the research questions. Relevant data was collected from secondary sources and field work consisting of qualitative semi-structured interviews. In this regard, the study can be seen as a

journey between academia and empiria. Academia is seen as the general world which consists of theories and constructs. In contrast, empiria represents the specific world which contains the case area and other contexts of this study, like the specific policies. The development of a conceptual framework provided a bridge between those two worlds.

1.3 Structure of the thesis

Chapter Two consists of two sections. First section discusses entrepreneurship and high-tech start-ups. This explores some critical issues, such as how the inventor comes to choose the risky route of becoming a start-up; what technological features are involved; what incentive mechanisms trigger the inventor to found a start-up. Second section provides some overall information and knowledge to understand the characteristics of high-tech start-ups in Daedeok as a study area. This chapter becomes a starting point to interweave crucial issues in later chapters with regard to start-up, innovation, region and policy.

Chapter Three examines the process of innovation. There are two important issues associated with the nature of innovation process. First, it is considered whether the innovation process can be seen as a path dependent or a path breaking process. Second, it is asked whether this process is linear or systemic. The territorial dimension of innovation is also reviewed in terms of systems approach. In addition, the rationale for policy intervention is discussed from the traditional market failure perspective and the more recent system failure perspective. At the same time, the matter of intervention mode is considered in terms of differentiated circumstances in time and space.

Chapter Four, in first section, reviews the theoretical expansion of path dependency approach in different fields such as technological, institutional, organisational and regional change. Particularly, institutional path dependency is reviewed as the main interaction between policy intervention and changes at the organisational or regional level. In second section, conceptual framework is established to explore policy induced

'government dependency'. The conceptualisation of the government dependency mechanism is based on the modification of the classical path dependency approach: moving from a linear and deterministic perspective to a non-linear and more flexible one. As a result, this thesis suggests a circulating type of path dependency approach. This is intended to help understanding of the phenomenon of both new path creation by policy intervention, and the emergence of second-round path dependency. This chapter develops two concepts of policy reliance and behavioural persistence to apply the new model to the field.

In Chapter Five, the methodology of the empirical work is discussed. This chapter outlines the methodological underpinnings of this thesis and the issues raised by fieldwork based on qualitative research methods and an analysis of secondary sources.

Chapter Six explores the broader institutional factors which affect on the reproduction of government dependency at the actor's level. Daedeok regional innovation system is analysed through a path dependency perspective in association with the national context of Korea. This analytical chapter provides understanding of institutional inertia in shaping regional and entrepreneurial trajectories.

Chapters Seven and Eight reveal the findings from qualitative interview data analysis. Chapter Seven focuses on the changes of risk perception of start-up firms in the process of new firm formation. Chapter Eight examines the behavioural persistence of start-ups in seeking benefit from policy support by focusing on four entrepreneurial activities: venture certification, financing choice, grant or subsidy chasing, and location choice.

The concluding chapter attempts to make discursive expansion on the basis of research findings. Research findings from the empirical interview data analysis are critically reflected on a wider context, and the policy implications of this thesis are suggested. Finally, this chapter reflects on the limitations of this study and outlines the possible directions for further research.

2 HIGH-TECH START-UPS AND REGIONAL DEVELOPMENT IN DAEDEOK, KOREA

2.1 Introduction

This chapter discusses how knowledge workers like researchers or engineers become start-up entrepreneurs and outlines the role of high-tech start-up as the unit of analysis in this thesis. It also explores the characteristics of Daedeok in specific Korean locality over the last thirty year of period. High-tech start-ups and their technological entrepreneurship are increasingly considered to play a crucial role in the generation of both regional innovation and economic development. As witnessed in the case of Silicon Valley, there has been significant interest in the agglomeration of ‘technopreneurial’ activities and the ways in which they can contribute to regional transformation and high economic growth. In this respect, governments in many countries have attempted to promote ‘technopreneurship’ (Lek and Al-Hawamdeh, 2001; Venkataraman, 2004; Milton-Smith, 2006) by pursuing various policy initiatives. There are, however, a few issues with regard to this transformation process from technology to market and business. Starting up technology-based firms can be influenced by the nature of technology itself and people’s perception of risk. When a certain technology has an ‘embryonic’ and/or ‘tacit’ nature, there would be information asymmetry between the inventors and the people who try to commercialize their inventions (for further detail see Section 2.2.2). In this situation, technology transfer by way of licensing might be limited by possible risks if the inventors do not relevantly involved in commercialization process. Previous literature suggests inventor-founded start-ups rather than licensing tend to be emerged in this situation and incentive structure plays an important role for the inventors to decide which pathway they choose. This chapter discusses the relationship between entrepreneurship and risk-taking, the role of high-tech start-ups in regional innovation, and the rationale for choosing high-tech start-ups. In following section, it provides the understanding of start-ups in Daedeok in the context of specific Korean locality.

2.2 Rationale of high-tech entrepreneurship

2.2.1 Entrepreneurship and risk-taking

Although a ground-breaking contribution to the analysis of entrepreneurship was made by Schumpeter (1934), start-up entrepreneurship has not drawn much attention as an academic theme until the late 1970s. This might partly be because research interest focused on large firms which were seen as the main vehicle of achieving economic growth. However, these views had to be revised after the world-wide crisis in the 1970s. People have seen that small firms are able to adapt to changing economic conditions better than large firms. Since the 1980s many researchers and policy makers have focused on SMEs and entrepreneurship. The concept of entrepreneurship has been defined in various ways in different disciplines. It seems to involve the discovery, creation and exploitation of opportunities (Shane and Venkataraman, 2000). Schumpeter described entrepreneurs as active agents that seek to organise resources and actively refine the environment to be conducive to their pursuit (Schumpeter, 1942). According to Sahlman and Stevenson (1991, p. 1), “*entrepreneurship is a way of managing that involves pursuing opportunity without regard to the resources currently controlled. Entrepreneurs identify opportunities, assemble required resources, implement a practical action plan, and harvest the reward in a timely, flexible way*”. Entrepreneurship is apparently “*a multi-faceted phenomenon that can be viewed from different angles*” (Nijkamp, 2003, p. 397), but many researchers in the mean time have focused on ‘risk-taking’ as an important feature of entrepreneurship. Entrepreneurs, by their nature, have been understood as typical ‘risk takers’ who know how to properly deal with uncertain situations and willingly bear (or accept) riskiness. The feature of risk-taking by entrepreneurs is found in the dictionary definition of an entrepreneur, who is a person that “*organizes, operates, and assumes the risk for a business venture*” (American Heritage Dictionary of the English Language, Fourth Edition, 2000).

Traditional entrepreneurship literature tends to attribute the success and failure of such behaviour to heroic individuals or specific individuals who possess special traits. But

recently, it is widely agreed that entrepreneurship is a complex social and economic phenomenon. In the broadest sense, it is defined as “*activities to promote socio-economic stabilization and effective utilization of resources by stimulating socio-economic progress, creating new values, and providing employment opportunities*” (Yamada, 2002, p. 4). As Miller (1983) suggests, entrepreneurs are likely to take proactive action with risk bearing to explore business opportunities and promote innovation. Entrepreneurs must confront uncertainty and effectively cope with it in the real market particularly at the early stage of a start-up. Uncertainty can be created by a lack of information about environmental factors and their likely impact on the organisation and an inability to assign probabilities to events with any degree of confidence (Mokry, 1988). As Mokry argues, to some extent uncertainty can give firms opportunities for profit, but too much uncertainty can block a start-up or slow it down. Start-up motivation depends largely on the entrepreneur’s prior knowledge and context, but it is also influenced by networks and environment (Dubini and Aldrich, 1991).

Luger and Koo (2003) suggest that most of the literature on start-ups uses three different definitional criteria: ‘new’, ‘active’ and ‘independent’. As they argue, these three criteria are closely interrelated. The ‘independent’ criterion, in particular, raises an important question on start-ups: should start-ups and spin-offs be distinguished? Spin-offs are defined as “*new firms created by individuals breaking off from existing ones to establish competing companies of their own*” (Garvin in *ibid*, p. 18). In this respect, some spin-offs may not meet the ‘independent’ criterion. They argue that “*whether a new firm can satisfy the ‘independent’ criterion depends on the relationship between a newly created start-up company and the firm for which its founder(s) originally worked*” (*ibid*, p. 19). In Korea, a legal definition of venture firms has been in common use, but the number of certified ventures by the government can not cover the growth of various start-ups. Particularly, there are around 60% of spin-offs from DST among the total number of high-tech start-ups in Daedeok Valley (Daedeok Valley Master Plan, 2001), but some of these spin-offs could not officially be certified as venture firms. How to define start-ups is closely associated with measuring their entrepreneurial activities or performance.

Small business owners commence their business for a variety of reasons. An understanding of the reasons why people start businesses would give useful insights into the nature of start-up businesses and entrepreneurship (Souter and Still, 2000). Many previous researches suggest that the motivation to start-up a business comes from various psychological or lifestyle reasons such as a desire to make more money, or to build wealth and social position for the family, or to work independently (Buttner and Moore, 1997; LeCornu *et al*, 1996). However, the motivation of start-ups can be influenced by broader factors besides the entrepreneur's personal traits or abilities. Entrepreneurship and the growth pattern of start-ups can also be understood in the broader institutional, social and economic context. Nijkamp (2001, p. 399) suggests three complementary factors which may be used in an explanatory framework as follows: personal motivation; social environment; and external business culture. Personal motivation is the psychological factors to drive an individual to become an entrepreneur such as need for achievement or risk-taking propensity. The above-mentioned several characteristics can be generally identified from successful entrepreneurs in many cases. However, it has been criticized as many empirical studies have demonstrated that these psychological traits or propensities are also found among those people who are not self-employed or are unsuccessful entrepreneurs. Social environment appears to be another important factor for entrepreneurship. It contains various situational contexts, encompassing entrepreneurs' dissatisfaction with a current job, the loss of job, encouraging circumstance of start-up, organisational restructuring. But this approach alone is not enough to offer a necessary and sufficient condition for explaining entrepreneurship. External business culture indicates mainly cultural, political and institutional factors. Cultural factors like 'societal appreciation of entrepreneurship' or 'recognition profile of successful entrepreneurs' can affect the level of new firm formation. Also political and institutional factors, like strong policy support for enterprises or the establishment of legislation for regulating firms can play a decisive role in stimulating entrepreneurship.

2.2.2 Rationale for choosing high-tech start-up firms

Technological innovation and entrepreneurship have long been recognised as one of the most crucial driving forces for the development of capitalism. Newly developed technology can be commercialised through technology transfer or start-ups. In this process from technology to market and business, some technologies have led to great commercial success but others have disappeared from the market. There may be a big gap between laboratory research and commercial products. In this sense, the commercial value of a certain technologies is determined in the market. However, inventors who developed new technologies do not always start their own business. Here, inventors mean the people who develop and hold certain technologies in the form of patents or knowledge. There are, generally speaking, technology producers and technology users in the market. Universities or research institutes are representative technology producers, and existing firms are typical technology users. When an inventor develops a certain new technology in the research lab, the inventor is likely to think about how to deal with it in terms of further development or commercialisation. There might be two possible choices for an inventor in this situation: licensing to existing firms or starting-up new firms. Licensing means that inventors make a contract to license their technologies to existing firms. In this case, licensees usually pay royalties to inventors for the intellectual property rights. They must also consider several complicated factors related to market opportunity. In contrast, inventors can just take royalties and provide necessary consulting in line with a licensing contract. Thus, inventors are relatively taking less risk in this case than start-up. For inventors, founding their own firms must be more difficult route compared to licensing. Start-up might, of course, bring bigger rewards to inventors, if their challenges are successful. However, it seems to be riskier than licensing in that most inventors do not initially have enough business experiences and other resources.

Consequently, significant questions can be asked with regard to the above argument: why do inventors become start-up entrepreneurs? What drives inventors to start high-tech firms, and why don't inventors always license their inventions to existing firms?

Why are some technologies commercialised in start-up firms but others are not? To answer these questions, previous literature has focused on two features of technology: technological 'uncertainty' and 'tacitness' (Jensen and Thursby, 2001; Lowe, 2002; Thursby and Kemp, 2002; Thursby and Thursby, 2002). In other words, when a certain technology has the nature of uncertain and tacit knowledge, then it is not easily transferred to existing firms in the market and consequently inventor-founded start-ups emerge (Lowe, 2002). There is likely to exist a sort of market failure in technology transfer or commercialisation when a technology has the characteristics of uncertainty or tacitness. Jensen and Thursby (2001) used survey evidence to show that the start-ups were founded to develop inventions that were at an early or pre-prototype stage of development. These inventions can be characterised by considerable technological uncertainty. Inventions developed in research labs are 'embryonic' in many cases, thus may need further development by commercialising firms. This technological uncertainty can deter existing firms from initially licensing early-stage inventions. On the other hand, when the inventor holds 'tacit' and consequently 'not codifiable' knowledge related to his/her inventions, then the success or failure of technology commercialisation may strongly depend on the inventor's further efforts. The inventor's personal knowledge or experiences are usually gained in the process of working with the invention for a long period of time. Hence, the personal or tacit knowledge of the inventor is often critical and can be invaluable in shaping the outcome of technology commercialisation. It also requires the inventor's continuous involvement in transferring knowledge. These two matters may be solved by the inventor-founded start-up but also by inventor involvement in the process of commercialisation. Inventors can be associated with the firms which try to commercialise their technologies in different forms. For example, they can participate in the process of further development or provide necessary consulting activities. In some cases, the inventor takes part in the management of the firm as a stakeholder. The licensing firm can propose various forms of incentives to the inventor for acquiring the successful outcome of technology commercialisation.

The above problems can be logically distinguished and may have different implications. In this respect, two types of technologies can be considered: one is the case of

embryonic but codifiable technology, and the other is the case of reasonably developed but tacit technology. For successful commercialisation, the former case requires further development activities, and the latter needs close inventor affiliation. Uncertain and embryonic technology is difficult to fully assess since its commercial value is not yet proven in the market, and as a result its technological success is also uncertain. When an existing firm tries to commercialise an embryonic technology by a licensing contract with the inventor, the firm may find it difficult to predict the probability of its success. In contrast, tacit knowledge is difficult to write down or codify because it is embodied in human capital. As Shane (2002) argued, the skills or know-how involved in technology development are largely tacit and can not be easily sold or exchanged in the market. Thus, continuous and close personal contacts between the inventor and the licensee are necessary for successful technology transfer. Such distinction between tacit knowledge and embryonic knowledge can suggest different theoretical predictions about the outcome of technology commercialisation. However, this distinction is often obscure and even meaningless in the real field, as newly developed high technologies simultaneously have embryonic and tacit nature in many cases. This distinction is closely correlated with not only the problems of 'information asymmetry' or 'moral hazard' between the inventor and the licensee, but also the matter of incentives to induce the inventor to commercialise in both post-licensing and pre-licensing. Jensen and Thursby (2001) argued the inventor can privately maintain valuable information which belongs to the invention but non-contained in the licensing contract or patent documentation. They also argued that the inventor can decide to not transfer vital information related to the invention after the licensing contract is executed, if the transfer of technology requires costly effort on the part of the inventor.

As argued above, inventors usually face the choice between different alternatives, when they try to commercialise their inventions. Generally speaking, inventor-founded start-ups seem to be riskier than licensing or just simple affiliation. In this sense, it may be assumed that inventor-founded start-ups would be rare in the market, without any appropriate incentive mechanisms to induce inventor's risk taking. This sort of market failure can be more likely to occur when the inventor is relatively risk averse. On the

other hand, inventor's motivation to start-up can be affected by the organisational setting of technology producers or the institutional environment associated with technology commercialisation. Research institutes or universities may have fixed rules which endow more favourable conditions to the organisation itself rather than to the inventors on the occasion of their intellectual property rights being transferred. In particular, 'patent rights' usually belong to the research organisation rather than the individual inventor when it is developed through a government sponsored R&D project. In this case, the inventor is an employee of the research organisation, and any eventual royalty is earned by the research organisations with only a certain proportion of incentives being given to the inventor. Inventors might need to license their inventions from the organisation which maintains all title or rights even when they want to start a new firm.

Research organisations, whether they are public or private, are basically interested in technology transfer. At the same time, existing firms which require new technologies must be also keen on it. However, potential licensee can be confronted with the above mentioned two problems. Technological uncertainty and tacitness can be seen as the obstacles blocking successful technology transfer. Even in this case, however, inventors may willingly found their own firms, if incentive structures can properly induce their motivation. This is because they can have sufficient information about the potential value of their invention, and also they have adequate experience and ability for further commercialised development. In cases where a researcher tries to license his/her invention which legally belongs to his/her research organisation for starting up a new firm, but the licensing cost is bigger than his/her expectation, a start-up decision can be deterred. In this case, however, the inventor may choose the route of new development after start-up on the basis of his/her already embodied knowledge rather than the route of costly licensing. In this regard, it can be said that inventor's start-up decision depends largely on incentive structures associated with technology commercialisation.

Start-up support policy can motivate inventors to found their new firms through the influence on 'opportunity recognition' (Park, 2005) or through incentive structures. Inventors or scientists who are potential entrepreneurs can be assumed to make start-up

decisions through their own risk-reward calculations. In the process of exploiting business opportunity, they may choose the difficult route of start-up rather than other routes like licensing, when they think any reward from a start-up venture would be bigger than the possible risks from it; or they believe risks of the challenge can be properly mitigated by their own potential capabilities. Inventions developed in labs are likely to be embryonic, particularly in case of R&D results from universities or public research institutes which are oriented in the field of basic research or pure science. These inventions are not developed in response to commercial market needs. As a result, the commercial potential of these inventions that are still in a pre-prototype form is uncertain, and the likelihood of their success is also quite small. The value of these uncertain inventions is difficult to evaluate in the market. Moreover, technology tends to be embodied in inventors in the form of tacit knowledge and hence is not easily codifiable. Information asymmetry and contracting mechanisms are likely to make inventors drive new firm formation. As Lowe (2002) argues, embryonic technologies developed on basic research or in the field of new science, and/or inventions associated with high degree of tacit knowledge will be more likely to be commercialised in inventor-founded start-ups.

2.2.3 The role of high-tech start-ups in regional innovation

Entrepreneurship has been regarded as a critical factor for regional economic development. Researchers particularly in economic geography have long been interested in innovation in the geographical context. There have been many studies on industrial agglomeration in terms of technology transfer, innovation, development of start-ups (Athreya, 2001; Zoltan and Attila, 2005; Roland et al, 2005). There have also been studies with regard to regional learning infrastructure and environment as the determinants of competitiveness and innovation (Yamada, 2002; Capello and Faggian, 2005). New firm formation and the entrepreneurial activities of new start-ups can contribute to job creation and economic growth at a regional level through accelerating innovation and promoting the full use of resources (Potter, 2005). In this respect,

entrepreneurship can be said to be closely and inextricably linked with regional institutions or culture;

“Because entrepreneurs make active use of external resources particularly at the start-up stage, entrepreneurs play a dualistic, contradictory role, one of agent of change, but the other of carrier of regional legacy” (Aoyama, 2003, p. 8).

As seen in the case of United States, technological entrepreneurship indeed plays a central role in regional transformation, and the example of Silicon Valley has been frequently associated with entrepreneurship and regional innovation. The concept of a start-up eco-system can show how high-tech entrepreneurship is linked to regional innovation. High-tech start-ups can provide a region with wealth and vitality through continuous job creation and increased investment. At the same time, an innovative region can provide a favourable ‘habitat’ (Lee *et al*, 2000) for breeding high-tech start-ups. Considering this critical role of high-tech start-ups, policy makers have struggled to build a ‘venture habitat’ for nurturing their entrepreneurship. In the meantime, many countries have attempted to duplicate the case of Silicon Valley story through policy initiatives and conscious planning. However, scholars like Saxenian (1994) have argued that provision of tangible infrastructure or active policy intervention does not necessarily bring about a virtuous and spontaneous cycle of regional innovation. Instead, the ‘intangibles of entrepreneurship’ (Venkataraman, 2004) such as risk-taking culture or the mobility of the workforce have been given more emphasis as the crucial factors of a region’s success. Favourable legal systems or transparent market systems can be seen necessary prerequisites for nurturing high-tech entrepreneurship, and are factors usually conditioned by the development of the nation state. However, the above mentioned intangibles are largely influenced by the potential of regions. Thus regional institutions can play an important role in shaping regional entrepreneurship and consequently determine the variations of it in each region. At the same time, the entrepreneurship of regional actors like high-tech start-up plays a critical role in facilitating regional transformation.

A region can remain in a state of stable equilibrium when it has evolved over time through historical and regional contingencies, and becomes settled into specific regional

institutions. In this case, these institutions, by repeatedly practicing certain cultural and economic activities in the same ways, contribute to the reproduction of a certain pattern of behaviours in a region (Venkataraman, 2004). As discussed above, knowledge workers' start-up decision depends not only on the nature of technology which they hold but also on the incentive structure associated with technology commercialisation. This means that an incentive structure which is formulated by both private and public institutions can encourage knowledge workers to choose one of two possible pathways between starting up their own business and making licensing contract. In this respect, regional institutions and high-tech entrepreneurship are closely intertwined in transforming a region. A region can generate the impetus of continuous innovation when there is a virtuous and spontaneous cycle between actors and institutions within it.

In summary, uncertain and/or tacit technology can be commercialised more often in inventor-founded (or at least, inventor-affiliated) start-ups, and it can be influenced by not only market incentives but also non-market incentive mechanisms like government policy support. In this transformation process from technology to business, institutions also have an influence through the formation of incentive structures. Thus, it can be said that high-tech entrepreneurship plays a central role in regional innovation and simultaneously, regional institutions influence the entrepreneurship of high-tech start-ups. This chapter attempted to understand the rationale of technological entrepreneurship and the role of high-tech start-ups in regional transformation. This is linked to the discussion in following chapter about more expanded issues on innovation and policy.

2.3 High-tech start-ups in 'Daedeok', Korea

Daedeok in Korea was chosen as a study area for this research. Considering the purpose of this study, it is expected to be a relevant choice in that there is a large-scale science park (DST) and considerable number of spin-offs from it, and there have been quite long efforts of policy support to promote innovative activities such as R&D and start-ups. Daedeok has a unique position in the Korean national innovation system in that it has played a central role in generating knowledge through public R&D subsidization. DST

has long been understood as a national R&D hub, but more recently, many spin-off start-ups have emerged in Daedeok. According to this change, there have been increased attempts to understand Daedeok not just as a 'technopole' but as an innovative cluster, a venture ecosystem or a regional innovation system (Han, 2000; Seol *et al*, 2002; Kwon, 2004; Lim *et al*, 2006). How to understand Daedeok seems to be still controversial although it can be a starting point for the study on Daedeok. This study, as mentioned already, accepts a systems approach to innovation. In this sense, Daedeok is basically understood as a regional innovation system in this study. However, it needs to be understood under the consideration of Korean national innovation system. Thus, this section starts with the overview of Korean economic system and start-up sector. In addition, it presents the characteristics of Daedeok as a national R&D hub and a hotbed of high-tech based start-ups, particularly in terms of Korean-NIS and Daedeok-RIS.

2.3.1 Growth of start-up sector in Korea

The Korean economy, which was once admired in the world as an 'economic miracle' (Lucas, 1993), is now facing serious problems and limitations after the success of 'catch-up' model. It has been quite successful in accomplishing 'condensed economic growth' in a short period of time through 1970s. This catching-up strategy based on cheap labour costs and the strong motivation to be rich was the main impetus which made this rapid growth possible. In addition, strong political leadership took the central role for pushing economic policies. Much of literature studying the Korean economic development recognised the Korean government as one of a few relatively successful developmental states (Evans, 1995). Since a military coup in 1961, the military government concentrated its political power on mobilisation and allocation of national resources for rapid economic growth. In 1960s and 1970s, the government was quite competent to implement strategies and policies for its ambitious goals particularly in terms of their effectiveness. On the strength of this active government initiative, Korean people were strongly motivated to work hard and bear poor working conditions with cheap wage levels. It could transform South Korea from one of the most starving nation after the Korean War (1950-1953) into the twelfth largest exporter ranked on the list of world

trade by volume in thirty years. This spectacular Korean growth was achieved through high investment and saving rates and vigorous export expansion which could be induced by policy intervention.

However, the comparative advantages of the Korean economy diminished during the process of democratisation in 1980s. Increasing wage levels and the lack of core technology made the Korean economy slow down in the face of harsh global competition just as it was on the threshold of entering the group of advanced nations. Furthermore, the expansion and rigidity of the government sector has been increasingly experienced in this process (Kim, 2001). As a result, several symptoms began to appear on the surface of the overall Korean systems since the 1980s. Too frequent government intervention in the market, authoritative and unnecessary regulation, collusion between bureaucrats and businessmen were hindering the development of the free market economy and the adaptation to a rapidly changing economic environment. The result of these structural problems led to the erosion of national competitiveness. According to the World Competitiveness Report (IMD, 1998), the competitiveness of the Korean government sector as a whole was ranked 34th, management efficiency 44th, and the degree of its intervention at the bottom of 46 countries. In this respect, the economic crisis in 1997 might be an already foreseen consequence of the structural weakness of the Korean systems. After the crisis, the government has implemented strong reform programs throughout the overall Korean systems. As a result of these reforms, Korea was able to recover from the crisis in comparatively short period of time, and the IMD ranking of competitiveness in the government sector has ascended from 34th to 26th in the two years (IMD, 2000). However, in the aftermath of this unprecedented crisis, fundamental skepticism about the effectiveness of the traditional development strategies of the Korean economy began to emerge.

The economic system within the country can be understood in the context of its complicated mixture of politics, social system, culture and history. There is an overall agreement that the Korean economy has worked on the basis of the following several factors: state-dominated system, imbalanced development strategy, large conglomerates

oriented economy rather than SMEs, public investment for technological development. These factors could be very effective in the era of mass production and in the early stage of economic development. However the paradigm shift to a knowledge-based economy and globalisation required a different system and strategy for sustainable development. The Korean economy failed to adapt promptly to this rapidly changing environment. This might be explained well by the perspective of path dependency in that the whole system and strategy for the Korean economy was locked into a path which was successful in the past. In particular, the government-led economic development strategies and the concentration in the capital area (the Capital, 'Seoul' and its surrounding regions) were challenged by the rapid growth of the private sector and the necessity for balanced regional development. In Korea, as a result of an imbalanced development strategy, most of the population and the national government function have been traditionally concentrated on Seoul. The land area of Seoul and its surrounding region is just 11.8% of the total national territory of Korea, but 46.3% of the population, 56.6% of the manufacturing companies, 46.2% of GRDP, 83% of government-sponsored organisations, and 95% of 100 major companies' headquarters are concentrated in that area as of 2002 (Han, 2004). This phenomenon is still creating varied and serious problems to the national economy, but it seems difficult to find a solution to sort out these problems in the near future. The concept of path dependency can be very effective in addressing this phenomenon. Recently, the Korean government has been struggling to breakthrough this 'lock-in' situation by encouraging regional innovation and creating a more balanced regional development strategy.

As mentioned above, the Korean economy has experienced radical changes and institutional contradictions particularly since 1997. As a matter of fact, Korea's miraculous economic performance was not achieved in a policy vacuum. Instead, the role of the government was regarded as a 'change agent' during the period of economic drive. However, public sector has its 'Janus-faced' feature; on the one hand, it is being promoted for sustaining economic development, but on the other hand, it is quite often seen as the hotbed of corruption and inefficiency. This dual standard is also applied to the large conglomerates, known as the '*chaebols*'— family-owned large business

conglomerates (Shin and Chang, 2003). The *chaebols* were at the heart of production, employment and export growth for the Korean economy, particularly during the period of 1970s when the policy focus was concentrated on the setting up of heavy and chemical industries. They had been “backed by government-administered credit allocation to enable them to achieve the government’s industrial targeting by taking advantage of economies of scale” (Ahn, 2001, p. 454). The Korean government controlled and directed banks to meet these policy measures. In consequence, the *chaebols* could expand and diversify their business domain through aggressive debt-financing. They generally focused on increasing market share and external expansion. They acted as guarantors to their affiliates and subsidiaries in order to secure loan financing from the banks. This meant that the banking and the corporate sectors in Korea became intertwined. For years, the Korean government had treated “the banks as tools of state industrial policy, ordering them to make loan to uncreditworthy companies and industries” (the Economist, 15 November, 1997 in Shin and Chang, 2003, p. 42). Not surprisingly, the banks had to take on the serious burden of bad debts, due to the increase in the rate of bankruptcy of corporations since the financial crisis. According to the MOFE (Ministry of Finance and Economy, 2000, p. 35), huge amounts of public funds (a total of 64 trillion Korean Won by the end of 1999) have been injected to rescue the troubled banks. Shin and Chang (2003) describe this Korean catching-up model as ‘the state-banks-*chaebols* nexus’ which means close collaboration between the state, a dominant player, and other players.

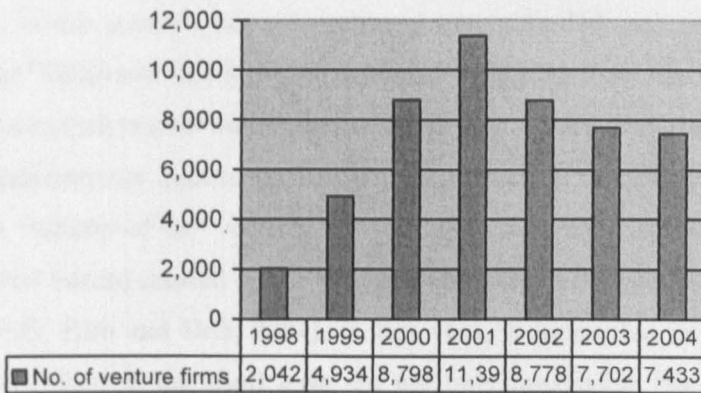
However, by the 1980s these *chaebol*-oriented policies became increasingly questioned as a result of the revelation of their serious inefficiency and problems. It is apparent that they contributed to rapid economic growth, but at the same time they are being criticized as ‘the villain of the piece’ because of their serious bad effects on the national economy. In the meantime, the *chaebols* had been closely connected to politicians. This created a moral hazard which was prevalent in the overall economy, and also produced a deeply rooted chain of corruption between the conglomerates and politics.

Consequently, the Korean government began to pay attention to the development of SMEs which, in a rapidly changing economic environment, have greater efficiency and economic benefits compared to the large enterprises. Since 1997, the *chaebols* experienced a rapid dismantling process. Some of them merged with foreign companies and some were divided into several sectoral companies or forced into bankruptcy themselves as a consequence of their credit burden. During the post-crisis IMF programmes, thirteen out of the top-thirty *chaebols* went into court-supervised restructuring (Pyo, 2004). For example, the Daewoo Group, Korea's second largest *chaebol* in terms of asset size was dismantled due to its excessive debt burden. This shocking story demonstrated that the traditional belief of "*chaebol* should never fail" no longer holds true in the Korean economy (Ahn, 2001, p. 460). As a consequence of this logic of 'too big to fail', there had been a kind of moral hazard (in the form of excessive risk-taking) that "*the government cannot afford to sit and watch them go bankrupt for fear of large-scale 'ripple effects' such as large-scale unemployment and bankruptcy of subcontracting firms*" (Shin and Chang, 2003, p. 47).

These series of phenomena could be interpreted as the result of 'the failure to adapt' due to their insensibility as seen in the case of the extinction of dinosaurs. Another target seriously criticized after the crisis was the banking system which had been controlled or influenced by the government. The Korean government began to push the restructuring of the corporate and financial sectors. In this process, the Korean government needed to find a new driving force to replace the *chaebols* to create sustainable economic growth and found the answer to solve this problem in high tech start-ups (these have been called 'venture firms'). Originally this 'venture policy' adopted in the 'Kim Dae-jung' (former president of Korea elected shortly after the crisis) administration was targeted on job creation in order to reduce the unemployment rate which was increasing sharply after the IMF crisis. This policy aim was quite effectively achieved on the initial stage of struggling efforts from the crisis, and it seemed to be a clever contrivance of 'killing two birds (job creation and the replacement of the *chaebols*) with one stone'.

The start-up sector in Korea began to emerge from the mid 1980s. However, until the mid 1990s, Korean start-up firms were labelled ‘high-risk but low-return’ rather than ‘high-risk and high-return’. This low profitability hampered the growth of risk investment in the market. As a matter of fact, the co-evolution between start-up firms and venture capital companies is seen as a ‘*which-came-first-the-chicken-or-the-egg question*’. Thus, it can be said that there was a sort of vicious circle between the poor profitability and the lack of equity investment in overall start-up sector in Korea. However, this sector turned around the corner since the late 1990s for market-driven growth. A rapid growth and wide dissemination of information technology (IT) like software or internet paved the broad way for a leap in the number of high-tech start-ups. As seen on the graph in Figure 1, the number of high-tech start-ups (certified venture firms) began to sharply increase from 1998 after the government launched ‘venture promotion’ programmes in 1997. This increasing trend reached to a peak in 2001 and it began to decrease from 2002.

Figure 1. Number of certified venture firms by the government in Korea



Source: SMBA (Small and Medium Business Administration)

In some sense, the financial crisis can be seen as providing a good opportunity for high-tech start-ups to emerge from the shadows and come to public attention. However, this remarkable growth of high-tech start-ups during this period was largely influenced by

the thriving Korean IT industry despite overall setbacks in the economy. The Korean government set out a clear aim to ensure it did not lag behind in the information era reflecting the painful lesson it experienced because of its industrial backwardness. Consequently, the transition towards information-oriented society has progressed quite speedily. Korean people are well known as 'early adopters' in the IT product markets as evidenced by fast adoption of mobile and internet-related services. On the basis of these institutional factors and strong government support, the importance of IT startups particularly 'dot-com' businesses increased dramatically during this period. Over the past a few years after 1997, a large proportion of the budget was concentrated on fostering 'ventures' in this field.

However, the government support policies for 'venture firms' stirred up the controversy of 'venture bubble' after a short booming period. After the dramatic boom of new 'dot-com ventures' and the related financial markets, the optimistic outlook began to be changed as most of the companies which had no concrete profit models collapsed in spite of desperate government supporting efforts (Shin and Chang, 2003). This shockwave, not surprisingly, damaged many individual investors who invested money in 'dot-coms'. In this process, several problems were revealed such as fraud incidents or 'rent-seeking' behaviour like lobbying, presumably arising from moral hazards related to corruption and stock market manipulation. Since then, both policy makers and the public began to fundamentally question not only the effectiveness of this venture support policy but also the viability of the 'ventures'. Critics attributed this 'unexpected' side effect to both the moral hazard created by the ventures and the government's policy failure (Kim and Lee, 2003; Kim and Doh, 2004). In this vein, it seems that indiscrete attempts to evaluate this policy in the short term are not only impossible but also not desirable. However, it seems quite obvious that these unintended effects have been produced from the policy responses of actors.

SMBA (Small and Medium Business Administration) which was established in 1996 to support SMEs at the sub-ministry level administration launched a special institution termed 'venture business certification' since 1997 by the legislation of the *Act on*

Special Measures for the Promotion of Venture Businesses (this was time limited legislation – for 10 years until 2007). SMBA has designated those small size high-tech companies who meet any of the following four criteria in the below box as ‘venture firms’, and provides various policy support for such certified ventures. This unique institution in Korea has been regarded as a hidden contributor to the rapid growth of start-up sector. However, the increased number of certified ventures by the government does not necessarily mean a significant expansion of market potential. It means this selection mechanism by the government would be always under the risk of market distortion by several reasons like ‘government failure’, if market forces are not matured enough to buffer this type of direct policy intervention (Jung, 2004). These four types or definitions of venture firm were transformed into three types by the revision of the Act in 2002. The third and fourth types in previous criteria were integrated as a type of ‘new technology firms’.

The category of legally defined ‘venture’ firms

- ***Venture capital-backed firms***: more than 10 percent of the stake should be invested by venture capital companies
- ***R&D intensive firms***: R&D investment should account for more than 5 percent of the total revenue of the preceding fiscal year
- ***New technology based patent firms***: new technology-based products should account for more than 50 percent of the previous year’s total revenue or more than 25 percent of exports. In this case, new technologies include patents, utility models, or other new technologies developed by R&D projects designated under Presidential ordinances
- ***Positively evaluated high-tech firms***: firm’s technologies should be evaluated as excellent and promising ones from designated institutions empowered to conduct technology evaluation by the government.

The purpose of this policy measure was basically to select firms which have strong upside potential and to provide them with some favoured even in some cases exceptional benefit or financial assistance. Given the logic of ‘selection and concentration’, this selecting mechanism can be very effective, and seems to be invaluable criteria for the government who allocates scarce resources. Although there have been many criticisms

in the meantime and it has been adjusted from the government-led certification to the more private sector-oriented selection, it is still in operation in Korea.

Powered by the growing number of venture businesses, venture financing markets such as venture capitalists, stock market and 'angel' networks grew explosively during that period. Following Silicon Valley, new start-ups are likely to resort to equity or risk financing rather than debt financing. Start-ups usually do not have sufficient tangible assets or market revenues, so it is not so easy for them to borrow money from commercial banks. Venture capitalists provide seed money to early-stage start-ups and support them to grow fast to create rapid increases in turnovers from the investment. Startup-oriented stock markets like KOSDAQ (Korea Security Dealers Association Automated Quotation system) or its US counterpart NADAQ (National Association of Securities Dealers Automated Quotation system) make the virtuous circulation of venture investment possible through direct equity financing both for start-ups and venture capitalists. It means that the stock market offers exit opportunities to private investors such as venture capitalists and angel investors. In Korea, the government took a central role in the growth of the venture capital industry. Unlike the typical US venture capital, 'start-up investment companies' which were established under the supervision or investment of SMBA have led the equity financing for ventures in Korea. This type of Korean venture capital has formed investment funds with outside investors mostly government, institutional investors and corporations.

KOSDAQ market was opened officially in 1996. It began to grow significantly in terms of size and volume since 1998. The existence of KOSDAQ market has been undoubtedly crucial for the growth of venture business even though once again there has been the social stigma of it being a hotbed of venture corruption. The peak in market valuation in 1999 appears to have been a 'venture bubble', but since then, KOSDAQ market has been showing at least a solid growth path. As of the year 2001, KOSDAQ enjoyed a head-to-head stance in terms of listings and transaction volumes with Korea Stock Exchange (Kim and Lee, 2002). Venture firms have played a crucial role in growth of the KOSDAQ market. Many government-certified ventures have used

KOSDAQ for their initial public offerings (IPO). At the same time, the existence of an 'exit route' made venture capitalists optimistic that they can get capital gains from their investment within a certain period of time.

2.3.2 Unique position of Daedeok in Korean-NIS

At the initial stage of economic development, Korea could enjoy a comparative advantage on the basis of cheap labour costs. The import of foreign capital and advanced technologies from the developed countries was quite easy and cheap. However, when Korea entered into the next stage of economic development based on heavy and high-technology industries, it became more difficult for Korea to maintain the high level of economic growth in the following decades without independent innovative capability in science and technology. Thus, the central government of Korea decided to create a large scale science town at the centre of South Korea to compensate the lack of private sector R&D capacity. In 1973, the government initiated the construction plan for Daedeok Science Town (DST) in Daejeon.

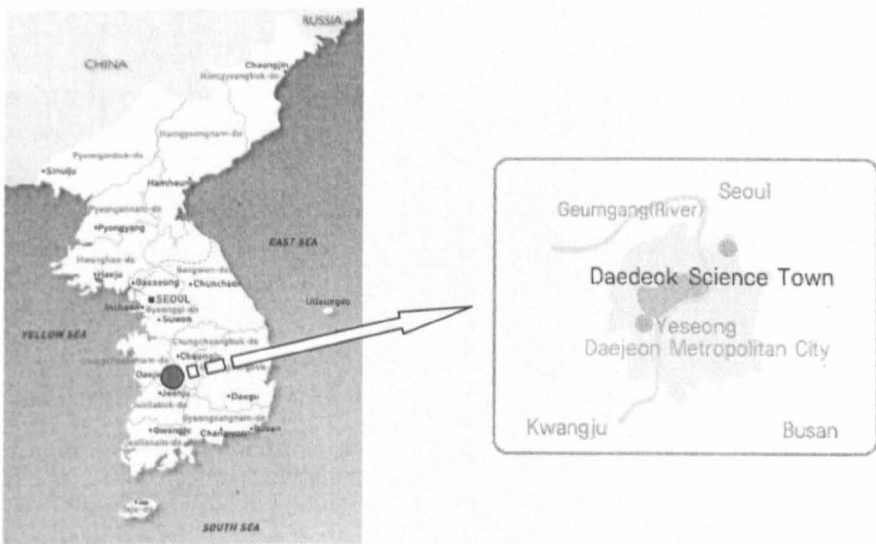


Figure 2. Location of Daedeok Science Town (DST)

The above maps (Figure 2) show that DST is geographically surrounded by the DMC (Daejeon Metropolitan City), the fifth largest city in Korea. Daejeon is located at the distance of two hours by car from the Capital Seoul, and it is well connected to other regions within two or three hours by motorways or railways. At this point, it is necessary to think about why the decision was made to locate the DST in Daejeon not Seoul. Some researchers who studied the DST argue that the DST project appears to be a purely political decision by the late president Park to locate a new centre of excellence in a ‘non-Seoul’ region so as to mark his efforts at decentralization (Castells and Hall, 1994). They seem to conclude that neither functionally nor industrially was DST a viable project. According to their opinion, Seoul and the suburban belt around the capital was the only place in Korea where they could find the necessary synergy, dynamism, and network for science and technology (Ko and Kim, 1997).

Table 1. A brief history of ‘DST’

May 1973	Basic plans for town construction decided by the Ministry of Science and Technology.
Mar. 1974	Construction work of basic facilities and institutes started. The speed of construction was slowed until 1976 due to the political apathy and resistance of residents against the land acquisition.
Dec. 1977	The Ministry of Construction took the charge of building DST, and designated Daedeok as the Industrial Base Development Area.
Apr. 1978	Research institutes started to moving in.
Aug. 1981	The basic planning for Daedeok Industrial Based Development project was announced by the Ministry of Construction.
May 1985	Plans for public land development began (Korea Land Development Corporation). The site was developed by the public development scheme.
Nov. 1992	The construction of foundation facilities completed.
Aug. 1993	International exposition, Daejeon Expo '93, was held, commemorating the completion of DST construction.
Dec. 1993	The Daedeok Science Town Administration Act was enacted.
Jan. 1997	Daedeok Research Complex Management Plan announced to the public
Sep. 2000	Proclamation of ‘Daedeok Valley’
Dec. 2004	Daedeok was designated as a ‘specialised R&D zone’

Source: Daedeok Science Town Management Office, 2004

As shown in Table 1, it took almost two decades to plan and construct the whole project. The process of developing DST was far from smooth. The basic plan was modified more

than three times, and the government agencies which were responsible for planning and coordinating the development of DST, were changed from time to time.

From the beginning, DST was conceived as a pure science town entirely devoted to research institutions, supported by scientific and engineering universities. The intended linkage with private firms was to be established through the research organisations of the private sector (Ko and Kim, 1997). The total land area developed was 27.6km² and 48% of the site is used for accommodating research and educational institutions. As of the end of 2004, total of 251 organizations are housed and more than 21,849 people are working in DST. Among them, there are 19 (8,003 employees) government founded research institutes, 9 (2,535 employees) government invested research institutes, and 11 (728 employees) public service agencies. Table 2 shows the concentration of a high quality labour force in DST. It means that DST can be seen as the pool of knowledge and human resources.

Table 2. Personnel of DST

Total	Researchers				Research assistants	Administrative staff
	PhD	Masters	Undergraduate	Total		
21,849	5,687	6,464	2,604	14,755	2,287	4,807

Source: Daedeok Science Town Management Office, 2004

Historically, only seven research institutes were moved into Daedeok before 1980. The relocation of government research institutes was quite slow during the 1980s. The total number of research organisations moved into DST is 11, and out of these organisations only 1 is from the private sector. It means that before 1990, the central government was the main actor because 15 out of 18 institutes established in Daedeok were government or public research institutes, only 3 were R&D branches of private firms. However, the private sector began to take a leading role in the development of DST during the first half of 1990s. Research institutes from industry were moved into DST and 7 others followed during the second half of 1990s. As shown in Table 3, the fields of research in DST show a wide range of heterogeneity.

Table 3. Major Fields of research in DST

Field of Research and Development	No. of research institutes	No. of venture labs
Telecommunications	9	102
Biotechnology	8	28
Mechanics/Aerospace	6	15
Energy	11	4
Material Science	5	11
Fine (synthetic) chemistry	11	2
Standard/Fundamental science	4	0
Others	4	8
Total	58	170

Source: Daedeok Science Town Management Office, 2004

Owing to the existence of DST, DMC has relatively high potential in the field of R&D and innovation (See Table 4). Daejeon has a total of 436 research organisations (5.6% of national total, ranked 3rd after capital regions such as ‘Seoul’ and ‘Gyungi’ province), and among them, there are 20 public research institutes, 26 universities, and 390 private company R&D organisations.

Table 4. R&D expenditure of Daejeon

	Nation total (A)		Daejeon (B)	
	Million Won		Million Won	B/A (%)
University	1,932,663		180,414	9.3
Public sector	2,626,326		1,324,349	50.4
Private sector	14,509,663		893,012	6.1
Total	19,068,682		2,397,775	11.4
R&D expenditure /10 thousand people	3,336		13,009	
National R&D/Total R&D	4,121,666	25.6	1,092,125	59.6
Regional R&D/Total R&D	383,154	0.02	8,281	0.0
R&D/Local authority's budget	0.76		0.53	

Source: Survey Report (2004, MOST and KISTEP)

The number of R&D engineers in Daejeon is 18,428 persons (9.3% of nation total) and ranks 2nd after Seoul. On the other hand, the total amount of R&D expenditure in Daejeon is 2,397.7 billion Won (as of 2003) and particularly the R&D spending of Daejeon per 10 thousand people is 13,009 million Korean Won (ranked 1st among a total

16 local authority). But as shown in below table, the portion of national R&D expenditure in this total is 59.6%. It means that R&D in Daejeon is largely dependent on the central government. Contrastingly the portion of the local authority's R&D expenditure among its annual budget is only 0.53% (ranked 14th among 16 local authorities).

Tables 5 and 6 show the regional distribution of R&D resources in Korea. In these statistics, Daejeon appears to have a relatively high portion in respect of criteria such as R&D expenditure, research organisations and the number of researchers. This high potentiality in the field of R&D in Daejeon is obviously attributed to the existence of DST.

Table 5. Distribution of R&D resources in Korea

	R&D expenditure		Research organisation		Researchers	
	Billion Won	%	No.	%	Person	%
Nation	19,068.7	100.0	7,820	100.0	198,171	100.0
Seoul	3,678.3	19.3	2,521	32.2	52,787	26.6
Busan	332.3	1.7	300	3.8	7,351	3.7
Daegu	231.5	1.2	244	3.1	4,799	2.4
Incheon	582.4	3.1	347	4.4	6,022	3.0
Gwangju	253.3	1.3	154	2.0	4,162	2.1
Daejeon	2,397.7	12.4	436	5.6	18,428	9.3

Table 6. Distribution of research organisations in Korea

	Public research institutes		Universities		Private research organisations		total	
	No.	%	No.	%	No.	%	No.	%
Nation	241	100.0	398	100.0	7,181	100.0	7,820	100.0
Seoul	55	22.8	69	17.3	2,397	33.4	2,521	32.2
Busan	9	3.7	27	6.8	264	3.7	300	3.8
Daegu	7	2.9	17	4.3	220	3.1	244	3.1
Incheon	6	2.5	10	2.5	331	4.6	347	4.4
Gwangju	9	3.7	16	4.0	129	1.8	154	2.0
Daejeon	20	8.3	26	6.5	390	5.4	436	5.6

Source: Survey Report (2004, MOST and KISTEP)

According to the statistics of KOSEF (Korea Science and Engineering Foundation), there are 14 SRCs and ERCs (2 Science Research Centres and 12 Engineering Research Centres) which were designated by the government in Daejeon as of 2003. This represents 23% among the national total of 62 centres. This programme is aiming to foster high quality human resources centering around universities through the networking of the isolated capability among respective research organizations. On the other hand, there are 4 RRCs (Regional Research Centres) and 1 TIC (Technology Innovation Centre) in Daejeon as of 2003. These statistics and previous studies indicate that DST has been positioned at the core of science and technology development as a national R&D hub. At the same time, DST endows Daejeon, its surrounding region, with the highest potential to be an innovative region except the capital Seoul.

The development of DST was initiated by central government planning and anchored from the outset on the location of government research institutes. The development of science towns or science parks like DST has been regarded as a way of maximizing the use of limited R&D resources. Especially, it was expected that DST could enhance research efficiency through a systematic and comprehensive R&D investment to each institute, create an optimal research environment by mutual exchange and application of a variety of information, knowledge and know-how, and promote investment effectiveness by the shared use of facilities, manpower and projects (Oh and Kang, 1997). In order to achieve these aims, the development of DST in the initial stage was centered on public sector research institutes and nationally funded research programmes.

It has been widely accepted that DST contributed to knowledge generation and high-skilled human resource supply in overall Korean economic system. Particularly, when the R&D capability of universities and the private sector was not matured enough, it has taken a crucial role to correct 'market failure' in this field. For example, KAIST (Korea Advanced Institute of Science and Technology) has fulfilled annually about 1,000 entrusted research contracts and supplied approximately 30,000 highly educated engineers to the public and private sectors since its opening. On the other hand, there have been many remarkable R&D performances particularly in the field of basic and

core technology development. CDMA in mobile technology, new medicine for AIDS 'Factive', nuclear reactor and artificial satellite development are representative achievements produced in DST.

DST was originally designed as a kind of 'technopole' in terms of science and technology policy. It can be understood in a similar way to a 'growth pole' in economic development policy. Thus, in the initial stage, DST started from an isolated 'pole' like an island, but it has gradually developed as a 'R&D driven innovation cluster' (MOST and DMC, 2004). It means that the R&D function is situated at the top in the value chain of Daedeok. Of course, it might be controversial to describe DST as a 'cluster' in that industrial function has been excluded for nearly two decades. However, since the mid 1990s, DST began to be transformed from the characteristics of a simple R&D park into the innovative complex combined with industrial function through the start-up process. Thus it would not be wrong to describe 'Daedeok' as a 'cluster' under the current situation. On the other hand, when it comes to innovation system, it can be meaningful to look at DST through a lens of 'National Innovation System' (NIS). DST as a NIS has worked well under the catching-up strategy. The physical concentration of R&D facilities in a specific region and the provision of public R&D subsidies took a central role in terms of knowledge generation. As Table 7 shows, DMC has the biggest innovative potentiality in Korea at least in the field of technological innovation. Without doubt, this comes from the existence of DST within its administrative boundary.

Table 7. Index of regional technology innovation potentiality in Korea

	Concentration of R&D labour forces (1)	Concentration of R&D expenditure (2)	Concentration of R&D organizations (3)	Concentration of Intellectual property right (4)	Index of Tec. Innovation potentiality
Korea	1.17	3.01	0.24	0.33	4.75
Seoul	1.59	4.33	0.38	0.67	6.96
Busan	0.63	0.67	0.10	0.09	1.49
Daegu	0.59	1.31	0.11	0.12	2.13
Inchon	0.73	1.97	0.24	0.15	3.10
Gwangju	0.76	1.32	0.12	0.22	2.42
Daejeon	4.08	14.40	0.44	0.52	19.44
Ulsan	1.02	0.74	0.17	0.08	2.01
Gyungi	1.50	5.49	0.34	0.48	7.82
Ganwon	0.93	0.61	0.07	0.07	1.68
Chungbuk	1.02	1.00	0.22	0.12	2.35
Chungnam	0.98	1.19	0.21	0.15	2.52
Jeonbuk	0.76	0.57	0.09	0.08	1.50
Jeonnam	0.39	0.38	0.07	0.05	0.89
Gyungbuk	0.71	1.73	0.14	0.32	2.89
Gyungnam	0.79	1.25	0.18	0.10	2.31
Jeju	0.43	0.53	0.06	0.04	1.05

Source: Modified from the Survey of science and technology statistics, Intellectual property statistics (2002, The Korean Intellectual Property Office)

(Note)

- (1) Number of researchers/ economically active population \times 100
- (2) R&D expenditure/GRDP \times 100
- (3) Number of research institutes/total number of corporation \times 100
- (4) Number of patent application/ economically active population \times 100

However, despite the large scale of DST and the long period of policy concentration on it, spatial concentration of R&D functions seems to have had little spill-over effect on regional development at least until the mid of 1990s (Daedeok Valley Master Plan, 2001). This is partly a result of the absence of substantial programmes to favour synergy and of specific mechanisms to implement such a program. If the goal of creating a science town is to provide the research basis for economic productivity and competitiveness, the integration of public agencies and private firms at the very onset of the design is a precondition for future linkages between basic research, R&D, and industrial applications (Castells and Hall, 1994). As mentioned above, DST is currently experiencing gradual changes to that of an innovative industrial cluster. But in the meantime (even until more recently), the main actors in DST were public research institutes and the government as their strong supporter. In this regard, it might be assumed that there has been very limited learning mechanism between the limited actors

in DST. The function of knowledge transfer was relatively weak compared to the function of knowledge generation. According to NIS approach, innovative activities are not solely and dominantly dependent on just entrepreneurial actors like firms, but instead interconnected with many other actors like universities or public actors. In the same manner, several factors related to innovative activities also need to be considered: knowledge generation, product and process innovations, and other determinants of innovation such as incentive structures or the availability of skilled labour. In this regard, technological innovation might be just one of several successful factors in a NIS. Considering the existence of DST, Daedeok must be having a unique position in the Korean-NIS, particularly in the field of high-tech R&D. It points out that policy initiatives were quite well functioned for organisational buildings, financing and performing R&D, and promotion of human resource development. However, as DMC recognised in Daedeok Valley Master Plan (2001), Daedeok revealed a few weaknesses particularly in institutional interactions and technological entrepreneurship. R&D collaborations and technology diffusions were not well facilitated in Daedeok. In addition, informal interactions and personnel mobility were not activated beyond the boundary of the R&D domain.

The NIS, in Korea, was important when economic development and technological innovation were mainly directed by the government policies, but more recently, RIS approaches have become increasingly important for regional development under the globalisation of economic processes (Park, 2001). In the RIS perspective, regional actors and factors such as the role of local authorities and the local innovative milieu need to be taken into account as more critical ingredients of innovation system. From the viewpoint of RIS, the weakness of Daedeok can be identified easily such as the lack of collaboration between R&D and industrial sector, the lack of diversity of actors and networks with other regional actors, the weak role of local governments (Seol *et al*, 2002; Kim and Jung, 2005). Basically it might be impossible to understand 'Daedeok' through a single theoretical model, but a lens of RIS appears to be very helpful to analyse Daedeok in association with NIS.

2.3.3 Characteristics of Daedeok-RIS

Until the mid 1990s, it seems that DST attained the critical mass of researchers and institutions large enough to spawn high-technology spin-offs at least from an external and quantitative point of view. Actually the history of spin-offs in DST goes back to the end of 1980s, but its increased pace in numbers began to grow explosively since 1998, the period of venture boom as seen on Table 8.

Table 8. Change in numbers of start-ups in Daedeok

	1998	1999	2000	2001	2002	2003	2004
Total	250	300	493	776	811	814	824
Certified	30	170	340	503	413	393	367
Uncertified	220	130	153	273	398	421	457

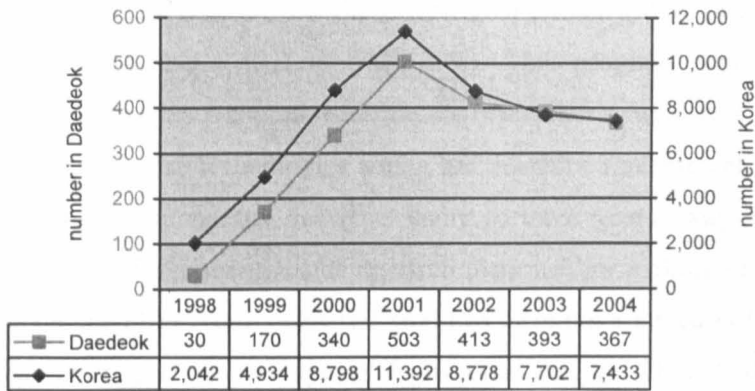
Source: SMBA, Daejeon Metropolitan City

Figures in this table might be very confusing for non-Koreans. Some of figures (particularly in the case of uncertified start-ups) are estimated numbers. This complexity in statistics comes from the special institution of ‘venture certification system’ in Korea. The term ‘venture firm’ has been widely used, but there is not a fixed definition in its concept. In general, it means a certified company by the government in Korea, but it is obviously not enough to cover the various typologies of start-ups. Nevertheless, statistics on start-up numbers could be collected by this legal definition after 1997 in Korea. Thus, in the above table, the number of certified start-ups means the firms officially certified by the government as venture firms, and the number of uncertified start-ups contains estimated figures of non-certified start-ups in Daejeon. Unfortunately, statistics of start-ups before 1997 can not be gained because there was no official scheme to make statistical data on start-up firms.

According to Daejeon city, in 1998 when venture certification was started, the total number of start-ups was estimated to be 250 including 30 certified venture firms. In these statistics, uncertified venture firms mean generally ‘newly established technology-oriented firms’ even though they are not certified by the government (Seol *et al*, 2002).

As seen on the below chart (Figure 3), the number of start-ups began to increase sharply from 1999, but the number of certified venture firms began to decrease in 2002. This tendency was not confined to Daedeok but was general nationwide: total 11,392 venture firms in 2001 but 8,778 in 2002.

Figure 3. Changes in number of certified venture firms in Daedeok



Source: SMBA and Daejeon Metropolitan City

In the early 1990s, few researchers formed their own business and the number increased gradually. KAIST opened an incubation centre in 1994 to encourage starting up and technology innovation. In 1996, these start-ups made an informal gathering, named ‘Daedeok 21st Century’. Its membership was originally limited to the start-up company spin-offs from DST, but later it was gradually opened to other start-ups from neighbouring regions. This spontaneous start-up phenomenon contributed to the transformation of DST from a research and academic agglomeration to an innovative cluster with an industrial function as well.

Seol *et al.* (*ibid*) suggest that the reason for this significant change in DST can be found in some of economic, social and institutional changes such as the improvement of living condition of DST, government policy and legislative supports, the influence of nationwide restructuring particularly since the crisis in 1997. DST was isolated from the

outside until the early 1990s, so most of the researchers felt some inconvenience to live in DST. Even though DST was originally designed as an ideal place for R&D which has good amenity in terms of a living environment, other factors such as cultural and educational provision were quite restricted compared to other urban areas. But, following the incorporation of DST into Daejeon City in 1989 and the 'International Exposition 1993' held in Daejeon, the urban infrastructure around DST in particular began to be improved remarkably. In terms of institutional changes, there have been a few significant institutional reforms in Daedeok. The government (MOST) launched a support program for researcher's start-up from 1990. This program contains some unconventional benefits which are enough to stimulate researcher's motivation for start-ups: to allow researchers to use technologies which are developed in research institutes after start-up; to permit researchers to spend as many as three years away from their jobs; to approve unofficial fundraising inside research institutes for making seed money for business starts. On the other hand, industrial facilities were not allowed in DST from the beginning stage of its planning by special legislation. But, as 'DST Management Act' was revised in 1996, a 'technology commercialisation area' was added as a possible way of land utilisation. Since then, industrial facilities such as incubation centres, small-scale venture business complexes, etc. could be developed or could move into DST. The far-reaching restructuring in Korea after the IMF crisis also has an impact. This affected private sector research institutes first and public research institutes later. In the case of private research institutes, there were around 30~40% staff reductions and organisation curtailment for the year of 1998. Some of the research institutes were closed following the bankruptcy of their mother corporations. In the case of public research institutes, personnel reduction was inevitable due to budget cutbacks. It was implemented mainly through early retirement. Approximately half of these retired staff was absorbed into newly created start-ups. Spontaneous retirements for start-ups began to increase from the end of 1990s. This phenomenon can be seen to be partly influenced by the social atmosphere at that time due to 'venture boom'. Many researchers or engineers in PRIs (Public Research Institutes) retired and rushed into venture business. On the other hand, it was partly affected by the changes in operating 'PBS' (Project Base system) in PRIs after IMF crisis. This system, started in 1994, requires all public research institutes to

appropriate their expenses from undertaking research projects. It means that researchers should seek contracts for research projects to meet their own personnel expenses. Not surprisingly this system was a source of many complaints from researchers in PRIs. The government strengthened this system to enhance the efficiency of R&D activities in PRIs as a step to reform public sector after the crisis. This action was, however, connected to increased complaints of PRI researchers and consequently it triggered 'start-up rush' in Daedeok.

Up to 1998, there were 65 spin-off start-ups from DST (based on the membership of 'Daedeok 21st Century') and their major mother organisations were ETRI (27 firms), KRISS (11 firms), KAIST (11). In particular, ETRI has been a cradle for start-ups in DST. According to EVA (ETRI Venture Association), up to 1998, 104 firms were spun out from ETRI (ETRI and EVA internal statistics). The number of start-up firms has increased sharply since 1999 as seen on the above graph, and around 90 companies moved into Daedeok from outside (mainly from the capital area) during the three years from 1999 to 2002 (Daejeon City internal statistics, Hankook Economic News dated on 9/Mar/2002). However, this remarkable expansion of start-ups began to decrease from 2001. According to ETRI, the number of spin-offs increased by 34 in 1998, 30 in 1999, and 72 in 2000, but it fell by 19 in 2001 and 9 in 2002.

As stated already, Daedeok can be understood as a regional innovation system rather than a region itself. It means looking at Daedeok as not simply a geographical space but a system. A systemic approach can provide a few advantages. One of significant advantages comes from its flexibility in setting system boundaries beyond the fixed administrative boundary. In this respect, it can be assumed that start-up firms in Daedeok interact with not only regional actors but also external actors out of the regional boundary of Daejeon. Considering the weak industrial basis of Daejeon, they may often have to make important business connections with firms in other regions. In this case, fixing Daedeok into the regional boundary of Daejeon can make it hard to grasp the overall fabrics of dynamic interactions among various actors. However, when Daedeok is understood through RIS perspective, its systemic boundary can include this

wider range of interactions. In addition, understanding Daedeok as a RIS gives a significant methodological meaning associated with the matter of representativeness. This study tries to approach regional issues through studying start-up firms. Field work of this study is focusing on mainly spin-offed start-up firms from PRIs in DST. The selection of specific high-tech start-ups, particularly spin-offs from PRIs as the main research target can be justified in terms of representativeness, when Daedeok is understood as a regional innovation system which is largely based on DST.

Table 9. Business categories of venture firms in Daejeon, 2001

		High-tech manufacturing			Information Service	R&D relating	Others	Total
		Total	IT	BT				
Daejeon	Firms	335	102	82	140	23	5	503
	%	66.6	20.3	16.3	27.8	4.6	1.0	100.0
Korea	Firms	6,889	1,236	869	3,715	333	455	11,392
	%	60.5	10.8	7.6	32.6	2.9	4.0	100.0

** Firms: certified venture firms by the government*

Source: SMBA statistics in Seol et al (2002, p. 108)

As shown in Table 9, the category of venture businesses in Daedeok is mainly concentrated on high-tech and manufacturing fields like IT, BT. The portion of IT and BT as of the end of 2001 is respectively 20.3% and 16.3%. It is higher than national average (respectively 10.8% and 7.6%). On the other hand, the portion of service business related to information processing systems is relatively lower than national portion (27.8% in Daejeon, 32.6% in Korea). This indicates that start-ups in Daedeok have relatively more manufacturing basis than the start-ups in other regions even though they are similarly classified as high-tech firms to others. Manufacturing basis means that firms require more spaces and facilities for production such as plants, assembly lines, testing machineries, etc. This feature of start-ups in Daedeok seemed to make them out of much attention from investors during venture booming period. From the investor's point of view, manufacturing basis might be seen too 'heavy' and 'slow' in terms of 'turnover' of invested money. The number of IPO start-ups in Daedeok is 12 firms in KOSDAQ market as of 2006. It looks quite small comparing total number of KOSDAQ firms in Korea. According to KOSDAQ market statistics in 2006 (website -

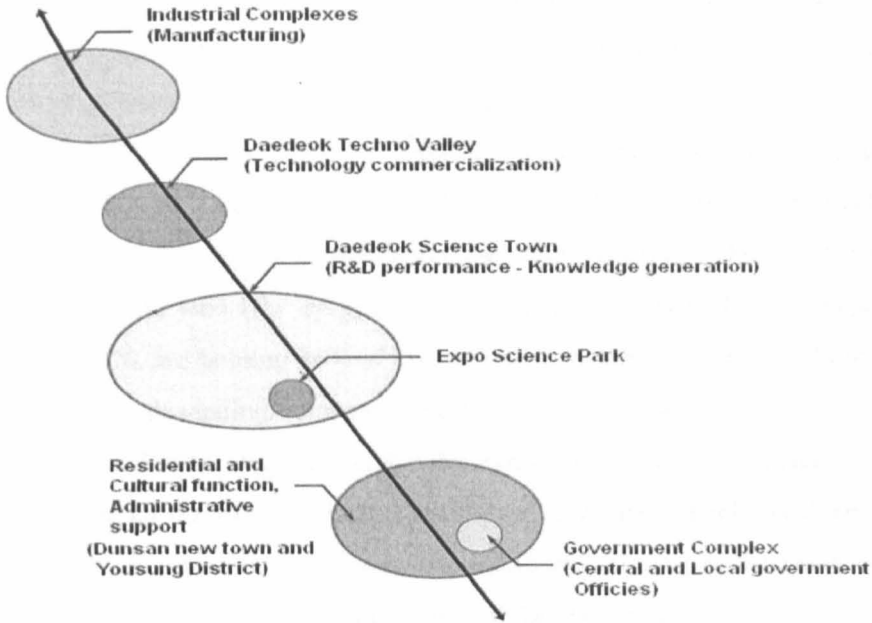
<http://km.krx.co.kr/> - accessed Dec. 2006), total KOSDAQ firms are 967, and 387 firms among them are registered as venture firms. In the meantime, there have been many debates on the reason of this phenomenon: why the performance of Daedeok start-ups in KOSDAQ market at least in numbers is not well matched with the potential of Daedeok.

On the basis of systems approach, 'Daedeok' is regarded as a RIS (Regional Innovation System) in this study. It contains various actors, components and their networks. DST is obviously located within the geographical area of Daejeon Metropolitan City, but the networks in DST are being extended to surrounding or neighbouring regions beyond its immediate geographical proximity. As stated in Daedeok Valley Master Plan (2001), its 'relational proximity' (Amin *et al*, 2003) is reaching to neighbouring regions such as 'Chonan' and 'Asan' in Chung-nam Province, 'Ohson' and 'Ochang' in Chung-buk Province, even 'Jeonju' and 'Iksan' in Jeon-buk Province. For the first time, since 1999, the concept of 'Daedeok Valley' began to be used as an administrative term to describe the changed characteristics of Daedeok, not just a R&D centre but an innovative cluster or system. But it became a common and popular term after the official declaration of Daedeok Valley on 28th September in 2000 by the former president Kim Dae-jung. Daejeon Metropolitan City prepared an ambitious master plan for the future of Daedeok Valley in 2001, titled 'Ideal and realization of Daedeok Valley'. In this respect, it can be seen that 'Daedeok' has been evolved from DST to 'Daedeok Valley'. As of now, the result of searching 'DST' through 'Google' search engine (www.google.co.kr) indicates around 39,800 hits, but in the case of 'Daedeok Valley' it indicates 194,000 hits which is nearly five times more than DST (Accessed on Oct 2005).

According to the Daedeok Valley Master Plan (2001), Daedeok Valley has a growth axis which means a functional relationship between the main components of the Daedeok innovation system. As seen on the diagram in Figure 4, there are four components of DST as a R&D centre, Daedeok Techno-valley as a technology commercialization zone, the 3rd and 4th Industrial Complexes as a manufacturing zone, and lastly the 'Dunsan' and 'Yousung' area providing residential and cultural functions. These functional links

form an inner network in Daedeok Valley and provide a basis for close interaction between actors.

Figure 4. The growth axis of Daedeok Valley



Source: Adapted from Daedeok Valley Master Plan (DMC, 2001)

However, it has been pointed out through various previous studies that Daedeok Valley has some serious weaknesses from a systemic point of view. Firstly, its industrial basis is weak compared to its R&D function. The industrial structure of Daejeon City shows that it is concentrated largely on service industry (84.8%) but the portion of manufacturing industry is just 13.6%, as of the end of 2001 (Daejeon Metropolitan City, 2001). The total area of industrial complexes in Daejeon is approximately 8.6 million square meters (as of 2003), but most of these are already occupied by traditional existing firms, so the availability of industrial spaces for new high-tech start-ups has been quite limited. Even though 'Daedeok Techno Valley (DTV)' is currently under construction (expected to be completed in 2007), its proportion of industrial accommodation seems not to be enough to accommodate the growing number of start-ups. DTV is designed as a mixed concept of high-tech industrial accommodation with R&D, production and

business. As shown on above figure, DTV is situated between DST and the 3rd/4th Industrial complexes, so Daejeon City is expecting that it can take a central role for the commercialization of R&D performances from DST and the manufacturing of prototype products. On the other hand, the proportion of GRDP of Daejeon to the whole of the Korean economy is at the very best 2.3% (it has changed between 2.1% and 2.4% for the last 10 years). According to KIET (Korea Institute for Industrial Economics and Trade), the portion of knowledge-based manufacturing industry in Daejeon is very low (from minimum 0.02% in the field of electronic/information device manufacturing to maximum 3.49% in precise chemical industry sector) compared to its R&D capacity (KIET, 2003). Unlike people's expectation, the main industry of Daejeon has been paper manufacturing and lens (for eyeglasses) producing industries: Hansol Paper Co. and Shinho Paper Co. are holding 30% of the total market share in Korea, and four of the top five leading lens producing companies based on a market share are located in Daejeon (Bank of Korea, 2002). This reflects that the industrial structure of Daejeon has not been closely connected to the commercialization of high-tech R&D performance. This weakness of this concentration of industry and manufacturing in the Daejeon economy has had an unfavourable affect on the growth of the start-up economy.

Secondly, the diversity of actors in the Daedeok innovation system can also be a weakness. There are few large corporations or their branch factories which can be influential for regional economic development. Spontaneously established venture capitals and voluntarily formed angel networks are also very rare in Daedeok although a few public venture funds were established by the initiative of DMC and the considerable investment from the central government. These disadvantages are connected to the lack of a varied and dynamic interaction between the actors. Many researchers have pointed out the importance of the venture capital's role in innovation. Venture capitalists make high-risk equity investments in new start-up ventures and venture capital financed start-ups contribute significantly to modern economic development (Callahan and Muegge, 2003). As Gompers and Lerner (2001, p. 83) assert, "*venture-backed firms grow more quickly and create far more value than non-venture-backed firms*" and "*similarly, venture capital generates a tremendous number of jobs and boosts corporate profits,*

earnings, and workforce quality.” In this respect, a lack of venture capital industry in Daedeok is obviously one of the disadvantageous factors in terms of regional start-up ecosystem. As Cooke (2004) says, ‘venture capital driven’ regional innovation system has a virtuous cycle between start-up entrepreneurs, venture capitalists like Silicon Valley. However, as shown Table 10, the portion of risk financing organizations in Daejeon as of 2002 is merely one or two percent of national totals.

Table 10. Venture Capitals in Daejeon, 2002

	No. of Ventures	Banks	Credit guarantee organizations	Angel Clubs	Venture Capitals*		
					Type I	Type II	Public venture funds
Korea	11,392	6,148	154	6	6	146	368
Daejeon (%)	503 (4.4)	177 (2.9)	10 (6.5)	-	-	2 (1.4)	2 (0.5)

Source: The Bank of Korea (2002)

* (Note)

- Type I: ‘New Technology Financing Companies’ by the Law to Assist the Financing of New Technology Ventures

- Type II: ‘Venture Investment Companies’ by the Law to Promote Small and Medium Size Companies

Considering the weak basis of the Korean venture capital industry, the limited availability of risk financing in Daejeon might not be such a surprising phenomenon, but it can be seen as a serious weakness in terms of a ‘business eco-system’. A survey (DMC, 2001) indicated that the most serious obstacle for venture firms in the process of starting-up and business management was ‘a difficulty in financing’ (51.0%). In particular, for venture firm’s CEOs who have an engineering background, financing problems are undoubtedly one of the most urgent matters. The immaturity of the venture capital market, in this respect, must be a factor restricting regional innovation in Daedeok. DMC, in this situation, has tried to support high-tech start-ups mainly by the way of low-interest bank loans. In this scheme, local authorities bear the gap between the normal market interest rate and the adjusted interest rate by allocating resources in their budget. This type of financial support is quite common in every region but its detailed operation such as the level of adjusted interest rate or the term of redemption varies according to the local ordinances in different local authorities. However, in spite

of its favored condition for start-ups, this measure is obviously a kind of debt financing which is far from the risk financing. Furthermore, this type of intervention could not only impede the development of the market for the venture capital industry, but also cause the distortion of the market mechanism and resource distribution (Ko and Shin, 2000, p. 477).

In summary, Daedeok is seen as a high-tech based regional innovation system rooted systematically in DST and geographically in DMC. It has a unique position in Korean-NIS in terms of a national R&D hub. According to the proclaimed policy aims by Daejeon city, Daedeok needs to be transformed from a state-driven, R&D oriented agglomeration into a regionally embedded, business oriented cluster (Daedeok Valley Master Plan, 2001). 'Daedeok Valley' has a huge potentiality to be an innovative cluster, but it has several weaknesses in terms of a systemic point of view. In particular, as discussed before, it becomes clear that there has been very weak interaction amongst the actors and inclined toward the R&D function in Daedeok when observed through a lens of both RIS and business eco-system. Without doubt, 'Daedeok Valley' has developed on the basis of DST which was implanted into Daejeon by the central government as a 'technopole' in Korea. In this respect, Daedeok can be seen as a kind of 'Dirigiste RIS' (Cooke, 1998) or 'the regionalised NIS' (Asheim, 2004). Main actors have been PRIs (public research institutes) and the central government in this system while other actors such as firms and universities and local governments have not been activated enough. It is not strange at all therefore that there have been no close interfaces among actors even between similar PRIs in Daedeok. According to the evolutionary economists like Nelson (1995), the core concepts of evolution in the process of innovation are 'variation', 'selection' and 'reproduction'. In Daedeok, it was difficult to expect co-evolution between actors due to the limited variety of actors and the selection by the government, so not surprisingly systemic reproduction was also very weak. Even after the emergence of spin-off start-ups in Daedeok, the co-evolution between start-ups and venture capitalists which is considered as a crucial factor in terms of business eco-system never matured.

3 THE PROCESS OF INNOVATION

3.1 Introduction

As stated above, this study started from quite a narrow meaning of innovation, such as technological and entrepreneurial innovation. However, innovation has been increasingly approached with broader meanings from various disciplines. More recently, the territorial dimension of innovation is providing a very useful perspective for understanding it as a regional specific phenomenon. This chapter tries to open up the arguments about innovation in a broader sense. Debates regarding the nature of the innovation process and systems were introduced in the first section in particular; path-breaking and path dependent processes of innovation; linear models and systemic models of innovation; and the territorial dimension was linked to the regional innovation system approach. These discussions provided an understanding about the rationale of policy intervention raising issues associated with ‘why’ and ‘how’ policy intervenes in the process of innovation, and with justifications of intervention such as the market failure and system failure perspectives. In addition, policy intervention can involve legislation, regulation, or support. Thus, the rationale of policy intervention is discussed in this chapter in terms of its justification logic and mode of intervention.

3.2 The nature of innovation process

Innovation has increasingly become ranked higher on policy agendas at national and regional levels, nurtured by the understanding that innovation is a main driver for sustainable economic, social, and regional development. Innovation includes process innovations, product innovations, and business innovations. Although innovation is often viewed as technology-oriented R&D activities, it is obviously much more than that. Innovation can result from new science and technology, from changes in business processes, or from the exploitation of new markets. The patterns and processes of innovation are also quite different across sectors, regions, and countries (HM Treasury,

2002). In this vein, this thesis uses the term ‘innovation’ in a broad sense to include both ‘technological innovation’ in firms or industries and ‘institutional innovation’ in regions and countries (Cooke and Morgan, 1998).

3.2.1 Schumpeter’s legacy in innovation study

Generally many scholars attribute the first use of the term ‘innovation’ in its modern sense to the economist Josef Schumpeter (1939). In his economic worldview, innovation is the process whereby a firm brings new technology into the economy: invention means generation of new idea, then innovation means development of new ideas into marketable products and processes, and diffusion means the broad use of new technologies. Schumpeter (1942) called the selection-culling mechanism of non-innovative firms in this innovation process, ‘creative destruction’. He argues that growth and progress will be hampered in a static economic system. A breakthrough can be created by innovative entrepreneurship (by a process of creative destruction). Consequently, static conditions can be changed and this change can lead markets to a new equilibrium (Nijkamp, 2003).

In Darwinism, evolution is the result of natural selection. Plants and animals with hereditary traits that lessen their chances of survival die out, leaving those with genetic traits that increase their survival odds to prosper and multiply. Similarly, Schumpeter argued that firms change their traits through innovation, and the firms that innovate creatively, and in ways that consumers value most, come to dominate their markets. In contrast, firms that do not innovate are destroyed by their more creative competitors. Schumpeter called this process of economic selection ‘creative destruction’, which means creative firms prosper but non-innovative firms are destroyed. In this process, firms can “*purposefully make themselves the fittest by investing in innovation*” (Morck and Yeung, 2001, p. 19).

Although Schumpeter’s works deeply influenced the development of evolutionary economics, there are also debates whether he can be classified as an evolutionary

economist. Nelson and Winter (1982) and Dosi (1988), for example, saw Schumpeter as an evolutionary theorist in that evolutionary ideas provide a workable approach to the problem of elaborating and formalizing the Schumpeterian view of capitalism as an engine of change. They base their models on a selection mechanism which is analogous to biological selection. On the other hand, Hodgson (1993) and Andersen (1995) argued that Schumpeter is not an evolutionary theorist in the modern sense, and emphasised the differences between Schumpeter and the evolutionary theorists in that Schumpeter eschewed the natural selection analogy for economics and adopted an entirely different conception of evolution. This difference and several other distinctions seem to demonstrate that the evolutionary ideas of the new evolutionary modellers have much more to do with Veblen and the old institutional economics than with Schumpeter.

Schumpeter's approach takes a dynamic outlook with an emphasis on historical specificity from the (German) historical school, and the need for a micro-based approach from the neoclassical economics (Fagerberg, 2002). Schumpeter's idea that evolution of capitalism is driven by technological competition between firms seems to be taken from Marx who had suggested that the main way for capitalist firms to keep competitive was to increase productivity by introducing new and more efficient machinery (*ibid*, p. 7). Firms that succeeded in introducing new and more efficient technology would see their competitive position improved, while those who failed would be unprofitable and, eventually, driven out of the market. Schumpeter extended the Marxian argument by introducing a broader notion of innovation. He defined innovation as 'new combinations' of existing resources, equipment and so on (Schumpeter 1934). According to his view, one innovation tends to facilitate other innovations, and consequently tend to concentrate in certain sectors and their surroundings. However, one problem in the process of innovation is that a certain knowledge or habit once acquired becomes firmly rooted in individuals or organisations. It does not require continuous renewal and to be consciously reproduced, but sinks into the strata of the sub-consciousness (*ibid*, p. 84). At the same time, this force which facilitates "*the ordinary routine*" at the individual as well as the collective level implies that "*every step outside the boundary of routine*" appears much more difficult (Fagerberg, 2002, p. 10-11). It

means there are many factors, working at the individual, organisational and social level that make it a very challenging task to succeed in innovation.

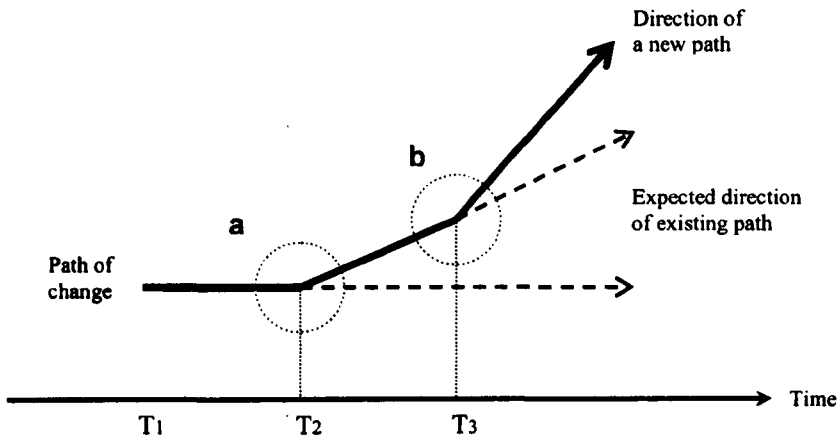
3.2.2 Debates regarding the nature of innovation

It is widely recognised that technological innovation does not take place in a vacuum or by a linear process. Especially in the fields of territorial development such as national or regional innovation, innovation needs to be understood as a broad and multifaceted concept. This thesis is looking at not only technological or entrepreneurial innovation but also spatial innovation. As reviewed above, Schumpeter described an uneven economic development process driven by new technologies that create opportunities for entrepreneurs. When his point of view is applied to regional innovation, it can be said that an innovative region must expect uneven regional development. This is associated with regional differences in innovation capacity. Before moving on to this territorial dimension of innovation, it is necessary to deeply understand the nature of innovation process by the examination of related debates.

In its original usage by Schumpeter, innovation was taken to cover structural, dynamic, and unpredictable changes, but did not mean only radical and rapid changes. In some studies based on a long term perspective, innovation was often used as a concept to include incremental, gradual, localized changes, where innovation occurred because these changes were able to generate a new trajectory rather than to strengthen an existing routine. Some scholars like Fagerberg (2002) point out a few shortcomings of Schumpeter's approach. Firstly, his sharp distinction between invention and innovation may be meaningless in that, for instance, most of firms today conduct both invention and innovation. In other words, firms are not just knowledge users any more but knowledge producers as well. Secondly, his emphasis of the crucial role of the entrepreneur and his deliberate neglect of the role of continuous learning (minor innovations) for economy-wide socio-economic change may not be enough to understand the role of innovation in modern societies in all its complexity. Innovation, especially in the field of territorial innovation, needs to be recognised that it takes place in the process of collective and

interactive learning. There were some applied researchers of Schumpeter's insistence such as Dosi (1988), to start their research from a point that recognises the cumulative and path-dependent character of innovation process. Within this perspective, innovation is regarded as not exceptional but instead a ubiquitous phenomenon.

Figure 5. Path-breaking and path dependent process of innovation



Source: Author

However, they do not insist that innovation itself has incremental or gradual characteristic, instead they argue that the process of innovation has interactive, collective and cumulative characteristic. On the other hand, this debate regarding the nature of innovation seems to be viewed differently considering the matter of time and scope in innovation process. Figure 5 shows that path-breaking innovations (circle 'a' and 'b') in the short-run can be seen as a path dependent process of innovation (a bold line) in the long-run. In other words, it can be said that innovation takes place in the collective and cumulative process of continuous path breaking attempts.

3.2.3 Linear and systemic model of innovation

Considering the above discussion, innovation might be constructed primarily as a process not as a single event. The original emphasis given to the isolated innovative act

or single event has been replaced by complex social interactions and mechanisms (Abrunhosa, 2003). Early understanding of this process of innovation was based on the legacy of neo-classical economics, where the generally accepted model of innovation was linear with research and development, production and commercialisation following one another consecutively.

The linear model deals with the inputs to and outputs from the process of innovation being enclosed in a mysterious 'black box'. Innovation in this perspective is seen as a step-by-step process in which R&D activities automatically lead to innovation. It is a simple and easily understandable model but it has critical flaw that regards R&D as the sole input to innovation. Consequently, this traditional linear idea has changed very rapidly over the last four decades. Evolutionary economists proposed more dynamic perspectives with feedback loops and with special focus on the role of knowledge. Some scholars like Kline and Rosenberg (1986) criticize that the linear model distorts the nature of the innovation process in several ways, especially because it considers R&D as the only source of innovation and since it ignores the existence of feedback loops and interactions among the distinct stages of the innovation process. Scholars such as Nelson and Winter (1977), Bijker *et al.* (1987) emphasise that innovation is the result of social and economic processes. Furthermore, authors like Freeman and Lundvall (1988), Gibbons *et al.* (1994) point out the numerous and frequent interactions and feedback loops between users and producers in innovation processes. They are concerned with 'opening' the black box in order to achieve a more comprehensive understanding of innovation as a dynamic and interactive phenomenon. Opening the black box has rendered our understanding of innovation far more complex than the linear model, and this is where the systems approach finds its place (Parr, 2004).

During the 1980s and 1990s, many researchers came to embrace the Schumpeterian idea that the process of innovation and diffusion of technology has a strong systemic character, where the various stages of the innovation process tended to be filtered together in the web of feedback loops (rather than as a linear process). In his early work on the theory of economic development, Schumpeter (1934) pointed to entrepreneurs,

who act individually, as the most important economic agents bringing innovations into the economic system. He revised his theoretical scheme later by giving a critical role to the collective work in R&D laboratories. Schumpeter's 'heroic entrepreneur' seems to be still vibrant in academic spheres of innovation, but more recently, scholars who are interested in learning process put more emphasis on firms rather than individual entrepreneurs. Firm as the key agent of innovation is undoubtedly the main repository of productive knowledge (Cooke and Morgan, 1998). However, focusing just on individual firm seems to be not enough for better understanding of innovation process. Instead, as Cooke and Morgan say, it needs to focus "*on the ensemble of relations in which firms, states, and systems interact*" (*ibid*, p. 33). In this respect, innovation can be seen as a collective and social process. In other words, interactive learning and collective entrepreneurship are considered as a fundamental aspect of the innovation process. From the end of the 1980s a series of contributions emerged focusing on the systemic aspects of innovation and the relationship between social, institutional and political factors.

Lundvall (1992, p. 2) defines "*a system of innovation is constituted by a number of elements and by the relationships between these elements*". According to this definition, innovation system can be understood as a social system. Learning is a central activity in innovation systems and it is a typical social activity which involves interaction between people. In this systems approach, innovation system is seen as a dynamic one which is characterised both by feedback loops and reproduction. The feedback mechanism of the system means continual interaction with its environment. This reflects that innovation is an interactive and systemic process, and it means the innovation system influences on its external environment but simultaneously is influenced by surrounding environment. Nowadays, in response to these perspectives, more attention is paid to the factors that lead innovation system to social or regional 'embeddedness'. A great deal of research (Putnam, 1993; Morgan, 1997; Gertler *et al*, 2000; Cooke, 2001; Fornahl and Brenner, 2003) has been conducted which helps understanding the nature of community and solidarity, the foundations of social trust, the networked types of relationship among different actors, strong entrepreneurship and the social climate of tolerance, high mobility of human resources.

This systems approach basically considers that innovation does not take place in isolation but in the context of a system. As a consequence, the performance of organisations in innovation system depends on the quality of that system, particularly on the quality of the sub-systems and on the mutual tuning of these sub-systems (Smits *et al.*, 2004; OECD, 1997). According to Edquist (2005), a system consists of components, relations among them, and boundaries which enable us to discriminate between the system and the rest of the world. Basically innovation systems consist of organizations and institutions. 'Organisations' are "*formal structures that are consciously created and have an explicit purpose*". 'Institutions' are "*sets of common habits, norms, routines, established practices, rules, or laws that regulate the relations and interactions between individuals, groups, and organizations*" (*ibid*, p. 188). He points to ten 'activities' which have an important influence on the development, diffusion, and use of innovation. These activities include the provision of R&D, networking, financing, support services for firms. They are not themselves constituents of innovation systems, but rather patterns of behaviour and development which have shown to be particularly important to process of innovation. He also mentioned 'boundaries' as one more central concept of innovation systems. Boundaries which distinguish what lies within a system from what lies outside, may be defined in terms of geography, sectoral characteristics, or activities (*ibid*, p. 199).

The systems approach stresses some characteristics of innovation system: heterogeneous actors are involved in innovation processes at very different level, systems do have the tendency of path dependency as a memory of systems, entities are strongly interlinked and boundaries of systems are very fuzzy (Smits *et al.*, 2004). Within the context of this systems approach, innovation can also be understood as a network activity between different actors. It indicates not only the growing need for public-private partnerships (PPP) in the area of research, technology and development, but also the importance to reinforce the quality of the innovation systems by improving the interfaces between the research and industry (Faroult in Smits *et al.*, 2004, p. 7).

3.3 Territorial dimension of Innovation

As discussed above, the understanding of innovation process has been changed in recent years away from a linear model towards an interactive or systemic model. Innovation is increasingly considered as an interactive process that goes beyond short-term market transactions and includes more durable trust-based relations like 'networks' (Cooke and Morgan, 1993) or 'untraded interdependencies' (Storper, 1997). In this respect, knowledge is seen as the most important resource for innovation and 'tacit knowledge' in particular is being more emphasized in terms of knowledge transfer. There are usually a range of actors involved in the process of innovation such as customers, suppliers, competitors, and so on. Tacit knowledge is basically favoured by face to face contacts coming from spatial proximity. Firms as one of main actors can learn knowledge in different ways through interactive learning with other actors like other firms, universities or research organizations. As systemic model argues, institutions play a critical role in this interactive learning process. Institutions are bound to specific territories such as regions and countries (North, 1990; Edquist, 1999). In this regard, territorial dimension is emphasised in understanding innovation systems.

3.3.1 Relationship between innovation and territory

In the last two decades, innovation studies in a broad range of disciplines have increasingly stressed the importance of the national or regional production environment in creating sustainable competitive and comparative advantage (Nelson and Winter, 1982; Nonaka and Takeuchi, 1995). There have been a few attempts to deal with these matters of systemic approach and territorial dimensions of innovation, such as 'national system of innovation: NIS' (Lundvall, 1992; Nelson, 1993; Freeman, 1995), 'regional systems of innovation: RIS' (Cooke and Morgan, 1994; Cooke, 1997; Doloreux, 2002). The territorial dimension of innovation has been discussed mainly with regard to the matter of proximity and regional embeddedness. The former issue is connected to tacit knowledge transfer, and the latter issue is linked to spatial differences or specificities. Institutions in a broader sense play an important role in understanding these issues in

terms of the interrelations between actors and territorial frameworks. As Kirat and Lung (1999, p. 27), "*the relationship between innovation and territory actually pertains to the interactions between learning processes, their institutional contexts and space*". RIS studies have investigated the innovation performance of firms in terms of the character of their networks and institutional factors.

However, in spite of research progress, it remains unclear how to measure the effectiveness of systems as an instrument of regional innovation policy designed to stimulate knowledge-led economic development. Is it possible to gain the effects of regional innovation like the 'Silicon Valley Story' or 'Cambridge Phenomenon', if such an innovative region is established in other parts of the world? This question provides various implications for policy makers in many countries which tried to make implantation of successful cases by governmental policy implements in specific region. The high profile of Silicon Valley largely contributed to the rapid increase of science parks as a 'pole' of technological innovation particularly in the 1970s and 1980s (Miller and Cote, 1987; Castells and Hall, 1994; Rosenberg, 2002). It had been a kind of fashion in the world. Many countries tried to implant innovation system in selected geographical spaces by making agglomeration of research laboratories and firms, but it often produced rather disappointing results in terms of the achievement of innovative synergetic effects. Of course, some of these attempts can be said to be quite successful in some extent, but it is really difficult to say clearly that some cases are successful or not at a certain point of time because innovation system evolves continuously reflecting environmental changes at that time. During this period, various attempts to explain what are the driving forces behind Silicon Valley's success were conducted and some theoretical approaches highlighted by many researchers such as cluster theory, technopole theory, industrial district theory, etc. These theories provided various implications for policy makers to involve in innovation processes.

In recent years, public innovation policies at different territorial levels have increasingly applied a systemic view on the processes of technological innovation and economic development. According to the systems approach, interaction among different actors in

the system as well as relation between system and external environment take a crucial role in the innovation processes. Thus, national or regional differences in technological performance can be attributed to variations in the institutional environment (Lundvall *et al*, 2002).

3.3.2 National and Regional Systems of Innovation

Using a 'National Innovation System' (NIS) as a concept to explain the competitive advantage of nations is relatively new, having only appeared in the last two decades. At the end of 1980s, Freeman (1987), Lundvall (1992) and Nelson (1993), among others, developed this concept in order to study the interrelations between technological development and the institutional embeddedness of innovative organisations. NIS can be defined in many ways but, according to Galli and Teubal (1997, p. 345), it is defined as "*the set of organizations, institutions, and linkages for the generation, diffusion, and application of scientific and technological knowledge operating in a specific country*". Thus, NIS is characterized by a differentiated set of organisations and institutions.

NIS rests on the premise that understanding the linkages among the actors involved in innovation is a key to encouraging technological progress. Innovation and technological progress are the result of a complex set of relationships among actors producing, distributing and applying various kinds of knowledge. This perspective came from a practical or empirical rather than a theoretical background and it appears to provide a guideline for economic success in specific countries. The innovative performance of a country depends to a large extent on how these actors relate to each other. These actors are primarily private firms, universities and public research institutes and individuals within them.

There is no single accepted definition of national innovation system. Regarding economic success in last century, the predominant ideology was based on the 'Fordist' mass production model. Delivering the maximum number of standardised products while incurring minimum production costs, 'Fordism' was "*compatible with the*

macroeconomic dynamics of the post-war period" (Boyer *et al*, 1993, p. 3). However, as the economic climate changed, Fordism could no longer cope with new changes and by the 1980s almost all its elements appeared to be hampering competitiveness.

Meanwhile, the Japanese economy was extremely successful with its emphasis on flexible specialisation and research and development (R&D). Freeman (1987), identified several major factors in the Japanese innovation system to which its economic and innovative success could be attributed. It was also within this work that he introduced the phrase "National Systems of Innovation". He also emphasised that qualitative factors affecting the national system have to be taken into account as well as the purely quantitative ones in order to account for the unsatisfactory results that the linear production model was providing (Freeman, 1995).

Lundvall went into more detail. His perspective was based on two assumptions, that "*the most fundamental resource in the modern economy is knowledge, and accordingly that the most important process is learning*" and that learning is "*a social process which cannot be understood without taking into consideration its institutional and social context*" (Lundvall, 1992, p.1). He determined that national systems of innovation are "*constituted by elements and relationships which interact in the production diffusion and use of new, and economically useful, knowledge and that a national system encompasses elements and relationships, either located within or rooted inside the borders of a nation state*" (*ibid*, p. 2). Within this kind of system, one of the most important factors is the relationships between the actors and institutions. The implication from these perspectives can be found that there is no single best way of stimulating an economy using the concept of NIS, but there are common elements to each case that can be treated in a similar manner despite national differences (Golden *et al*, 2003).

Since 1980, a new paradigm of regional development has emerged. One interesting finding in the recent period has been that the innovation process tends to be highly localised. Social scientists have increasingly focused on the significance of the region as a fundamental basis of economic development (Cooke, 1997; Storper, 1997). In this new

approach, regions appear as focal points for learning and knowledge creation in this new age of global, knowledge-based economy. There were two observations in the background of the emergence of RIS perspective as a new concept and a new policy for regional growth; one is that NIS does not necessarily achieve a balanced regional development, and the other is that regions matter for the implementation of NIS (Cooke, 1997; Morgan, 1997; Cooke and Morgan, 1998). As a consequence, the regions named as 'learning regions' are increasingly important sources of innovation. This increasing role of the region is rooted in 'untraded interdependencies' and that take the form of conventions and informal rules that co-ordinate economic actors under conditions of uncertainty (Storper, 1997, p. 5)

Studies of innovation systems in a sub-national level began to be identified through case studies of innovative regions in the early 1990s (Davis, 1991; Cooke and Morgan, 1994; Saxenian, 1994). Since then, these theoretical approaches have been diversified by studies that recognised the evolution of autonomous systems of innovation at the local and the regional level. According to these perspectives, the impact of innovation on regional development will be changed depending on the extent and depth of the innovation systems within a specific region. Since the effects of knowledge spillover are seen to diminish with distance, this provides a key motivation for organisations to agglomerate, strengthening the established 'regional innovation system' (RIS). Thus disparities in regions can be seen to stem from different RISs that organisations work under, and through their own innovative activities these organisations also contribute back to their own innovation systems (Courvisanos, 2003).

The concept of RIS combines the focus on regions with a systems perspective. Region has its origin in the Latin *regio* which stems from *regere*, meaning 'to govern'. In general, region has been used in the sense of administrative dimension in the field of regional development. Following this definition, region is an administrative division of a country (Cooke *et al*, 2005). However, region is very broad and abstract concept, so not surprisingly there are many different definitions. Moreover, some countries do not have regions but just have nation-states and local administrations. In Europe, a supranational

concept of regions can be also used in terms of EU dimension. Regions are now becoming more important and natural economic unit than nation-states which lose some strategic economic capabilities in an increasingly borderless, globalizing world. Thus how to define 'region' is very crucial but contestable to understand RIS and regional policy implications. Cooke (2003) says the boundaries of regions are not fixed once for all, in that they can change, new regions can emerge or old ones can perish. Therefore it is very important to distinguish different types of regions, and to understand a functioning unit of a region within a specific term. It is also important to analyse the relationship between national and regional innovation systems.

As Doloreux (2002) indicates, the precise distinction between an NIS and an RIS is difficult to ascertain. Some scholars such as Wiig (1999), Archibugi and Michie (1997) recognise RIS as a subset of NIS in that it originated from the discussions about NIS. However, the concept of RIS has recently become very popular among academics of various disciplines. Doloreux (2002, p. 246) identifies three notable elements of RIS such as 'interactive learning', 'institutional milieu' and 'embeddedness'. The translation of 'region' as well as the understanding of these three aspects is providing characteristics for RIS distinguishing it from other approaches.

According to the systems approach, 'interactive learning' is a central concept of RIS, and it can be understood as the process that generates learning between actors who participate in the innovation process. Cooperation or networking for learning is closely related to innovation. At the same time, shared knowledge is a very important aspect of RIS because it helps increase its interactive learning capabilities (Doloreux, 2002). In relation to the concept of regions and interactive learning, the role of 'proximity' is emphasised in RIS. Generally speaking, the matter of proximity is related to the benefits generated by spatial or geographical agglomeration of firms and other organisations. In particular, it has been recognised as a crucial factor for tacit knowledge transfer because it can reduce transaction costs in sharing knowledge between actors. Face-to face contact, high trust and understanding can also contribute to tacit knowledge transfer. However, there is a growing acceptance that globalisation reduces this importance of geographical

agglomeration or physical proximity. Amin *et al* (2003) argues that relational proximity is more important than geographical proximity in supporting the flow of tacit knowledge, and it can be achieved at a distance. This argument explains why tacit knowledge transfer does not appear naturally in a few science or technology parks built by government planning, even though spatial agglomeration exists. In other words, geographical proximity is not directly connected to relational proximity or shared understandings.

‘Institutional milieu’ and ‘social embeddedness’ are also contested factors constituting RIS. Institutions can be defined both narrowly and broadly. They can take the form of either a formal structure with an explicit purpose, or an informal structure that determine the norms, rules, laws that influence innovation. In evolutionary economics, institutions are usually recognised as a broader concept such as the rules of the game. Following this understanding, institutional elements in RIS are largely shaped by national system due to the fact that they are dependent on historical tradition, cultural differences and policy decisions at the national level (Doloreux, 2002, p.248).

3.3.3 Regional Innovation System and Start-up ecosystem

As mentioned above, innovation in knowledge-based economy can be understood as an interactive learning process, which is territorially embedded and institutionally contextualized (Lundvall, 1992). In this respect, RIS perspective provides a useful lens through which to view the innovation process in a regional, systemic, and institutional context. However, it is a normative and ideal type of approach in terms of its theoretical and conceptual foundation. It contains very abstract and elusive constructs such as region, innovation and system. Moreover, its basic factors such as interactive learning, institutional milieu, social embeddedness and the matter of proximity are also contestable and problematic. Thus a system and its outcome depend largely on different regional contexts. At the same time, these weaknesses of RIS can be contrastingly understood as a strong point in terms of applicability. RIS needs to be recognised as not a fixed but still developing theory. No synthetic solution or panacea for every case can

be expected from this theory. Drawing on a more persuasive framework from various case studies which are adopting RIS perspective would be appropriate at this point, and it might be very helpful for making up for the weaknesses of RIS.

RIS has developed in a European context, and it emphasises institutional innovation. Contrastingly, the wide range of studies of Silicon Valley phenomenon, which has been undoubtedly accepted as a most successful innovation story, adopt mainly 'cluster' theory (Porter, 1990) or 'business ecosystem' theory (Moore, 1993; 1996; Rothschild, 1990). These two different flows of studies between Europe and America have their own emphases, strengths and weakness respectively. Business ecosystems or 'business ecology' (Abe *et al*, 1998), in particular, are worth consideration as they are also based on a systemic approach. These focus especially on 'self organisation' and 'co-evolution' of various actors within the system, and also emphasise the role of 'start-ups', 'venture capital' and 'exit market' (e.g. NASDAQ).

Scholars who are interested in business ecosystem agree that the biological metaphor of 'ecology' is useful because it takes account of the structural and social forces that contribute to innovation (Moore, 1993; Abe *et al*, 1998; Iansiti and Levin, 2004). Moore (1996, p. 26) defines a business ecosystem as "*an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world.*" According to Moore, the member organisms include suppliers, lead producers, competitors, and other stakeholders who co-evolve their capabilities and roles. The key to a business ecosystem are leadership companies ("the keystone species") who have the most crucial influence over the co-evolutionary processes (*ibid*, p. 9). Despite his definition, the lack of its clearness still causes conceptual confusion. Hence, it is used as slightly different terms in related contexts such as 'industrial ecosystem', 'start-up ecosystem' and 'digital business ecosystem'.

However, business ecosystem is a highly descriptive expression for the complex business environment which is the reality for most companies nowadays. This approach has its root in systems theory, complexity theory, and chaos theory. Systems theory, as

noted above, concentrates on the interest of the whole system instead of its parts, thus its goal is to define the relationships and communication between the parts within a system. Complexity theory defines complexity as depending on the ambiguity of cause and effect (Sammut-Bonnici and Wensley, 2002). Chaos theory is based on the assumptions of any kind of stable situation being only temporary, while chaos is seen as the dominant state of affairs (*ibid*, p. 309). On the basis of these theoretical roots, business ecosystems are closely associated with some concepts such as self-organisation, co-evolution, fitness, adaptability, selection.

It provides very useful insights to make a more persuasive conceptual framework for understanding regional innovation systems. While business ecosystem puts more stress on market oriented innovation, RIS emphasises institutional innovation. Consequently, it is important to link the larger institutional frameworks of the national innovation and the character of regional innovation systems, and business ecosystems. Recently there has been an attempt to make the distinction between the institutional regional innovation system (IRIS), and the entrepreneurial regional innovation system (ERIS). Cooke (2004-a) states that IRIS is driven by the government and public sector institutions such as public laboratories, universities, government ministries and technology transfer institutions whereas ERIS is driven by entrepreneurs and venture capitalists. The former (IRIS: typically in the case of German regions or regions in the Nordic countries) is characterized by the positive effects of systemic relationships between the production structure and the knowledge infrastructure embedded in networking governance structures regionally and supporting regulatory and institutional frameworks at the national level. In contrast, the latter (ERIS: found typically in the United States) lacks these strong systemic elements, and instead gets its dynamism from local venture capital, entrepreneurs, scientists, market demand and incubators to support innovation that draws primarily from an analytical knowledge base (Cooke, 2003, p. 57; Asheim *et al*, 2004, p. 304). Critics of ERIS argue that it lacks the longevity and stability of IRIS in that IRIS is closely coupled with social systems favouring stable, predictable paths of innovation (Asheim and Coenen, 2006). On the basis of this clarification, RIS is seen to emphasise the importance of institutions, and business ecosystem is seen to stress the role of start-

ups, venture capital and market forces. On the other hand, both of these perspectives have also similarities in that they are commonly based on systems approach and evolutionary economics, and they have a perspective of regional dimension, dynamism, and complexity. In addition, both of perspectives emphasise the interdependence of all entities, interaction, and evolution. Despite the fuzziness of border between these two perspectives, some distinction can be made (see Table 11).

Table 11. Comparison of RIS and SES

	RIS(Regional Innovation System)	SES(Start-up Eco System)
Assumption of system	Mechanism Dynamic process Value chain	Organism Habitat Food chain
Basic perspective	- Institutional approach (related to network theory) - Economic geography	- Market oriented approach (related to cluster theory) - Business, Ecological economics
Main flow	Flow of knowledge	Flow of knowledge + capital, workforce
Main actors	- knowledge producer (univ.) - knowledge user (firm) - knowledge diffuser (institutions)	- producer (univ. research institutes) - consumer (firms : start-ups) - decomposer (VC, stock market) - competitors
Assumption of actors	Behaviours - interact, cooperate – evolve	Species - interact, adapt - compete – evolve – extinct
Focused on	Interactive learning Cooperative networking	Self organization (adaptation) Co-evolution (fitness, selection)
Key elements for innovation	- geographical proximity - interactive learning - institutional milieu - social embeddedness	- market competition - strategic alliance - firm formation (start-up) - entrepreneurship (social capital) - food chain (VC-stock market, labour mobility-head hunting, etc)
Originated from	European context (originated from NIS)	American context (especially, from Silicon Valley story)
Dimension of recognition	- if it is embedded in regional and socio-cultural environment, then the SYSTEM is more likely to be innovative	- if it is healthy, facilitative, stimulative for the actors, then that region is more likely to be innovative

Source: Author

This distinction seems to mainly stem from the different dimension of recognition or view points even though two theories see same phenomena. However, policy implication derived from each position has been accepted quite contrastingly in a various range of empirical studies. In general, the role of public policy has been emphasised in RIS perspective. On the other hand, it has been relatively neglected in ‘business (start-ups) ecosystem’ and instead the role of market forces has been more emphasized. In the case

of Silicon Valley, market mechanisms and strong entrepreneurship seems to be more important rather than public intervention.

However, the role and extent of public policy can differ in different time and space. Moreover, it can be variously viewed from different angle. Rosenberg (2002) argues that even in America, one of the strongest advocates of free enterprise and market economy, government's contribution was a major factor in the growth and development of Silicon Valley. He suggests that government helps most when it creates mechanisms for improving the risk-reward ratio for private entrepreneurs, rather than trying to get into the business itself by forming investment funds or by picking industries through trade protection or tax incentives. As he argues, "*continuing with programmes that have already set the wheels of the private sector in motion eventually causes more harm than good by distorting market incentives*" (Rosenberg, 2002, p. 18). It means that the success of government intervention, even in case of SES perspective, depends on the proper timing for intervention and wide ranging policy support. In summary, policy intervention can be compared like a 'double-edged' sword in that it can facilitate innovation but at the same time it also can deter innovation.

3.4 Rationale of policy intervention and regional innovation

According to systemic approach, the innovation process is indeed far from simple in that various actors and elements are involved in the process. It means that there are many issues to be tackled by policy intervention. Traditional science and technology policy based on the linear model emphasised increases of the input factors such as the R&D budget. However, the focus of recent innovation policy is shifting from just supporting R&D or technology diffusion to promoting interactive learning activities in terms of a wider systemic point of view. In the background of this change, as stated above, there is a concern that policy intervention can facilitate innovation but can also produce serious distortions in the market. This section discusses two issues relating to the rationale of policy intervention in the process of innovation. One is the issue about 'why' intervene and the other is about 'how' to intervene. In other words, the former is associated with

the justification of policy intervention and the latter is related to the mode of intervention. These issues are closely interlinked with the nature and dimension of innovation which were discussed above.

It is widely held that most economic functions in a modern society are best fulfilled by the market mechanism which co-ordinates the behaviour and resources of private and public actors - often in a smooth and flexible manner. However, there are sometimes reasons to complement or replace or duplicate the market mechanism through public intervention. Edquist (1999, p. 3) argues that two conditions must be fulfilled for there to be reasons for public intervention in a market economy: Firstly, there must be a *'problem'* - which is not automatically solved by market forces and capitalist actors - for public intervention to be considered. Secondly, the state and its public agencies must also have the *'ability'* to solve or mitigate the problem. If not, there should be no intervention, since the result would be a failure. Adding second condition means that the existence of a *'problem'* is a necessary but not sufficient condition for public intervention. In traditional economics, this *'problem'* is often explained as *'market failure'*. But according to evolutionary economics, innovation processes have systemic characteristics, and the system never achieves equilibrium and optimality. Thereby, Edquist argues that *'market failure'* perspective loses its meaning and applicability.

Following Edquist's argument, governments need to develop their *'ability'* to solve the *'problem'*. New policy instruments or the creation of new organizations and institutions to carry out the intervention might also be necessary. Institutions constitute the *'rules of the game'* (e.g. laws, rules, habits, routines, etc), and organisations are the actors or players, the action of which are shaped by (and shape) the rules (Edquist, 1999, p. 4). Governments usually use non-market mechanisms such as regulation to solve or mitigate problems. These mechanisms are quite different from market mechanisms such as *'invisible hand'* (mechanisms of demand and supply). Taxation, subsidising, service providing are representative policy instruments, and sometimes technology standard creations, public funding for R&D can be other kinds of examples. On the other hand, governments try to improve market functions or create new markets. These policies are

focusing on a matter of increasing the degree of competition in a market. In both cases, policies result in a matter of creating, changing, or getting rid of institutions.

In this vein, policy can be seen as the main regulatory mechanism of the environment in which innovation takes place. While most theories have accepted a regulatory function of the state for basic institutional settings, there has been little or no political agreement about the normative role of the state or government. Cooke and Morgan (1998) delineate the changes in the state's development role according to shifting ideological waves: the State-Centred Repertoire, the Neo-Liberal Repertoire, and the Associational Repertoire. As the waves were dramatically changed from the first one which was called as the Keynesian state or the interventionist state to the third wave which is called as associational or interactive state, the key issue has been also changed from the scale of intervention or boundary between state and market to the mode of intervention or the framework for effective interaction (*ibid*, p. 22). The Keynesianism basically believes in the ability of state to intervene in markets, and stresses the offer of state incentives to individual firms to improve their competitiveness. On the other hand, the neo-liberal approach has its faith in the market mechanism, and seeks to deregulate markets and to underpin spontaneous entrepreneurship. In terms of regional policy, both of these two strands seemed to be not always successful in the mean time. Keynesian regional policies failed to encourage self-sustaining growth based on the mobilization of local resources and interdependencies due to the dependency on state aid, and neo-liberal regional policies did not succeed in securing developmental potential of the less favoured regions due to the failure to improve the weak economic basis of those regions (Amin, 1999). As Amin argues, the consequence of following one of these two approaches can be the choice between "*dependent development and no development*" (Amin, 1999, p. 365). This section tries to discuss the rationale of policy intervention in two points: the justification and the mode of government intervention.

3.4.1 Justification of policy intervention

Two contrasting models of innovation (linear model and interactive model) offer different kinds of implications for policy makers because the process of policy-making and its implementation is very complex and similar problems may be solved through the use of different types of policy measure. In linear model, it is important to manage interfaces between users and producers of innovation. This management should focus not only on knowledge transfer and technological competence, but also on stimulating demand articulation by providing tailor-made strategic information and bridging gaps between actors with different institutional backgrounds. The systems approach has two important implications for policy makers. The first one is the need to embed innovation policies in a broader socio-economic context. This implies a considerable expansion of the policy domain, better opportunities for tuning actions, and a shift from top down to network steering. The other one is about 'system failure' which is even more important. In the legitimisation of innovation policy, mainstream neo-classical economics point to a mix of market and government failures, whereas evolutionary economics emphasise system failure as an additional reason to intervene (Smits *et al.*, 2004, p. 6-7).

According to systems approach, system failure stems from the imperfection of system itself. However, the distinction between market failures and system failures is confusing, especially if one considers the systems to be the sum of markets and government (Hers *et al.*, 2004). Basically neo-classical economics assumes that free markets usually bring about an efficient allocation of resources, so it recognises market failure as an exceptional phenomenon. Hence, government intervention can be justified to correct market failures and to establish the rules of the game, but it might lead to government failure. As Stiglitz (1989, p. 56) says, we have to take into account the inevitable government failures for some types of public intervention, in that the full costs of government intervention may be less than the benefits arising from correcting (or improving upon) market failure.

Traditional market failure perspective

Neo-classical economists accept the fact that a variety of reasons may lead markets to fail: the existence of natural monopoly, public goods, external effects which stem from incomplete market and imperfect information (i.e. moral hazard, adverse selection). Market failure perspective in the process of innovation has been discussed mainly in relation to 'production of knowledge' and 'infant industry protection.' The former logic is associated with the recognition that production of knowledge (such as R&D, one of the most important activities in innovation system) by market system is insufficient to achieve optimality. It is because R&D activities have the characteristics of (quasi-) public good. Accordingly, a social optimum of knowledge production through private profit optimisation is not easy to be attained due to several factors such as the appropriability problem, positive externalities, duplication, and uncertainty (Geroski, 1990; Hauknes *et al.*, 1999). On the other hand, the latter logic of market failure perspective has been advocated in association with 'infant industry protection' in industrial policy. Government intervention for catching-up in many countries was largely motivated by this logic of supporting and protecting infant industry. In case of start-up sector, policy measures for promoting new high-tech firm formation and facilitating venture capital investments could be advocated by this market failure perspective. These sources of market failure arouse the 'finance gap' issue in the process of innovation. In other words, the market does fail by the above mentioned factors, and governments may need to intervene to address this issue of a less than socially optimal level of investment in promoting R&D activities or providing suitable protection for infant industries.

Proper policy measures can effectively address the matter of market failure as seen in extensive cases of successful policy intervention in many countries. For example, government intervention in the United States has been quite active and creative in the field of start-up support and venture capital promotion. This can be seen in terms of government funding for R&D via the university system. In addition there has been the use of a hidden but de facto industrial policy via the Pentagon and other areas of government in terms of the procurement and stimulation of high-technology products over many years, including computers, aerospace and semi-conductors (Geroski, 1990).

Overall, it can be said that there has been quite extensive public policy intervention in the United States, but this is often opaque and hidden (Bailey and Cowling, 2006). There is another case of successful experience of policy intervention in Israel for venture capital industry. The development of Israeli VC industry was not market-led but triggered by an appropriate design of a targeted VC policy programme such as 'Yozma Fund' (Gelvan and Teubal, 1997). In spite of this extensive evidence of the successes of policy intervention, various sources may lead governments to mistaken intervention. As a consequence, the effectiveness of policy instruments depends on the occurrence of 'government failure' which is basically caused by limited information, bounded rationality, limited control over bureaucracy, the influence of lobbying. Also, rent seeking behaviour and high transaction costs can also increase the risk of government failure.

In the traditional market failure perspective, government itself is considered as an important actor in market. Government has several advantages over the market compared to other private actors. It not only has some privileges and power to tax and punish, but also a great ability to reduce transaction costs. This provides an opportunity for governments to put pressure on the various market players to produce innovative solutions to societal problems. However, government failure may reduce the effectiveness of policy intervention, and sometimes can be more serious than non-intervention. Furthermore, policy makers have to consider the possibility that the financing of policy initiatives can cause distortion of taxation (Hers *et al.*, 2004; Hauknes *et al.*, 1999).

Market failure rationale provides the basis of science and technology policy or other innovation policies. However, limitations of this analysis with regard to technological progress and innovation have been analysed in the 1980s and 1990s (Baldwin and Scott, 1987; Cohen and Levinthal, 1989; Himmelberg and Petersen, 1994). The complexity of the innovation processes makes it very difficult to identify market failure; firstly, it ignores the broader institutional framework that defines how markets work; secondly it implicitly assumes that the market mechanisms have a competitive advantage over other

mechanisms in all industrial technological and intervening activities relevant for policy purposes; lastly it may fail in providing direction to policies when externalities are pervasive (Teubal, 1998, p. 139).

System failure perspective

Innovation policy is public action that influences technical change and innovations. It includes a wide range of policies such as R&D policy, infrastructure policy, regional policy and education policy, etc. It is also naturally associated with change, flexibility, dynamism and the future (Edquist, 2001). Traditional market failure analysis is used as a reason for R&D or S&T policy despite many critiques of its limitations (Martin and Scott, 2000). However, additional types of failure have been emphasised as the basis of justification for innovation policy (Smith, 1996, 2000; Malerba, 1998, 2002; OECD, 1999; Edquist, 2001, 2002). Those insights that innovation is systemic and multi-organisational lead to the need of rethinking the basic arguments for innovation policy. The 'systems of innovation' perspective evolved in the 1980s through analyses of the path dependent evolution of national economies and their innovation infrastructures (Freeman, 1988; Lundvall, 1988; Nelson, 1988). These studies have emphasised the importance of learning and its diffusion as a core process of innovation. Thus innovation is characterised by constant interactive learning between different actors, e.g. firms establish relations with other organisations such as other firms, universities and R&D institutes through their innovative activities. The systems approach has been extended to studies on regions (Cooke, 1997; Morgan, 1997) and sectors (Malerba, 2002).

As Hauknes *et al.* (1999) says, if there are mismatches between elements in an innovation system (e.g. a lack of interaction between actors), then innovation may be slowed or retarded. It means that modern innovation policies have to deal with the matter of system failure due to system imperfections. This perspective argues that governments should also address system failures which block the functioning of the innovation system and hinder the flow of knowledge (OECD, 1999). According to the OECD (*ibid*), system failures mainly encompass mismatches between the elements of an

innovation system leading to a lack of communication and networking and institutional rigidities. However, the concept of system failure is described quite differently in the literature and it may be somewhat confusing to understand this concept. Furthermore, there are some debates about the distinction between market and system failure. Some scholars like Teubal (1998) insist that it is important because it may be indicative of the root problem blocking the adaptation of enterprises to a changing environment, and also be indicative of the policy priorities that might have to be undertaken. On the other hand, in some literature, system failure is seen just as different type of market failure, and it is caused by underlying incentive problems which can be traced back to market or government failures (Hers *et al.*, 2004). Considering these debates, the concept of system failure needs to be discussed in more depth.

The sources of system failures have been identified quite variously by different scholars. Smith (1996, 2000) pointed to some of the policy issues arising from the complexities concerning the nature of innovation and its underlying learning processes. He argued that traditional market failure analysis links up with 'linear model' approaches and leads in practice to policies consisting of subsidies to R&D, but it is very weak in identifying where those subsidies should go, and what their level should be. Smith also indicated that any market-based system is likely to generate other areas of systematically weak performance, which might be termed 'failures', and which provide a justification for policy intervention. He distinguished four types of system failures that include failures in infrastructure provision and investment, transition failures, lock-in failures, and institutional failures. Smith (1996, p. 41-46) also added 'policy capabilities' on the basis of this rationale for policy action. In a systems context, policy makers need some competences, skills and resources to operate policies: the assessment of system specificities, understanding of relevant knowledge bases, assessment of system dynamics, system co-ordination, and identification of untraded knowledge flows. Malerba (1998, 2002) put emphasis on four main types of system failures such as learning failure, exploitation-exploration and variety-selection trade off, appropriability traps, dynamic complementarities failures. His term 'failure' is not used with respect to any optimality situation, as compared with the term 'market failure' used in the

neoclassical literature. Whereas 'market failures' refer mostly to a static framework and call for government policy intervention due to missing markets, the lack or appropriability and the public good aspects of scientific research, and the indivisibility and uncertainty related to R&D projects, Malerba's 'evolutionary system failure' refers to the absence or the mismatches and traps in the key evolutionary mechanisms (Malerba, 1998, p. 5-6). Edquist (2001, 2002) suggests that market failures are irrelevant in a system approach and recognises four system failures; missing functions, organisations and institutions and a lack of interaction in the innovation system. Bemer *et al* (2001) identify three types of system failures. These are too much or too little interaction, path dependency and lock-in, missing or inadequate institutions (Hers *et al.*, 2004). While market failure perspective addresses failure in the generation of knowledge due to associated risks or uncertainties, the system failure perspective focuses on within-system interactions and system dynamics in knowledge exploration and exploitation.

3.4.2 Limitations of systems approach

The perspectives of market failure and system failure are controversial areas for policy makers. In reality, these are not mutually exclusive rather complementary in some sense in that they have their own theoretical basis and limitations in terms of policy implication. As mentioned above, the traditional rationale for policy intervention has been that of market failure, but this assumes that governments have enough ability to tackle the problems caused by market imperfections. However, governments cannot be assumed to do better than markets, even when the latter fail. This is government failure. Beyond this, the basis for and implementation of innovation policy is subject to systemic issues. It means that innovation systems deal with system failures caused by the imperfection of system itself. Consequently, the justification for policy intervention in innovation processes depends on country or regional specific context including market forces, government's capabilities, and institutional environment. Table 12 shows the basic distinction of two approaches between market failure and system failure.

Table 12. Comparison of market failure and system failure perspective

	Neo-Classical Economics	Evolutionary Economics
Basic Assumptions	<ul style="list-style-type: none"> - complete set of markets - no barriers to entry or exit - no externalities - rational actors (profit maximization) - perfect information, competition - market clearing equilibrium 	<ul style="list-style-type: none"> - imperfect market - barrier of entry - externalities - incomplete information - bounded rationality - no equilibrium
Failures	Market Failure	System Failure
Innovation model	Linear innovation model - technology-push / market-pull	Systemic innovation model - interactive / dynamic
Source	Market imperfection - Underinvestment in R&D activities	System imperfection - Underdevelopment of innovations
Focus	Knowledge generation	Knowledge diffusion
Gov. intervention	<ul style="list-style-type: none"> - To establish the rules of the game - For correction of market failure - Can be legitimated when market failures are large enough to outweigh government failures 	<ul style="list-style-type: none"> - Governmental role in monitoring and encouraging innovation is very essential - For correction of market failure and system failure
Policy Implications	S&T policy or R&D policy	Innovation policy
	<ul style="list-style-type: none"> - R&D subsidising - public sector R&D - R&D agglomeration 	<ul style="list-style-type: none"> - facilitating interaction - stimulating networking - encouraging cooperation

Source: Author

In some situations, policy intervention would be in vain or even worse than non-intervention. Policy actions in the market are usually implemented in the form of non-market mechanisms mainly using regulation such as taxations, redistribution, subsidising. However, this type of intervention may cause serious distortion of market mechanisms, and as a consequence, it can be connected to another market failure as an impact of policy (Teubal, 1998). Thus, more recently, innovation policies have been designed on the basis of a system failure perspective that focuses on stimulating or facilitating knowledge-based activities within a political jurisdiction - typically a nation or a region. Policy measures to address system failure, e.g. the lack of coherence among institutions or the lack of interaction among actors within an innovation system, are mainly intended to promote cooperation among key actors, and to change the design of institutions and incentive structures.

Systems approach for innovation implies that policy making itself becomes an adaptive and learning-based activity. As stated before, market and system failures are not mutually exclusive but that both require attention by policy makers. Each has its limitations and pitfalls. Andersson (1998, p. 17) identifies three such pitfalls relating to the application of systems approach; Firstly, *“there are no doubt limitations to governments' ability, as well as high opportunity costs in employing those capabilities”*. These limitations stem from mainly the competence of government officials, the time available to them and the possibility of rent-seeking behaviour. These are recognised as the reason of government failure. Secondly, *“the limitations on government capacity make it important to determine priorities”*. Setting priorities regarding the issues which need to be addressed by policy *“becomes very important in the systems approach as it may produce a range of suggested policy adjustments”*. Thirdly, *“a systems approach raises issues with respect to the generalisation of policy principles and lessons.”* (ibid, p. 18). Country specific conditions are important in that policy objectives and instruments are influenced by the specific issues in different countries. Hence, a systemic framework makes it difficult to draw policy lessons from the experience of others.

Among above pitfalls of the systems approach, the second one may be related to the selectivity of policy. Edquist (1999) argues that most of innovation policy is selective rather than general, especially when governments do not use the market mechanism. It means that the consequences of policy are not uniformly distributed between different activities. According to him, a policy for basic research has a selective nature. Policy makers must allocate public funds between various research fields. Someone has to decide which fields of research that shall be given priority. He suggests that regional policies seem to be also selective in a similar point of view in that someone decides which regions to favour, why and how. Furthermore, such decisions for selective resource allocation are made every year, but what's going on inside the black box of this political decision making is seldom, if ever, discussed explicitly and publicly. This selectivity of government policy might deepen the distortion of market mechanisms. Financial support or subsidising for high-tech start-up companies can reflect relative disadvantages for existing manufacturing companies. Supporting innovative and

advanced regions may amplify the gap of innovation with lagging regions, as the term 'regional innovation paradox' implies well (Oughton *et al.*, 2002).

According to the system failure perspective, path dependency is one of the main sources of failure. As discussed above, in the systems approach, policy measures to correct the 'system failures' mainly focus on increasing interaction and stimulating innovative demand by stimulating cooperation, information brokerage, or public consultancy. This point of view provides additional reasons why government should intervene in the process of innovation. However, there are some criticisms of this idea that most sources of system failure can be explained by market forces view points. Dealing deeply with these debates is not relevant for this research, but they provide very interesting insight in terms of different mechanisms between market and policy being operated in the systems of innovation. Various empirical studies show that market-driven innovation and policy-driven innovation are quite different in terms of performances and mechanisms. As Hers *et al.* (2004) argue, if the problems are caused by market power of firms, these measures are not likely to be very effective. For example, if governments stimulate cooperation between firms under these circumstances, then market failure can be enlarged. In addition, the scope for governments to solve information problems (e.g. a lack of capability in acquiring or processing information) is limited as government agencies suffer from information problems themselves. Moreover, government intervention in the form of public consultancy might replace more efficient private initiatives. Thus some sources of system failures can be seen just as a different side of market failure analysis, although path dependency and lock-in raise more fundamental issues.

In conclusion, system failure rationale for government intervention provides different implications for policy makers in that policy needs to be much more complex issue than in the market failure rationale (Smits *et al.*, 2004; Hers *et al.*, 2004). In other words, the systems approach has contributed not only to provide a useful concept to visualise the complexity of the innovation process, but also particularly to identify the concept of path dependency and lock-in as a potential source of failure and a reason of government

intervention. Hence, the matter of path dependency in the process of innovation and other issues relating to this matter need to be deeply discussed below.

3.4.3 Mode of intervention

Generally speaking, policy does not exist in a political or social vacuum. It means policy reflects the changes in time and space. While the justification of government intervention is associated with the issue 'why' governments should intervene in the process of innovation, the mode of policy intervention is linked to the issue 'how' governments should intervene. As noted before, these two issues are closely intertwined with each other. This matter can also be seen a quite normative issue. Although the justification of government intervention can be accepted in spite of the possibility of government failures, the matter of intervention mode can still remain as a crucial issue in association with the role of governments. Governments can have various roles to play, for example, in supporting or facilitating entrepreneurship. There are, however, strong pressures on these public initiatives that any government intervention in the market has to pass the test of the three 'D's': Dead-weight, Distortion and Displacement (Arzeni, 1997/1998). Firstly, the matter of 'dead-weight costs' may be produced if taxpayers have to finance a potential entrepreneur who would have started a new business in any case. Secondly, fostering new start-ups may also distort the market mechanism if doing so gives certain firms an unfair competitive advantage. Thirdly, new firms may displace old jobs instead of creating new ones. These concerns point out that it is important for governments to think over how to step in support.

With respect to the mode of intervention, two aspects exist to be argued. One is related to the consideration of firm specific factors, and the other is associated with the reflection of spatial differences. As mentioned already, the linear model of innovation policy was dominant until the 1990s in western countries. It focused mainly on R&D infrastructure provision, financial support for start-ups, and technology transfer. This type of policy emphasised the inputs and support instruments in the innovation process. However, it often neglects firm's capacity or demand for innovation such as absorptive

capability, behavioural characteristics, organisational deficits (Lagendijk, 2000). Moreover, it did not pay much attention to regional specific factors like regional differences in less favoured or well-performing regions. Many studies have focused on key concepts from new growth theory (Romer, 1986; Krugman, 1991; Lucas, 1998) such as high-tech cluster (Porter, 1990) or innovative milieu (Aydalot and Keeble, 1988; Ratti *et al*, 1997, Keeble and Wilkinson, 1999). These began to deal with the questions of why such industries agglomerate in particular locations, and what kinds of networks exist. Basically these approaches tried to analyse the cases of well-performing and more advanced regions. However, the problem of these efforts is that successful stories in advanced regions are not easy to apply to less favoured regions (Cooke *et al*, 2000; Isaksen, 2001; Nauwelaers and Wintjes, 2003). In other words, 'best practice' can not be easily transplanted from one innovation system to another (Lundvall and Borrás, 2005). It does not indicate that policy lessons can not be drawn from the cases of leading dynamic regions. Instead, it means that innovation policy needs to take a specific regional context sufficiently into account. As argued in previous section, RIS approach provides a useful framework for more differentiated innovation policies. It pays more attention to firms, institutions, systems, and specific policy options or strategies. In accordance with this RIS approach, it can be said that policy intervention needs to be more interactive and more differentiated.

The discussion above shows that there is no single best practice innovation policy applicable everywhere. There can of course be some policy lessons derived from past policy experiences or new theoretical approaches. However, at least one thing seems to be certain that the policy approach to find an ideal model or 'one size fit all' policy instruments is likely to be impossible and even not desirable in some cases. As Lundvall and Borrás (*ibid*, p. 617) argue, it points out "*why innovation policies that focus on subsidizing and protecting suppliers of knowledge at best are incomplete – at worst they increase the gap between technological opportunities and absorptive capacity*".

This chapter explored a few critical debates regarding the nature of innovation process. According to the RIS perspective, innovation is an interactive process shaped by a

variety of institutional functions between actors and the wider institutional milieu (Morgan, 1997). The interactive process can be regarded as a localized process of interactive learning, emphasising the importance of cooperation and mutual trust in promoting competitiveness, further promoted by proximity (Asheim and Isaksen, 2000). Many geographical studies suggest locally embedded social, cultural and institutional arrangements as a source of knowledge creation and learning (Amin and Thrift, 1995; Storper, 1996). In this regard, regional advantages are considered as an important policy issue, and RIS can be a policy tool for the construction of supportive innovation systems at a regional scale (Park, 2001). When considering RIS as a policy tool, there is a need to recognise the interdependent connection between RIS policy and the changes of regional context. In other words, policy intervention can influence the formation of regional development trajectory, and simultaneously, the impact of same policy can be differently presented in different regions due to their varied regional contexts.

Innovation can be seen, as argued above, both path breaking and path dependent process according to the view point of seeing innovation in terms of time scale. Many accumulated path breaking innovations in short term perspective can formulate path dependent innovation processes in longer term basis of understanding. In addition, systemic approach of innovation provides very useful understandings about path dependency approach and regional innovation system. Furthermore, system failure perspective on the basis of systemic approach suggests additional rationale for the justification of policy intervention in the process of innovation besides market failure. Systemic approach does also provide very meaningful insights into how the mode of intervention can influence innovation process and how even the same intervention can bring about different outcomes in different situation. This chapter provides the basic understanding for the discussion in following chapter about path dependency perspective and regional innovation. Path dependency is basically seen as one of the sources of system failure, but it can be understood in broader sense as a useful tool for understanding the changes in entrepreneurial and regional innovation.

4 THE PATH DEPENDENCY APPROACH

4.1 Introduction

In the above chapters, various issues and arguments regarding high-tech start-ups, innovation processes, and the rationale for policy intervention were critically reviewed. On the basis of these wide ranging reviews of literature, this chapter discusses how the concept of path dependency has been examined in different domains and disciplines and how it can be connected to regional development. In addition, this chapter tries to develop a conceptual framework of 'government dependency'. As noted before, path dependency has been understood as one source of system failure which takes place due to the imperfection of the innovation system itself. The notion of path dependency was first employed to explain technological changes, but it has been expanded to the field of explaining institutional changes or regional changes. Basically, path dependency as a rhetoric indicates a sort of inertia or resistance to change. In more academic usages, it has been used to criticize some of the assumptions in neo-classical economics. More specifically, unlike the neo-classical economic view, suboptimal technologies can survive in markets as a result of random or chance events in the past, and this inefficient equilibrium can persist in the future. David (1985; 1994) and Arthur (1989; 1994)'s rigorous modelling of path dependency have greatly affected later studies in explaining path dependent institutional changes.

More recently, path dependency has also been adopted to understand why regions find it hard to break regional inertia or deviate from existing trajectories. The concept of institutional path dependency provides meaningful insights to understand this problematic issue. It is also connected to an interesting question: why do regional changes retard or take place in an incremental manner although a wide range of public policies for innovation have been concentrated on a specific region? Most of the recent literature on this issue focus on 'lock-in' problems in lagging or less-favoured regions (Visser and Boschma, 2004; Kaufmann and Wagner, 2005). In addition, it is also

interesting that policy intervention can contribute to the formation of regional legacy via the operating mechanism of actor's behavioural change. Many recent policies (in particular, innovation policy) aim to change behaviours in principle. The change of actor's innovative behaviour shapes a collective behavioural pattern in the innovation system. It consequently is combined with regional characteristics and builds a certain type of regional legacy through cumulative interactions between actors (Aoyama, 2003). Thus, path dependency and regional lock-in can take place in regions even in which policy measures have been concentrated.

Conceptualising 'policy induced government dependency' has three meanings in this study. Firstly, it is necessary to have a container to represent the problematic phenomenon as raised in introduction. Secondly, a tool is necessary to look inside a black box located between input and output of an innovation system. Thirdly, it is necessary to develop an analytical frame for empirical research in the field. First of all, the notion of path dependency needs to be unpacked in terms of space and policy. In addition, a modification of the classical path dependency approach is undertaken to produce a non-linear and more flexible frame for recognising and understanding a new path creation by policy intervention. This modification produces a 'circulating' type of dependency which can be helpful to understand the phenomenon of government dependency. On the basis of this modification, two gearing concepts of policy 'reliance' and behavioural 'persistence' are developed to delineate the mechanism of government dependency. Policy reliance refers to start-up firm's perceived reliance on policy support, and it is addressed by probing the change of risk perception in the process of business start-up. Persistence refers to start-up firms' behavioural persistence in seeking benefit from policy support, and it is approached by probing their self-reinforcing expectation of continuous benefit-seeking in business.

4.2 Theoretical expansion of path dependency approach

4.2.1 Path dependency in technological change

Neo-classical economics is based on an assumed rational choice made by individuals, such as cost minimizing or utility maximizing behaviour. It assumes that institutional change driven by rational choice of individuals would lead to an ideal institution, if free negotiation over contracts is ensured. It means that, as North (1990) asserts, institutional changes can be driven by the individual entrepreneur's response to incentives embodied in the institutional framework. However, there are many limitations or obstacles to hinder institutional changes towards efficient market equilibrium in the real world. Moreover, the individual economic actors can not be expected to always behave rationally due to their 'bounded rationality' (Simon, 1986). The path dependency argument from evolutionary economics starts from the critique of these unrealistic premises or assumptions. In this approach, institutional changes tend to occur incrementally and the market may lead to inefficient equilibrium due to the path dependency.

Evolutionary theorists focus on the importance of uncertain and unexpected outcomes in an economy, and emphasise how the future of an economic system is affected by the path it has traced in the past. They also put a lot of effort to explain why change is unlikely to take place, and why change is often incremental and gradual of nature. They make use of evolutionary concepts such as bounded rationality, routines, trajectories, lock-in, rigid institutions, path dependency to answer these questions. According to them, current decisions and events are not determined by past ones, but they are conditioned by them (Boschma, 2004). The fact, that some developmental paths produce ineffective solutions and suboptimal outcomes, is a precondition for evolutionary selection: 'no variety, no evolution'. Accordingly, the evolutionary process can entail development through failure, and imperfections are the primary proofs of evolution (Grabher, 2004).

Path dependency is a concept that has appears to have become very widely-used across a wide range of disciplines, but it is also being used to mean a various range of possible phenomena (Scherrer, 2004). It was first elaborated in the field of economic history for

understanding technological change and the possibility of a lock-in to durably inefficient solutions because of increasing returns and the influence of historical matters. Technological path dependency is based on relatively precise economic mechanisms, but there are a few controversial issues in applying this concept to institutional change (Vincensini, 2001). To understand the underlying mechanisms of how technological path dependency can be transposed to institutional path dependency is a useful step towards developing an analytical perspective for explaining the relationship between innovation policy and regional path dependency.

The argument that technological change is path dependent has been developed by Arthur and David in 1980s. According to David (1985), path dependency refers to a property of contingent, allocative, non-reversible dynamical processes, including a wide array of biological and social processes that can properly be described as ‘evolutionary’.

“It may be defined either with regard to the relationship between the process dynamics and the outcome(s) to which it converges, or the limiting probability distribution of the stochastic process under consideration” (David, 2000, p. 4).

David tries to explain why ‘QWERTY’ keyboard became ‘locked in’ as the dominant keyboard arrangement even though it was not convenient compared to DSK (Dvorak Simplified Keyboard). Through this case, he specified three conditions which make the process of technological change path dependent: the technical interrelatedness of system components, quasi-irreversibility of investments (matter of switching costs), and system scale economies due to positive externalities (David, 1985).

Arthur (1989) emphasised the importance of increasing returns as a necessary condition for technological lock in. He particularly focused on the dynamics of allocation in a context where ‘increasing returns’ arise naturally. In an industry characterised by increasing returns, small random events can drive the adoption process into developing a technology that has inferior long run potential (Arthur, 1989). Under increasing returns, even trivial circumstances can be magnified by positive feedback to tip the system into the actual outcome ‘selected’ (*ibid*, p. 127). It shows how increasing returns can

dynamically cause the economy to lock in to an outcome not necessarily efficient to alternatives, and entirely unpredictable in advance (*ibid*, p. 128).

According to Arthur, increasing returns may arise either on the supply side of a market as a result of 'learning effects' or on the demand side as a result of positive 'network externalities'. He argues that network externalities are important not only because of their impact on each direction of technological development, but also because they represent a source of market failure and call for public intervention (Arthur, 1994). In further detail, he argues that technologies display increasing returns because of two mechanisms. The first is 'learning by using' which means the more they are adopted, the more experience is gained with them, and the more they are improved, and so the more they are adopted again. The second is network externalities: the first adopters of a technology choose according to their own needs and preferences and impose externalities on the following adopters by not exploring promising but expensive technologies, which could have brought higher returns to all later on (Arthur, 1989). Consequently, the combination of small random events and increasing returns may lead to the domination and lock-in of inferior or inefficient technologies (Vincensini, 2004).

Originally, as noted above, the concept of path dependency developed as a criticism of the neo-classical point of view about technological change, and it appears that the main contention regarding this concept is the possibility of sub-optimal outcomes. Neo-classical economists such as Leibowitz and Margolis (1995) acknowledge that technological change may be influenced by initial conditions and therefore difficult to predict, may be costly to change and that there may be multiple equilibria. However, they separate path dependency from inefficiency by challenging the link between the influence of initial conditions on the outcome and the possibility of a lock-in and the degree of efficiency (Vincensini, 2004). They distinguish between static and dynamic comparisons of a different solution, and "*tailor their definition of efficiency so as to accommodate the fact that economic change may not reach the most efficient (static) solution but only the most efficient solution considering switching costs*" (Vincensini, 2004, p. 3). Although they accept path dependency, they do not accept all its claims.

Liebowitz and Margolis (1995) illustrates three different types of path dependency, each having a different implication regarding market errors and lock-in: First-degree path dependency occurs if initial actions lead to a path that cannot be left without some costs and this path is efficient and agents are rational. Second-degree path dependency implies that decisions are based on imperfect information. In this situation, dependency on initial conditions leads to outcomes that are regrettable and costly to change, but they are not inefficient in any meaningful sense, given the assumed limitations on knowledge. These two types of path dependency are commonplace in mainstream economics but provide no support for the claims that remediable errors occur. Third-degree path dependency, which is the relevant one in the innovation literature, critically challenges the neo-classical paradigm of relentless rational behaviour leading to efficient and predictable outcomes. The argument of Liebowitz and Margolis has implications for path dependency in that they interpret path dependency as a market failure. They suggest that path dependency can be partially overcome by several mechanisms (communication between actors, planning and institutional solutions), which increase the efficiency of the final result. However, they show this form of failure requires important restrictions on prices, institutions and foresight.

4.2.2 Institutional Path Dependency

As discussed above, the concept of path dependency emphasises that routines or paths in the past may be embodied within physical objects in the form of technology or products. The arguments of Arthur and David show effectively that rational decisions of a benefit maximizing individual can result in sub-optimal outcomes. However, according to Gertler (2004, p. 25), an important part of past events is also embodied in institutions that shape the attitudes, norms, expectations, and practices of individuals and firms through formal or informal means of regulation. Path dependency also has a strong social dimension. The new institutional economists suggest that 'institutions' humanly devise constraints that shape human interactions: they imply routinized behaviour and actions. They reduce uncertainties, coordinate the use of knowledge, mediate conflicts

and provide incentive systems by establishing a stable (not necessarily efficient) structure for human exchange. At the same time, institutions affect the performance of the economy by their effect on the costs of exchange and production (North, 1990, p. 3-6; Lundvall, 1992, p. 26).

From this perspective, institutions have high start-up or fixed costs. There are also considerable learning costs and coordination costs that arise in the course of the mutual adaptation of formal and informal rules (Leipold quoted in Scherrer, 2004, p. 5). North argues that transaction costs in political and economic markets can result in inefficient property rights, and the interaction between institutions and organisations can produce a lock-in that accounts for the persistence of inefficiency (North, 1990).

On the basis of above understanding of institutions, it shows that the concept of path dependency can be applied to address institutional change. However, some critical issues are raised regarding whether its relevance can be simply assumed or not. Vincensini (2001) points out three main difficulties to the transposition of the idea of path dependency from technologies to institutions. Firstly, the technological and cognitive mechanisms of path dependency should be properly specified to become entirely relevant for institutions. Secondly, one of the main points of technological path dependency is the possibility that it might lead to an inefficient solution, but measuring the comparative efficiency of different institutions is far from straightforward and a very delicate task. Thirdly, the underlying vision of technological change is the idea of 'institutional diversity' rather than that of 'institutional standardisation' in that "*it is possible to conceive of a situation where several institutions continue to coexist*" in the realm of institutional change (*ibid*, p. 4).

4.2.3 Path dependency in organisational theory

Path dependency has become a popular concept in most organisational research. It appears, however, as a metaphorical notion in many cases, indicating generally well-

known phenomena like institutional inertia or resistance to change. There have been, of course, several attempts for more rigorous approaches in explaining technological development or institutional changes. In these fields, as mentioned above, some analytical concepts like 'increasing returns' or 'positive feedback' were developed to address the phenomena that once entered a path that cannot be easily quit or replaced. These concepts can be also useful in explaining organisational changes. Organisational change and structural inertia have an important agenda from organisational research for decades. More recently, as there has been growing interest in paths and the path dependency of organisational changes, organisational theory has developed beyond this general interest towards recognizing structural inertia in terms of the path dependency perspective.

Firms in general and start-ups in particular, are not only very important economic agents in the market, but also key actors in innovation systems. In order to explain firm behaviour and the economic growth process, it is necessary to combine the technological and institutional path dependency with the organisational path dependency frame. This is because start-up firms are basically seeking continuous technological innovation, and in doing their business they are interacting with institutional settings. Thus, the sources of path dependency identified in the field of technological and institutional changes can provide useful insights in organisational studies such as scale of economy or increasing returns, learning effects, network externalities, coordination effects. However, further sophisticated approaches are needed to explain organisational path dependency.

Organisational studies are usually divided into two approaches on the micro level and the macro level. Micro level approaches such as 'behavioural theories' (Cyert and March, 1963; Lindblom, 1965) or 'cognitive organisation theories' (Gioia and Sims, 1986, Barr, 1998) mainly focus on the existing organisational routines, cognitive schemes, or decision-making processes in organisations which cause organisational inertia. These approaches emphasise the importance of the initial conditions which influence later behaviour, and also the continuous self-reinforcing mechanisms which lead to the

accumulation of a certain behavioural pattern. Initial events or specific conditions can gain momentum through self-reinforcing processes, and eventually generate persistence.

On the other hand, macro-level approaches can be divided into broadly two streams: one is institutionalism, and the other is the evolutionary perspective. The former generally focuses on the process of 'institutionalisation' which represents the sedimentation of structure over a certain period of time (Hargadon and Douglas, 2001; Lawrence *et al.*, 2001). These approaches try to explain 'institutional inertia' by adaptation in terms of legitimacy-seeking behaviour. The other stream of macro-level approach is the so-called 'population ecology theory' (Carroll and Harrison, 1994; Levinthal, 1997) based on an evolutionary perspective. This approach focuses on 'structural inertia' (Hannan *et al.*, 2004) which points out the stability of organisational arrangements opposed to environmental change. Structural inertia arises from the necessity of routinizing organisational activities in order to survive in competitive environments. As a result, organisational routines are reproduced and certain behavioural patterns are shaped over time. In this reproduction process, positive feedback and self-reinforcing mechanisms play important roles in causing inertia or persistence in organisational change. Structural inertia is seen as source for effective survival strategies by securing the reliability or the accountability of an organisation, but paradoxically it can also often be a serious threat to the survival of the organisation. This is because structural inertia may bring about failure to adapt in rapidly changing environments. There is another stream of evolutionary based research. This approach focuses on the organisational learning process. Theoretical development of path dependency in evolutionary economics (e.g., Dosi, 1982; Nelson and Winter 1982) provided much insight to this 'co-evolutionary theory' (Rodrigues and Child, 2003; Volberda and Lewin, 2003). The learning ability of an organisation is affected by its previously accumulated experiences or knowledge. Thus the organisational learning process is likely to be a path dependent one. This is associated with regional innovation theories which emphasise 'learning' as the source of innovation. According to the evolutionary perspective, regional innovation is seen as path dependent process due to the path dependent characteristics of organisational learning process.

Organisational studies, as reviewed above, have developed the concept of path dependency on the basis of theoretical arguments developed in economics. According to traditional economics, all individuals are regarded as a rational actor who behaves following the principle of maximizing individual utility. From this neoclassical perspective, the market reaches an optimal equilibrium through rational behaviour of all actors. However, these naive and unrealistic assumptions have been criticized by later economics on the basis of 'bounded rationality' (Simon, 1986; Williamson, 1996) and 'path dependency' (David, 1985; Arthur, 1989). Economic actor's behavioural choices can not be rational due to individual's cognitive limitation, emotional dimension and political processes in and between organizations. Moreover, individual actor's rational decisions may have irrational and unintended consequences at a collective level, and eventually entire markets can be locked into a sub-optimal equilibrium. These criticisms, as already discussed, have provoked controversial debates. Path dependency in organisation studies is, however, quite differently embedded from the sets of premises in economics. Although the classical model of path dependency provides very useful insights in organisational studies, its assumption of rational choice and its deterministic perspective have raised many objections in this field. More recently, theoretical approaches to organisational path dependency have developed into less deterministic and more realistic directions. The possibilities of 'unlocking' path dependency are being accepted, even if a 'lock-in' situation has already occurred. According to this perspective, both path dependency and path breaking are possible in the reproduction of an organisational path. This point of view forms the main basis to build the conceptual framework for this study.

4.2.4 Path dependency in regional context

The sources and mechanisms of technological path dependency and the lock-in process are relatively well understood, but the transposition of them into institutional changes is still a controversial issue even though various academic attempts have been done in the mean time. It is obvious that to apply these efforts to a regional innovation study must be

much more difficult and highly contested. The region is a very abstract and broad concept. In particular, there are many debates regarding how to understand regions in regional innovation systems (RISs). Most studies of RISs commonly emphasise the importance of the role of institutions. Thus it can be very useful to approach regional path dependency on the basis of institutional path dependency.

Paul Pierson tries to address what keeps things moving along the same path through specifying mechanisms of institutional reproduction. He argues that a specific path is promoted via various positive feedback mechanisms to moving along this path, and suggests a few mechanisms which could be operative in the reproduction of a given path: 'large set-up cost', 'learning effects', 'coordination effects' and 'adaptive expectations' (Pierson, 2000, p. 76-78). For Deeg, path dependency involves three phases;

“the first is the critical juncture in which events trigger a move toward a particular path out of at least two possibilities; the second is the period in which positive feedback mechanisms reinforce the movement along one path; finally, the path comes to an end when new events dislodge the long-lasting equilibrium” (Deeg, 2004, p. 5).

Following these arguments, the distinction between 'change within the existing path' and 'change to a new path' seems to provide quite important insight to understanding regional innovation and path dependency (Deeg, 2004, p. 7). In the process of shaping a regional trajectory, the perspective of institutional change and path dependency can be very useful. David and Arthur's notions of 'path dependency' are quite relevant to understanding the historical paths taken by specific regions. The foundation of their framework implies that history matters in the sense that once historical paths are chosen (even by coincidence), then they dominate future development.

It can be expected that every region will have its own regional trajectory, and will be affected by path dependency, as institutions play an important role in the concept regional innovation. As Fuchs *et al* (2004, p. 225) argue, regional trajectories “*consist of economic structures that have developed in relation to technologies and embedding institutions*”, so “*existing regional structures, institutional thickness, existing relations*

of cooperation as well as approved policy strategies are path dependent – which implies, that they can be hard to change”.

According to Deeg (2004, p. 8), regional changes depend on the logic of institutions in the system. He argues that *“exogenous shock is not the only way a path gets disrupted”*, but endogenous sources of change such as actions undertaken by actors (or by events, processes) within the institutional logic, can also move actors off a current path. Actors *“seek new institutional changes that will either restore the old path (possibly through non self-reinforcing mechanisms of institutional reproduction, e.g., power) or move to a new one (off-path)”* and these kinds of endogenous sources of change are very important in explaining the extent of change (*ibid*, p. 9). He also raises an interesting claim that increasing returns (as a mechanism of institutional changes) to *“social and political institutions must often be cultivated by actors, i.e., they do not happen automatically”*. *“Actors deploy power or ideology (or both) to promote their favoured outcomes”*, but *“we should also recognise that the pursuit of specific institutional changes by particular actors may not always result in their intended outcomes, but the unintended effects may nonetheless reinforce the move toward a new path”* (*ibid*, p. 10).

Since 1980s, a new paradigm has emerged in the arena of regional development policy which some refer to as the ‘network or associational paradigm’ (Amin *et al*, 1995; Cooke, 1997; Morgan, 1997; Storper, 1997). Regions in this new approach appear as very crucial units for knowledge generation and interactive learning. As a consequence, regions are increasingly regarded as important sources of innovation and economic growth. From the influence of this change, most of studies for the last two decades have focused on region-specific assets such as local tacit knowledge, the quality or thickness of regional institutions, formal and informal networks, norms or conventions of interactions, etc. Consequently regional innovation policy has also focused on the generation and diffusion of knowledge, building of learning capacity, facilitating co-operations both at an individual and at a collective level.

The systems approach of innovation stresses the importance of knowledge diffusion and interactive learning within the region as a system (Morgan, 1997). In a regional context, innovation can be seen as a process embedded in a regional innovation system. As mentioned in previous chapter, a regional innovation system consists of various actors and their close, regular, strong networks that promote the innovativeness of the region. As Gertler (2004, p. 23) argues, it is widely understood that regions are highly uneven in their ability to support learning. It means innovation is also geographically uneven both within and between nations. *“As this geography of innovative activity continues to evolve, there are strong tendencies for winners to keep winning and losers to keep losing in local economic opportunity”*. The prospects for overcoming this process depend on the capability of regions to change the direction of existing ‘paths’ over time. According to evolutionary economics, economic systems, as a consequence, have a tendency to change slowly, in path-dependent ways, whether at the national or regional level. Moreover, the direction of this change is strongly shaped by past experiences, decisions, and events of history (*ibid*).

According to various empirical studies, particularly successful regions in terms of regional innovation systems have some similarity that the institutional context and regional networks are closely complementary to the dominant industrial clusters of the region. Regional economic development can be understood as an evolutionary process of collective learning, which is following path dependent courses. This process might lead to *“lock-in situations that prevent regional institutions from adapting to changes in the environment and from learning new knowledge”* (Fuchs *et al*, 2004, p. 225). Fuchs *et al* differentiate three types of regional changes: breakthrough, incremental change and lock-in. While ‘breakthrough’ means revolutionary changes, ‘incremental changes’ mean evolutionary changes that do not set up new paths but try to lead previous paths into a new direction. Contrastingly, ‘lock-ins’ are characterised by institutional and technological structures which are inefficient but hard to be changed. However, it is very difficult not only to indicate the exact demarcation between these three types of changes, but also to interpret certain changes in some region as an example of breakthrough or incremental change or lock-in.

In economics, the concept of path dependency has been particularly used in empirical studies on the syndrome of 'lock-in'. Grabher (1993) classified 'lock-ins' into three types: functional lock-in, cognitive lock-in, and political lock-in. 'Functional lock-in' means that close cooperation within strongly-tied networks impede contacts with other regions. 'Cognitive lock-in' means that personal relations lead to shared common ideas, feelings and beliefs that prevent the adoption of new ideas. 'Political lock-in' means that new ways of thinking or policymaking are very hard to be expected where historical trajectories of economic development is maintained by cooperative relations between regional actors.

Grabher (2004) argues that once an economic system is locked into a particular trajectory, the costs of shifting strategy from it can be heavier than the benefits of alternatives. This implies that it is very hard to escape regional path dependency and lock-in once a certain trajectory set up in a specific region. Regional trajectories can be led into an evolutionary dead end through the positive feedback dynamics of lock-in processes. He suggests that the 'lock-in syndrome' can be amplified by regional political intervention which kept the region effectively on its path, even when this path became a 'dead-end'.

In summary, path dependency approaches, as reviewed above, have been continuously developed and expanded to explain why path breaking and radical changes are not easy to be witnessed in various fields. In spite of a few of its weaknesses, it has quite strong explanatory power in understanding path dependent institutional and regional changes. This study focuses on the regional dimension of innovation system which is interlinked policy system. Policy can be seen as one of the most powerful exogenous factors to tackle path dependency. As argued already, the role of institution is critical in shaping regional trajectory and it largely influences on the pattern or aspect of actor's interaction and learning. Policy intervention can bring about institutional changes, but there have been rare attempts to look at the changes under the consideration of the influence from public intervention. Basically this thesis accepts the possibility of path breaking or un-

locking by policy intervention. However, it also recognises the possibility of recurrence from this deviation to path dependency due to the inertia in changes of actor's behaviour and institutions. The theoretical discussions and literature review above provide the basis for developing the conceptual framework of policy induced 'government dependency' in following chapter.

4.3 Construction of a conceptual Framework: Policy-induced 'Government Dependency'

4.3.1 Re-thinking path dependency in 'space' and 'policy'

Conceptualising 'government dependency' needs to be considered in association with notions of the 'region' and 'policy'. In this regard, it is necessary to integrate various insights of path dependency which have been developed to address technological changes with understanding of organisational, institutional or regional changes. The role of institutions, in particular, is central in the reproduction of a certain mode of policy intervention and also in the formation of regional development paths.

As Cooke (2004, p. 46) argues, "*regions with strong markets that could supply support services had a competitive advantage*", and "*regions with leading amateur firms were similarly privileged*". On the other hand, "*regions with innovative public innovation support systems were advantaged over those without any of these supports*" but not over the other market oriented systems. Political and economic institutions evolve differently among different regions and countries. These differences relate to the institutional traditions of the respective region or country. In this vein, the outcome of policy intervention to correct path dependency can be also differently presented in regional and national context. At this point, the concept of path dependency takes a crucial role in generating regional innovative variations. Choices or decisions in the past may be embodied within material objects in the form of technology, firm assets and labour skills

(Walker, 2000). However, an equally important part of this past is also “*embodied in institutions - social structures that shape the attitudes, norms, rules, expectations, and practices of individuals and firms through formal or informal means of regulation*” (Gertler, 2004, p. 25). This institutional path dependency can also be a useful concept to analyse path dependency in regional innovation systems. One of the crucial questions in analysing policy-induced ‘government dependency’ is what role does the policy intervention play in regional innovation?

Every region has its own regional trajectory which has been shaped by complex institutional contexts. This regional trajectory is likely to be path dependent due to institutional path dependency. Thus, policy intervention can be seen to be aiming at the creation of new development paths. According to the system failure perspective, policy intervention should orient itself to the interdependencies among relevant actors in the system. As Staber (2004, p. 120-121), “*the idea is to encourage the formation and development of networks of actors in the institutional setting who are loosely embedded in a dense, yet open and dynamic web of economic and social relations*”. Many policy practitioners have tried to clone the successful story of ‘Silicon Valley’ over the last decades, but the outcome of these attempts turned out to be not so successful. Some studies point to region or country specific institutional contexts caused such a wide range of policy outcomes (Rosenberg, 2002; Gertler, 2003; Sturgeon, 2003). These view points are quite relevant indication in terms of institutional path dependency and regional lock-in. Besides these regional specific institutions, policy mechanisms that operate in the process of innovation need to be explored as well. Policy intentions, especially for facilitating regional innovation, are usually concentrated on the change of regional paths to new, innovative ones. Unlike traditional R&D policies, it is very important to encourage interaction for learning and knowledge distribution in innovation policies. Collaboration such as partnerships between university and industry or strategic alliances between firms is propelled by a grant or subsidy regime.

The aim of regional innovation policy mainly focuses on transforming regions into ‘learning regions’ (Morgan, 1997). In other words, it aims to introduce changes in the

innovative behaviour of companies and regions, taken as a whole, through the processes of learning and of the creation and accumulation of knowledge. As Nauwelaers *et al* (2002) note, most policy measures to promote innovation aims to change actor's behaviour in principle. Policy can affect the innovative activities of actors (particularly firms) directly via providing financial incentives such as grants or subsidies. The effect of this policy intervention works on individual actor's choices or decisions based on the cost/benefit or risk/reward calculations. Not surprisingly, intervention influences actor's motivations, expectations, attitudes or behaviour and consequently can affect actor's innovative activities such as firm creation, funding, investment.

At the same time, policy intervention can influence the shape of regional trajectories through institutional changes. Institutional change induced by policy intervention combines with inherited cultural and institutional structures, and consequently constrains future innovation. But policy mechanisms are not as straightforward as one might hope. Possible government failures or unintended policy impacts may reduce the effectiveness of policy interventions. Government supportive policies, particularly direct financial supports such as grant or subsidy can generate a strong dependent tendency on them. This tendency may also be connected to the matter of moral hazard, grant/subsidy-seeking behaviour or loss of entrepreneurship. Then it may produce a sort of crowding-out effect to policy effectiveness. The mechanism of this phenomenon is quite similar to the mechanism of institutional path dependency. For rational actors, especially profit maximising entrepreneurs who have to do their business under very harsh and uncertain market environment, they want to avoid uncertainties or risks as far as possible. Government financial support can reduce the risks for new start-ups in the process of business growth. Considering the situation of new firm formation, start-up entrepreneur can be faced with huge risks due to uncertainty and the lack of resources. Hence, firms are likely to depend on the financial support provided by governments particularly at the initial stage. Once this reliance is locked into the memory of firms, it might be quite hard to change or replace this path due to its benefits or convenience.

Based on insights of David (1994) and Arthur (1994), the concept of path dependency is broadened in this study by focusing on how human cognition and learning processes can be affected by policy intervention. Policy supports, particularly those providing financial incentives can make certain types of behavioural rules for firms. In other words, policy measures influence incentive structures and consequently affect individual actor's perception, motivation, attitude, or expectation through a reflective learning process. In the case of start-ups, the role of founders can be crucial for the survival of their firms and their business performances. Their vision, values, belief or specific business style can be directly reflected on the firm behaviour. As Heffernan (2003) argues, the pattern of response (a set of rules) can be referred to as routines or behavioural rules. Once the set of rules is developed, it is reinforced by a variety of mechanisms of learning and incentive structures. Thus, once firms get benefits from policy aids, it can be connected to a reliance on the external incentives through the firm's cost/benefit or risk/reward calculation, and it tends to persist at least for a certain period of time. It can be described as a conditioned response pattern formed by an interactive learning process. Environmental uncertainty and human's 'bounded rationality' can be crucial factors in transforming the recursive responses to external incentives into a sub-optimal level of policy consequences. Basically, if the actor's particular response seems to correct problems that arise in their business, it becomes a routine. Due to environmental uncertainty and the limits of human cognitive ability to anticipate every possible contingency, to perceive all potential choices inexpensively, to gauge the responses of others accurately, it may be rational to adopt a set of rules already settled in an organisational routine. According to Heffernan, individual actors will follow rules without thinking about them in this situation, rather than trying to determine the optimal response to each situation they encounter. The effects of this can be magnified and self-reinforcing, and consequently becomes a mechanism. It also "*acts as an incentive structure to reward rules-following behaviour*" (Heffernan, 2003, p. 47).

In this process, policy intervention can influence actor's responding mechanism as mentioned above. Thus we can expect if benefits from policy measures seem to be helpful to solve their problems, then firms may tend to seek this assistance continuously.

As a consequence, it creates a certain reliance based on set of rules that become a routinized pattern of behaviour. As Heffernan (*ibid*, p. 48) argues, “*rules-following behaviour persists not just because it is expensive to change behaviour, but because people may not know how to go about changing the system or even think about changing the system*”. These behavioural rules put some rigidity into system. Thus, following the rules may provide a clearly suboptimal response to the problems. This phenomenon is similar in some sense to the choice of imitation by firms rather than the introduction of new paths. Copying practices assumed to be successful or emulating the most commonly used practices may raise the possibility of potentially greater value. However, imitation may lead to unintended failures because of uncertainty. Imitation may reduce some of the costs of trial-and-error, or buffer some possible risks at the early stage, but may also lead to the adoption of ineffective practices, and a lack of variety which is crucial for evolutionary innovation (Staber, 2004). Thus, government policy for facilitating innovation through tackling the matter of system failure may paradoxically produce a different type of dependency, and consequently constrain innovation rather than enable further innovation. This perspective can contribute to an explanation of why the process of regional change is overwhelmingly incremental through continuous marginal adjustment rather than being achieved by breakthroughs to previous paths.

The response to the policy intervention depends on the individual actor’s perception and capability. As Heffernan (2003, p. 49) said, “*Bounded rationality does not imply people all suffer from the same type of myopia*”. These differences may provide a method of breaking out of inefficient path dependency. Individual differences in firm’s ‘entrepreneurial alertness’ (*ibid*, p. 45) can prevent the possibility of lock-in since it leads people to alter perceptions and change behaviour. Many empirical researches on path dependency that focus on technological and institutional changes, have tried to explain why inefficient or suboptimal choices can persist in the future. As mentioned already, recent studies try to apply this perspective to address regional innovation or to identify the factors that lead to regional lock-in. As Aoyama (2003) argues, regional institutions couple with path dependency and shape ‘regional legacy’ as a way of sustaining regional distinctiveness. Even under the same national economic system,

regional legacy forms different perceptions of risks and incentives among entrepreneurs in regions.

In summary, policy intervention can play a critical role both in breaking the dependency on an existing path and in generating a different path of dependency at individual actor's level and regional or systemic level. Indeed there can be a dynamic process of accumulation in policy regime before path dependency (or consequent lock-in phenomenon) or path breaking (or consequent new path creation) occurs. When there is a positive accumulation, policy intervention can become successfully entrenched. Accordingly, at what point this accumulation flips into path dependency or lock-in is one of key issues in determining the impact of policy intervention. As argued above, once actors experience some benefits from policy measures, it can be logically assumed they are faced with a critical juncture as to whether follow a dependent way or breakthrough this dependency. In other words, the actor's choice can be influenced by various factors such as individual (organisational) innovative capacity, regional legacy conditioned by institutional settings, and the type of policy intervention. Policy support can reduce risks or uncertainties in actor's entrepreneurial activities, but this initial effect (benefit) can also result in an unexpected 'dependency' on government policy. This phenomenon can be understood as the result of reflective learning, and not surprisingly, it can reduce the intended effect of policy intervention. Thus government dependency can be seen as a prevalent phenomenon rather than an exceptional one; however, its extent differs in each case.

4.3.2 Modification of classical path dependency approach

This study focuses on exploring the reproduction of start-up firm's 'government dependency' and its influence on regional innovation capacity. The notion of 'dependency' here means, on the one hand, start-up firm's 'reliance' on assistant policies which is found in the entrepreneur's mind and firm behaviour. On the other hand, it contains 'persistence' in the start-up firm's business history. Path dependency theory plays a central role not only in conceptualising the construct of 'government

dependency', but also deploying complex theoretical discussion for underpinning this attempt.

The start-up entrepreneurs, subject of this research, can be seen as risk-takers, in that they give up their jobs in stable employment markets and create their own 'risky' businesses. University faculties or researchers in PRIs are regarded as typical potential entrepreneurs for high-tech start-ups. PRI researchers, for example, transform themselves into self employment entrepreneurs from wage-earners in government funded research organisations. In Korea, the emergence of start-up businesses had already started after the early 1990s, but it expanded from 1997 when the Korean economy fell into the IMF crisis. In the case of Daedeok, it has similar history to the national trend. The number of start-ups that spun-off from PRIs began to increase from 1997 (Daedeok Valley Master Plan, 2001). Actually the 'venture boom' in Korea can be seen largely encouraged by the government policy initiatives for promoting start-up entrepreneurship since particularly 1997 (Baek and Ra, 2001; Shin, 2003). This can be supported by the statistics which show rapid increases in the number of new business start-ups when the legislative basis for special supports for 'certified ventures' by the government first prepared. The statistics show another notable phenomenon of sharp decreases in the number of these newly emerged firms since 2001 when the government reinforced the screening criteria for venture certification (Kim and Lee, 2003).

This new firm formation has two different dimensions in respect to a new economic development path. Firstly, from an individual perspective, the potential entrepreneurs were faced with a very critical 'career choice' (Kanniainen *et al*, 2005) when deciding to create their new and risky businesses, rather than to stay in the labour market as employees. Secondly, in regard to Korean policy regimes, the previous '*chaebol*-oriented' policy was partially replaced by a new 'venture-oriented' policy. After 1997, the government came to see venture firms as the main actors to substitute the *chaebols*, which were regarded as the source of the economic crisis. These dimensions of 'new path creation' (Garud and Karnøe, 2001) were intertwined with in that the individual

entrepreneurs' start-up decision as a new path creation was also largely influenced by the new path of policy intervention to stimulate potential entrepreneurship.

Path dependency has been used to explain why actors may fail to respond to changes in their environment. The classical path dependency theory is seen as a linear and irreversible perspective which is hard to turn back once a path has been adopted due to positive feedback or self-reinforcement mechanism. This approach shows "*the persistence of diffusion processes under relatively restrictive conditions, that is, unabated self-reinforcement without external intervention*" (Ebbinghaus, 2005, p. 25). As a consequence, the end of this path dependent process is likely to result in lock-in. It points to the saying 'history matters' and it appears as a deterministic process. In this perspective, the possibility of path breaking can exist but it is not very common. Only in exceptional cases such as war, crisis or exogenous shocks, does path breaking or new path creation can take place. However, this excessively rigid and deterministic approach often lacks a full explanatory power. Major changes do often occur in the real world. Even once settled paths can be changed. Path breaking or new path creation needs to be understood as normal phenomenon rather than exceptional one. Moreover, the deterministic approach does not offer explanations for institutional changes at the macro-level. As Ebbinghaus argues, "*it can explain neither the emergence nor the change of institutions*" (*ibid*, 2005, p. 25). In case of institutional changes, self-reinforcing processes are seen as social mechanisms, and may be increasingly eroded in the long-term process of institutionalization. Institutional change, of course, may emerge suddenly due to a certain contingent or chance events, but it is more likely to occur in long-term social mechanisms. Institutional inertia needs to be understood in terms of such social phenomenon.

The modified path dependency approach suggested in this study represents a more flexible and less deterministic perspective. Path breaking or new path creation can occur at anytime and everywhere, not only by individual efforts of 'mindful deviation' (Garud and Karnøe, 2001), but also by intentional policy interventions. In this regard, attempts for path breaking or new path formation may even be seen as ubiquitous phenomena.

However, this study suggests the problem is not so simple, instead it might be quite complex. A path can result in dependency and eventually lock-in, but at the same time, it can be replaced by a new path.

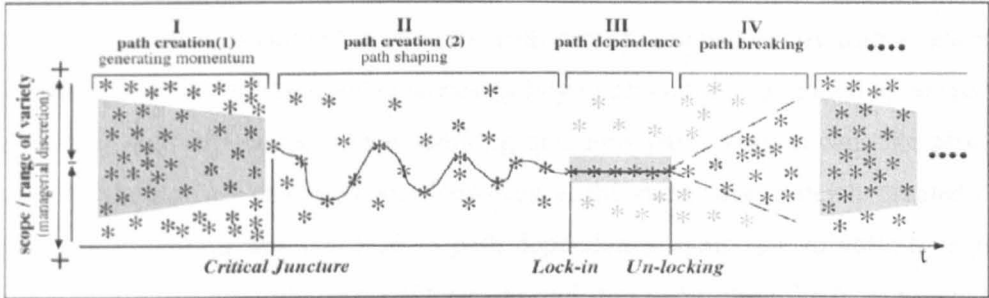


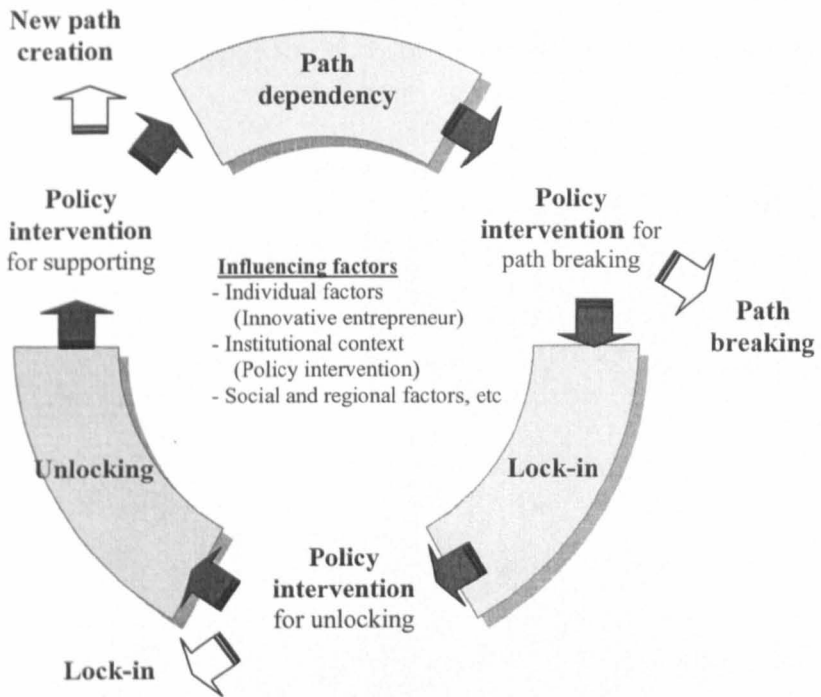
Figure 6. Breaking and creating organizational paths: Alternative route in face of path dependency (Source: Sydow et al, 2005, p. 32)

Sydow et al (2005) suggested a modified perspective of path dependency approach in their recent organisational study (See Figure 6). It shows that organisational paths can be newly created and locked into path dependency, but simultaneously those new paths can be broken again by un-locking path dependency. Reflexive actors with sufficient resource endowments may engage in breaking existing paths, even if a lock-in has already occurred (*ibid*, p. 19).

According to institutional economists, institutions can lower uncertainties which can be faced by entrepreneurs in the process of start-up. In this study, institutions are defined as ‘the rules of the game’ in a broader sense (North, 1991). Policy interventions definitely influence institutional changes. Supportive policy, in particular, can have effects on individual actor’s incentive structures, and consequently cause changes in his/her cognitive perception of business risks and the motivation to start-up. At the same time, actor’s responses to policy measures can influence changes in policy itself. It means that policy is changed or modified by the reflective reactions of actors, and this results in institutional changes. The relation between the individual actor’s mind and the institutional changes can be described as a feedback relationship in ‘policy learning’ process.

This more flexible and less deterministic path dependency approach appears to be useful to conceptualise the construct of 'government dependency'. Basically, it is assumed that path breaking can occur as a result of policy intervention, even when lock-in has taken place. As a result of path breaking, a new path can be created and at the same time, a previous path may be dissolved (a previous path can of course co-exist with a new path for a certain period of time). In other words, policy intervention is assumed as an enabler to unlocking path dependency. Path breaking or a new path creation can take place at any time in the process of innovation. However, at the same time, a newly created path by policy intervention can also lead to path dependency again due to various factors. Policy is influenced by political considerations and it may be often far from rationality, and policy makers themselves are regarded to have 'bounded rationality'. Even though policy makers conceive a structural and radical reform and intervene directly with regulatory measures, institutions are not likely to be changed as rapidly as they expected due to institutional inertia. On the other hand, firms do not always follow the 'rational choice' model in responding to policy intervention. Sometimes actors' choices which look quite irrational for other people can be perceived for themselves as very normal and rational decisions due to mainly bounded or limited rationality (Simon, 1986; Williamson, 1996) such as limited cognitive ability. Thus, the effect of policy may often lead to unexpected consequences. On the basis of these considerations, a circulating type of path dependency approach can be illustrated in Figure 7.

Figure 7. Circulating type of path dependency model (Source: Author)



As seen in the above diagram, policy intervention can be made at any point of this circulating format of process. It comes in various ways at any stage. Sometimes, as witnessed in the US case, governments can intervene in the market just on early stage to stimulate positive accumulation in the process of innovation, and then withdraw to leave the market to grow. In this perspective, policy intervention can play a critical role to promote the unlocking of path dependency. However, it may do not work properly and consequently results in lock-in. Then governments can be tempted to intervene again. At the same time, even though a new path is successfully created, it seems to be also not free from the possibility of path dependency. In other words, path dependency and lock-in can take place again within a newly chosen path. If then, from the circulating path dependency approach which this study proposes, policy makers may be required to intervene again by means of corrected policy schemes to sort out path dependency. As argued before in the section of institutional path dependency, policy changes are also likely to be occurred in path dependent ways. Therefore, corrected policy measures tend

to be staying in the level of incremental changes rather than drastic reform. Second intervention is of course different from previous intervention, but this process can be illustrated as a kind of repetitive circulation loop as follows:

‘path dependency (a) - policy intervention (b) - path breaking and a new path creation (c) - another path dependency (a’) - another intervention (b’) - another path breaking and a new path creation (c’).....’

Strictly saying, this process is not exactly ‘circulating’ in that path dependency (a) is not the same to path dependency (a’). Similarly, policy intervention (b) is also different from intervention (b’). However, in a broader sense, it can be seen a circulating pattern because the process of (a)-(b)-(c) forms a cycle which is repeated in another cycle of (a’)-(b’)-(c’).

4.3.3 Mechanism of ‘government dependency’

As stated already, this study seeks to develop the conceptual framework of ‘government dependency’ to explain why government intervention does not necessarily result in increase of regional innovation capacity. The construct of ‘government dependency’ can be approached at both micro (individual entrepreneur or firm) and macro (systemic or regional) levels and these need to be integrated. ‘Government dependency’ is, in a broader sense, defined as the unintended consequence of policy intervention which can be induced by a certain type of support policies. More specifically, it represents a sort of dependency culture on government financial assistance which is likely to be persistent in start-up firm’s entrepreneurial behaviour.

Generally speaking, the term ‘dependency’ represents two aspects: one is reliance, and the other is persistence. Reliance is often used to indicate more psychological dependency. For example, this reliance can be found in the cases of children’s dependency on their parents, welfare recipient’s dependency on welfare payments, or a drug addict’s dependency on drugs. The reason why people become dependent in these cases must be varied in each case, and many studies in these fields have suggested

different mechanisms for this reliance. In case of welfare related studies in particular, the concept of dependency has been examined in association with the concept of 'self-reliance' (Ringgen, 2006). In this field, dependency can be situated at the opposite to self-reliance or self-exploitation. In the extreme, it can degrade the effectiveness of welfare policies by preventing people from being self-reliant. On the other hand, persistence is usually used to indicate durability or continuance. There may be many reasons for persistence in different cases. It might come as the result of the above mentioned psychological reliance, or as the consequence of inertia. In this sense, it can be presented that psychological reliance is likely to be connected to behavioural persistence as if nicotine dependency can cause the persistence in smoking.

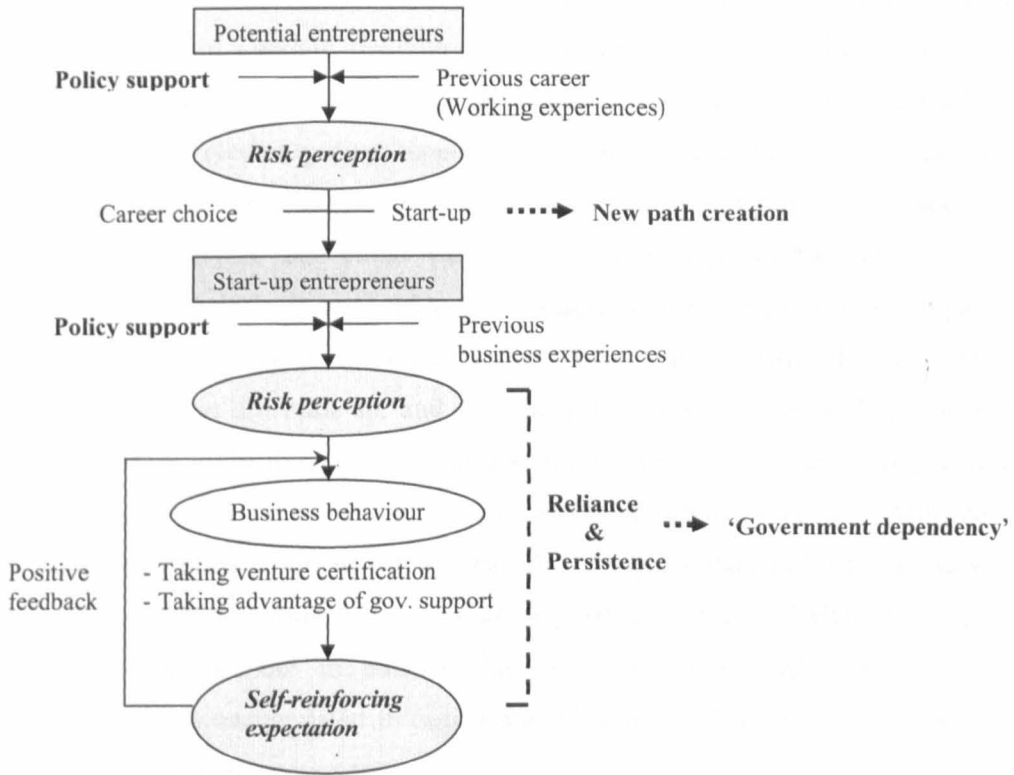
Government dependency is rooted in both reliance and persistence. These two intertwined concepts are crucial to developing the framework from general path dependency theories. However, it seems to be still quite abstract. A more precise analytical frame is necessary to move onto empirical study. In the above suggested 'circulating' type of path dependency approach, 'starting up' is once regarded as a new path created by policy intervention (of course, several factors influenced the emergence of start-ups). Within this newly created path, another path of 'government dependency' can be shaped to gain momentum over time. Institutional economics and NIE (neo-institutional economics) in particular, argues that institutions are changed over time and consequently in a path dependent way. From this epistemological point of view, it can be assumed that policy is likely to be changed in a path dependent way. Then, consequent changes in individual actor's mind (such as perception or motivation) by policy intervention are also likely to be path dependent. Once an entrepreneur thinks a certain policy measure is beneficial, this can be continuously reproduced in his/her mind and it must influence his/her business behaviour. This assumption can be also extended to a surmise that only really beneficial behavioural paths adopted in start-up stage can lead to the latter expansion and mature stages. Moreover, entrepreneurs can not foresee the exact consequence of their behavioural choices due to environmental uncertainties and cognitive limitations. In this situation, start-up founders can willingly take risks in the process of new firm formation when policy support is provided in that it can lower

the level of possible risks. It means that supportive policy measures work on their risk perceptions and on the motivations of start-ups. According to the path dependency perspective, this initial event or change makes a path formation and is likely to persist in later stages. At this point, on the basis of above argument, another significant assumption is possible that previously acquired and accumulated experiences of start-up entrepreneurs as researchers in PRIs are likely to persist in their entrepreneurial behaviours after start-up. Considering the characteristics of public R&D in Korea, most of PRIs in DST are, not surprisingly, accustomed to R&D subsidizing and grant regime for large-scale of national R&D projects. Researchers in PRIs have been generally recognised as representative 'risk-avoiders' in Korea. Contrastingly, start-up entrepreneurs are regarded as typical 'risk-takers' by establishing and running their own enterprises. This raises the question for both theoretical and empirical studies about how 'risk-averse researchers' could be transformed into 'risk-taking entrepreneurs'. In addition, how supportive policy intervention impacts on entrepreneurs' business behaviour through the changes in their perceptual patterns, and how these policy-induced changes have been reproduced in 'Daedeok' need to be explored. This study, in particular, focuses on exploring how entrepreneurs who once adopted the policy induced 'mindful deviation' (Garud and Karnøe, 2001) of start-up from existing career path become dependent on another path shaped by the very policy intervention and consequently locked into it.

The above discussion can be summarised that reliance means start-up firms' psychological reliance on policy supports, and it is approached by probing their changes in risk perception in the process of start-up, at the same time, persistence means start-up firms' behavioural persistence in benefit-seeking from policy supports, and it is approached by probing their self-reinforcing expectation in business history. Through this analytical frame, it can be suggested that one of the main themes which is worth addressing in the field study is the perception of entrepreneurial risks.

Figure 8 shows the mechanism of government dependency. As discussed before, previously acquired (and accumulated) experiences and supportive policy interventions can influence the adoption of entrepreneur’s behavioural path at an initial stage.

Figure 8. Mechanism of government dependency



Source: Author

In this process, the changes in entrepreneur’s cognitive patterns play an important role (Rizzello and Turvani, 2000). If an entrepreneur believes that the path is beneficial for his/her business, then it can become persistent and reproduced in his/her entrepreneurial activities. This frame can be seen as a kind of ‘self-reinforcing’ mechanism in the individual entrepreneur’s expectation, which is one typical source of path dependency.

Government policy brings about institutional changes through influences on rules of the game and incentive structures in the market place. From the perspective of

organisational theories, individuals or organisations are assumed to act on the basis of their own self-interest within a wider range of positive feedback mechanisms. Considering the characteristics of start-up firms such as their size and age, the importance of the start-up founder in its entrepreneurial activities is undoubtedly beyond simple individuals in other type of organisations. Start-up entrepreneur's values or decision makings are more often reflected directly in the direction of firm behaviours. The accumulation of a certain direction of firm behaviour can form behavioural patterns and eventually become embedded into organisational routines. Start-up founders are likely to initially receive policy support for intentional benefits or with just vague expectation. At this time, several conditions such as previous experiences and social circumstances influence their initial reactions. If they think policy support is beneficial to their business growth, it can lead to their behavioural or structural reaction patterns through a self-reinforcing feedback mechanism. Behavioural patterns of seeking benefit from policy support are built up, and consequently linked to structural inertia in the organisational level. In this process, changes in start-up entrepreneur's risk perception play a critical role for the formation of a path and the reproduction of path dependency. Policy support can be a sort of safety measure for a risky start-up business. As stated above, this self-reinforcement becomes an important source of 'reliance' on policy support and 'persistence' in business history. Government dependency can gain momentum as it is accumulated in organisational routines. This momentum can make the path resistant to changes over time.

Considering the above conceptual framework, a path of change in many cases can not be seen as a single, linear and deterministic trajectory, like in the classical models. In every phase of path dependency, a different dimensional path can exist, and in some cases, multiple paths can co-exist at the same time. Moreover, a path dependent mechanism does not occur always in the same way, and path breaking can also take place in this process at any time and anywhere. From the broader sense, a start-up decision related to an occupational choice can also be seen as a new path, as potential entrepreneurs deviate from their existing career path of 'wage-employment' and enter into a novel path of 'self-employment'. However, this path itself is not main focus of this study, although it

becomes a significant analytical starting point. To look at government dependency phenomenon through a path dependency perspective, 'start-up firm's reliance on policy support' is seen as the focus in this study. It can be described as 'a path within a new path', but those two paths are based on different dimensions. More specifically, the path of policy reliance is found in the newly entered start-up path. It can be also represented from a policy dimension. Policy intervention to promote a new path creation can be effective for that expected path formation, but simultaneously it can contribute to another unexpected path formation within a newly established path. The path of 'start-up firm's reliance on policy support', in this regard, can be seen as an unexpected consequence induced by policy intervention intended to create a new path of start-up entrepreneurship. If policy makers accept this unexpected path as a problem to be solved, then they must be trying to intervene again with new policy schemes or instruments. This attempt may create other new paths, but it also may bring about other unexpected paths due to the many policy constraints faced by policy makers. This multi-dimensional approach might be too complex, but it needs to be regarded as an inevitable challenge in this study to make the path more identifiable one. In line with this, this study constructed a 'circulating' type of path dependency approach to develop a relevant analytical lens.

When it comes to occupational choice, start-up decision making seems to be a critical juncture, and it can be clearly identified. Many entrepreneurship studies focus on this visible and relatively easily measurable path and critical juncture. In real world contexts, however, it is often nearly impossible to precisely predict a critical juncture. This study takes one step further towards more qualitative and fluid phenomenon. The term of 'critical junctures' from path dependency perspective is "*characterised by the adoption of a particular institutional arrangement from among two or more alternatives*" (Sydow *et al.*, 2005, p. 8-9). As Mohoney (2000) argues, the reason why these junctures are 'critical' is that once a certain option has been adopted, it becomes progressively difficult to return to the initial point when multiple alternatives were still available. Once the potential entrepreneur has made the decision to form a new firm, it looks difficult to return to previous working place in PRIs as a researcher. Many entrepreneurs in Daedeok did not return to PRIs although most of them were entitled to do so within

three years of suspension period of their duty. There, of course, may be some exceptions, but a critical juncture in this case can be easily detected. However, in the case of a path of policy reliance, the existence of critical juncture seems to be quite flexible and even elusive in some cases. Some firms may try to deviate from the path of policy support reliance at an early stage of start-up, but some can maintain their dependent behavioural patterns stemming from this reliance over a relatively long period of time. Furthermore, the points (or timing) of these critical junctures depend on firm specific conditions, capabilities or situational factors. At the same time, to what extent it is critical depends also on various factors. This matter is associated with the issue of 'irreversibility' of the path dependency process.

In this study, the start-up can be seen as path breaking decision making. In Korea, the start-up boom particularly from 1998 can be seen to be partly influenced by the exogenous economic crisis and policy intervention. Some entrepreneurs willingly take the risks from this path breaking decision, but not everybody dares to do it. Policy makers want to facilitate or trigger this mindful deviation through supportive policy measures. Policy support for start-up promotion in Korea seemed to work well at least for a short period of time, and statistics have showed positive policy effects in the increase of start-up numbers. However, after the cooling down of the 'venture fever', there was skepticism and even consequent criticism about the existing type of government policy for venture firms. In this period, the term of 'green house ventures' began to be often used to describe the firms which rely too much on government support rather than exploit their own self reliance.

To sum up this argument, deterministic nature of classical path dependency model is not accepted in this study. Instead, path breaking, unlocking paths, or new path creation are regarded as ubiquitous phenomena. Unlocking the paths can occur by intentional policy intervention. Then policy initiatives can produce beneficial effects in the process of innovation. However, the new path as a result of this intervention can be developed into a path dependent trajectory. This may cause continuous interventions. As a matter of fact, the framework in this study is developed to apply it to empirical work. Policy

intervention is usually in use as a way of systematically promoting localized learning process to secure regional innovativeness in practice (Asheim *et al*, 2003). In this respect, the application of government dependency framework to the field is expected to generate practical empirical data in identifying how government dependency has been reproduced. According to the framework of government dependency, reliance and persistence are the main elements that can be addressed through the investigation of risk perception change and self-reinforcing expectation.

5 RESEARCH METHODOLOGY

5.1 Introduction

As stated above, this study attempts to use the conceptual framework of government dependency to understand the role of high technology businesses in the period of economic readjustment in Korea. In this regard, the central unit of analysis in this study is high-tech start-up firms. In Korean context, dramatic structural changes have occurred since the financial crisis in 1997. The economic transition has not only caused severe economic disruption but also made numerous impacts on Korean society. One of notable changes since 1997 was that high-tech start-ups began to emerge as a main actor in Korean economy. Daedeok is expected to be a relevant study area in that there is a large-scaled science park and considerable number of spin-offs from it and there have been quite long efforts to promote innovative activities such as R&D and start-ups.

As stated in the introduction, this thesis addresses four sub questions for empirical work on the basis of two primary research questions;

1. What makes potential high-tech entrepreneurs become start-up founders?
2. How has policy support influenced changes in the perception of risk during the process of start-up?
3. What sort of entrepreneurial responses have been induced by this change in risk perception?
4. How have these responses been reproduced as a form of behavioural persistence in their business history?.

In collecting relevant data from the field, this study employs qualitative interview as its main data source. Secondary sources are also used in analysing the study area and policy contexts in terms of path dependency. Among the four questions above, first two questions are examined to address the emergence of a path of policy reliance and the rest of two questions are to address the persistence of dependent business behaviour. This provides the understanding of policy learning mechanism that interplays between

institutional building in systemic level and behavioural changes in actor level. In these considerations, how to position the researcher and how to prepare the research settings are very critical methodological issues. This chapter, first of all, discusses these issues to be tackled and also research methods employed under the consideration of them. In last section of this chapter, the descriptive information of Daedeok as a study area is outlined in terms of RIS perspective.

5.2 Methodological issues

There are many issues that need to be considered when conducting interviews as part of a data collecting exercise. Many of these have been well examined elsewhere and this section attempts to discuss a few fundamental issues for appropriate research settings in line with the nature of this particular study.

5.2.1 Positionality in situating the researcher and the research

This study was largely motivated by the researcher's personal observation during a period of working in the field as a practitioner. Thus, the researcher had been involved in the phenomenon observed in this study. This position of the researcher seems to be a good starting point of the study. However, it simultaneously raises two methodological issues associated with the researcher's ontological and epistemological point of view, and also ethical issues in conducting qualitative interviews. This study is basically looking at the interrelations between space, policy and business. The researcher is also situated between theory, research, and practice. Considering these elements and contexts, positioning of the researcher is crucial in determining the position of this research.

Positioning between theory, research, and practice

The researcher has fifteen years of working experience in practicing policies in the field, and the present thesis was motivated by these experiences. This study attempts empirical investigations through interviews in the field, but the researcher was involved in this

field through policy practice. The discussion of the relationship between theory and research and practice has always been problematic and thorny issue. As Einstein's statement that "it is the theory that decides what can be observed" implies (Heisenberg, 1989), theory is what gives direction to an empirical investigation. Theories can be used not only to explain or predict phenomena but also to generate hypotheses that can be tested by research. As Næss and Saglie (2000, p. 738) say, "[f]or any field of planning research there is a necessity of striking a balance between empirical and theoretical contributions over time. Empirical research may challenge the theoretical lenses used for looking at the world, while too strong emphasis on empirical investigations may lead to naive empiricism." In this vein, it can be said that the results of research may provide evidence that supports the theory, which, in turn strengthens the theory.

In the context of social science, researches are usually not conducted in laboratory settings where researchers can control the variables that they want to study unlike experimental researches in natural science. Thus, it seems to be skeptical that theories in social science can be easily tested in the real field to see whether or not they work (Stinchcombe, 1987). However, in spite of this limitation, theory and research serve undoubtedly as the foundation for the field of practices. In return, the results of research conducted in academia impact on the development and revision of theories in that field. It means that theory and practice are also closely interrelated. In this respect, it is very important to situate research in its particular institutional, social, and political contexts (Parton, 2000, p. 449).

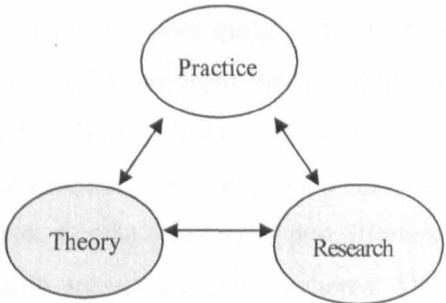


Figure 9. Positioning of the thesis between practice, theory, and research (Source: Author)

To sum up, those relationships can be illustrated by the double headed arrows linking three circles with the theory, research and practice circles (see Figure 9). On the basis of this illustration, it can be said that theory plays a crucial role for research and the relationship between theory and practice is mutually dependent. At the same time, *“practice has been heavily and consistently influenced by other fields of policy and practice”* (Thompson, 2000, p. 127). However, there are barriers to the fusion of theory and practice. They seem to come from different climate or culture that envelops them. Usually practitioners are more interested in pragmatic matters and focusing more on output or performance. For the practitioners, the language used in planning theories can be unnecessarily obscure, so it may not be easy to find academic output useful or digestible (Thompson, 2000). As Sandercock argues in her commentary on Thompson’s article, it might be vain efforts to stake a claim to a single theoretical solution. Theory, in itself, is not enough and sometimes too abstract, general and usually context-less (Sandercock, 2000, p. 136).

As stated already, the research interest of this thesis starts from the problematic recognition about the close interrelation between theory and practice. With respect to the study area (Daedeok), there have been several efforts in both academic and practical purposes to explain the phenomenon of R&D resources agglomeration in it (Oh, 1995; 2003; Oh and Kang, 1997; Lee, 2001; Seol *et al*, 2002). Daedeok has been understood through various theoretical approaches such as science parks, technopolis, clusters, regional innovation systems. Some of them understand that Daedeok is a successful and well functioning cluster or exemplary regional innovation system. Nevertheless, what the researcher felt as a practitioner was quite different from these research results. Moreover the policy recommendations from these researches were often too abstract, ambiguous and superficial to reflect well the many problematic phenomena in the field of practice. Academic researchers have neglected to address more practical and substantial issues in Daedeok. On the other hand, practitioners have also not realised the importance of interface with more theoretical spheres. Deep theoretical discussions could provide this empirical study with an academic basis. At the same time, the researcher’s working experience as a practitioner in the field could also provide solid

basis for doing this theoretical work. The researcher will return to the job in practice after the completion of this study. Thus, the learning from it could contribute to the integration of planning theory and practice, and also create a climate in which the interaction of theory and practice is encouraged in both the academic and practical sectors (Thompson, 2000).

Positioning between locality, policy, and business

This study is looking at three interrelated factors: locality, policy, and business. As stated already, it aims at exploring the reproduction of policy induced government dependency through the investigation of start-up firm's risk perception and business behaviour. Thus, this study seems to be situating closer in the middle of the relation between policy and business rather than between locality and policy or locality and business. However, locality in this study has the importance not only as the space where innovation takes place but also as the field for empirical investigation. The unit of analysis in this study is start-up firms, but it is approached under the consideration of regional context and policy regimes. Start-up firms are seen as an important actor in regional innovation systems, and also as an important target group for innovation policy. At the same time, this study stresses the importance of the regional dimension of innovation. 'Region' in this study is basically understood as a container in which innovation takes place. Studies of 'learning region' have focused on the dynamics of individual regions. This study, however, does not directly focus on regional differentiation or variation, but rather focuses on the feature of the relationship between regional innovation behaviour and regional development within a region. Thus this thesis does not use a method of comparative study.

Innovation processes are seen as systemic or interactive ones rather than linear. Policy intervention in the process of innovation is required to address the problems of market failures and system deficits as well. Theoretically, path dependency perspective can be a powerful tool to understand the nature of innovation process, and it becomes the main theory to encompass all these complex frameworks in this study. Start-up firm's

response to the policy intervention (support policy in particular) is analysed through the theoretical lens of path dependency, and also the empirical method of qualitative interview. As a result of these complex layers for observation, this study has inevitably multi-dimensional nature such as actor, systemic or regional, and policy dimension.

This study which is looking at start-up firm's business behaviour has two intertwined issues to be addressed in relation to path dependency theory: spatial issues and policy issues. Spatial issues are important to understand innovation in regional context. According to RIS perspective, firm behaviour tends to be accumulated over time in regional context. In this regard, start-up firm's dependency on government policy support which is the main interest in this study can be also assumed to be reproduced in regional context. However, a region as the construct developed particularly in European context might be tricky more or less in applying it to Korean context in that there is still no clear distinction between local and regional levels in Korea. On the other hand, this study is, of course, not focusing on policy itself. Thus, it is far from policy evaluation study. Nevertheless, policy issues need to be also deeply considered because 'policy matters' a lot in the reproduction of government dependency. Policy has continuously changing nature rather than fixed one. Policy feedback is likely to occur always and in every process. It means policy itself is changing all the time, but it seems to be changed in path dependent way. Moreover, policy can produce expected outcomes, but simultaneously bring about unexpected impacts as well.

In summary, the positionality in this research setting can be seen producing the limitation but the potentiality of this thesis. This issue seems to be not the matter of right or wrong, but instead the matter of fundamental viewpoints or values in research. Considering the researcher's position between academia and empiria, it might be impossible to completely eliminate the values in this thesis. It would be the potential weakness of this study, but simultaneously it would be the potential source of contribution in filling the gap between empirical knowledge and theoretical development. At the same time, the nature of this study which is anchoring in three different dimensional factors like locality, policy, and business may produce excessive

complexity. However, it seems to be inevitable in considering the nature of this study and it needs to be addressed by appropriate methodological research design.

5.2.2 Connectivity of studying firms to locality

The central unit of analysis in this study is start-up firms. In economics, firms have been understood as a key actor in the capitalist market economy. Start-ups in particular have drawn much attention from scholars and policy makers in that entrepreneurship plays a critical role in economic and regional development. Many entrepreneurship studies have focused on certain distinguished characteristics of individual entrepreneurs from non-entrepreneurs. On the other hand, organisational studies have emphasised the importance of organisational learning capacity for innovation. In this study, start-up entrepreneurs were interviewed to explore the changes in perception and behaviour of firms in response to policy support. Thus, connection between individual entrepreneurs and start-up firms may cast problematic questions in this study whether the unit of analysis is entrepreneur or firm. Considering the critical influence of start-up founders in small and newly established firms, start-up firm's behaviour is likely to be heavily dependent on founder's value, belief or business style. Those individual factors are often reflected directly in the start-up firm's business performances. As start-up firm's certain behaviour accumulates over time, it formulates behavioural patterns of firms and eventually it is likely to be embedded in organisational routine. In this vein, it could be no problem at all to look at start-up firm's behaviour through studying individual start-up founders.

As argued above, the unit of analysis in this study is the firm rather than individual entrepreneur. However, it still needs to be further argued that how to understand the firm. Basically, firms' behaviour and decision makings strongly depend on the information they receive from their environment. The start-up firm assumed in this study is an economic actor who has bounded rationality. It implies that start-up firm has not full information and only has limited information-gathering and cognitive computation abilities. In this vein, the information coming from the environment should fit into

already existing cognitive frames or patterns which firms hold. This '*cognitive representation*' (Anderson, 1980; Fornahl, 2003) can make actors choose one possible alternative that consequently lead them to a certain action and behaviour. As Fornahl (*ibid*, p. 41) argues, change of this cognitive representation can take place by individual and collective learning processes. The start-up firm can be recognised as an individual actor or a collective actor according to the nature of study. This research is based on systems approach. In a system of regional innovation, start-up firms are regarded as a key actor who interacts for learning not only with other actors within the system but also with external environment. According to neo-classical economics, firms are assumed to behave towards an optimal reaction to environmental changes on the basis of their capability of optimising behaviour. However, in the evolutionary economics, firms are recognised as actors who exist, behave and evolve in different ways. In other words, firms are not homogeneous, rather they exist in diverse forms in evolutionary processes and they possess distinctive learning capacities. Therefore, the firm as a collective actor can be different from the simple sum of individual firms. Furthermore, this recognition of firms is linked to the assumption that firm behaviour is likely to change in path dependent ways. Once certain behavioural patterns are embedded into organisational routine, it provides a sort of inertia for those patterns. As organisational routine builds up, firms may have competitive advantages in a relatively stable environment. However, this may result in lock-in situation in rapidly changing environment. These premises on the firm would be the basis in establishing conceptual framework below.

Another issue associated with studying firms in this study is the connection between firm behaviour and locality. It has been a central interest for regional planners and economic geographers for several decades (Harrison *et al*, 1996; Johannisson *et al*, 2002; Nijkamp, 2003; Tully and Berkeley, 2004). In the meantime, several notable approaches have been tried in this field such as location theories (North, 1955; Krugman, 1993), regional input-output studies (Jensen *et al*, 1988; Batey *et al*, 1993), agglomeration and clustering theories (Malmberg *et al*, 2000; Malmberg and Maskell, 2002), territorial innovation theories (Moulaert and Sekia, 2003). Many scholars have focused on not only structural factors of regions like industrial structure, business

cultures, cooperative networks, or innovative milieu, but also individual factors of firms like business strategies, competitive behaviour. This study is, as argued above, starting from studying start-up firms, but it is moving from studying individual start-up entrepreneur to firm as a collective actor. At the same time, it is moving further from firm to region. This study is using qualitative data collected from interviews of start-up founders. Methodologically, it makes sense because a key focus in this study is laid on probing the change in entrepreneur's risk perception and its persistence in business behaviour. Data on such qualitative factors may be nearly impossible to find in secondary sources and difficult to evoke even in surveys. In this sense, interviews can be quite useful for studying firm strategy and dynamics as behavioural phenomena (Schoenberger, 1991). However, as argued above, the researcher needs to make several assumptions about the matter of 'representativeness' in moving from interviews with firm representatives to inferences about regional dynamics (Markusen, 1994, p. 478). This matter is closely related not only to the selection of case area, but also to the sampling of target firms for interviews. In other words, this matter is the question whether the specific start-up firms selected as interview targets can represent the study area (or region). There exist various types of firms in a region such as large firms or SMEs besides high-tech start-ups. In this study, the founders of spin-off start-ups from PRIs in Daedeok Science Town are mainly selected as interviewees. Then, can they really represent Daedeok? This question is also linked with the matter that how Daedeok is understood in this study. Basically, Daedeok is regarded as a regional innovation system which is deeply rooted in DST. Thus, the above asked question can be answered in terms of representativeness in choosing a study area and interviewees.

5.2.3 Dealing with 'time' and 'space'

The issue of time and space seems to be methodologically one of the most critical factors in this study. This issue has been the most fundamental elements in a number of disciplines in that all things occur or exist in relation to space and time (Peuquet, 2002). It is related to the matter of time range and space scope in research. These two factors are often very closely interconnected to each other, and this entanglement adds to the

difficulty of analysing these concepts (*ibid*, p. 12). Generally speaking, history reflects time and geography represents space. Economic geographers often try to combine these two. In particular, the studies aiming to connect path dependency to regional development are interested in regional inheritance and endowment differentiating one region from another (Clark *et al*, 2002). As Cooke and Morgan (1998) argue, the persistence of industrial district or innovative milieu based on local relations or assets not easily reproduced elsewhere.

The term 'space' in this study is understood to contain several associated concepts such as area, place, territory, region, regional innovation system, etc. As argued already, a region is basically understood as the vehicle of innovation, and it is increasingly becoming the relevant unit of observation in innovation studies. At the same time, policy is seen as intentional intervention to facilitate innovation. Thus, policy itself also needs to be understood in a regional context. This study is basically looking at the changes in actor's perceptions and behaviour, but simultaneously interested in the changes in region and policy as well in a broader sense.

Time and space can be described by the boundaries between its entities or attributes. "*Spatial boundaries form when adjacent locations differ; temporal boundaries form when adjacent states of the modelled system differ, i.e. when change occurs.*" (Langran, 1992, p. 29). In this regard, it is necessary to look at 'government dependency' through the angle of 'spatial boundary' in regional context, and within the 'temporal boundary' on time line. The concentration of science and technology policy on DST over the last three decades endowed 'Daejeon' city with a clearly advantageous status in accepting benefits from innovation policy or venture policy. As discussed previously in chapters of conceptual framework of government dependency and institutional arrangements for venture policy, it can be inferred that the more policy measures are concentrated on a certain region and the more institutional environment is firmly established, the more economic actors like start-up firms in regional innovation systems try to embed themselves in it. This study focuses on high-tech start-ups in general, inventor-founded start-ups in particular. Many previous studies point out that the most conspicuous

characteristic of the start-ups in Daedeok is the fact that there are many spin-offs from PRIs, and they have a strong 'technology-orientation' rather than 'market-orientation' (Kang, 1998; Lee, 2001; Seol *et al*, 2002). Most of studies have focused on these spin-offed start-ups' quantity and quality. According to previous survey data (DSSC, 2001; DSSC, 2003; DSSC, 2004; DSSC, 2005), the proportion of them is over 60% of total number of start-ups in Daejeon city. But, this quantity may be increased a bit more when the firms which recruited external CEOs are included. In their quality, 12 out of 14 IPO firms in Daejeon are spin-offs from PRIs in DST. It implicitly indicates that they have played a significant role as leading companies in Daejeon. This characteristic can be seen as a sort of path dependency in that the past experience of CEOs as researchers or engineers in PRIs has influenced on business styles even after their career change to start-up entrepreneurs. PRI researchers in DST are seen as typical scientists or inventors, and there have been policy measures to support them to create their own business in Korea. In this regard, Daedeok would be a relevant study area to observe high-tech start-ups and to explore how policy-induced government dependency has been reproduced in their business behaviour. In this study, Daejeon, a local authority encompassing DST is seen as an administrative region which has the clear spatial or geographical boundary. 'Daedeok' in this study is dealt with as a regional innovation system which is rooted on the one hand in Daejeon geographically, and on the other hand, in DST systemically. Thus, it is assumed that its system boundary is beyond the administratively fixed geographical boundaries of Daejeon Metropolitan City or the legally defined area of DST.

In exploring the reproduction of government dependency in Daedeok, a long term perspective seems to be necessary in that path dependency approach itself is based on long term perspective. The time scope of this study is basically focused on around ten years after the outbreak of IMF crisis in 1997. This time setting comes from two points: firstly, this ten year period has very significant meanings in terms of economic readjustment, and secondly, it triggered many institutional changes including the emergence of high-tech start-ups in Korean economy. Considering the research aim and objectives, analysing this period can be quite relevant. However, from the path

dependency perspective, this period can not be free from the past in terms of institutional continuity or inertia. Daedeok could be constructed by the intervention of Korean government in the early 1970s. Furthermore, there have been continuous R&D supports for Daedeok over the last three decades. In this regard, as Figure 10 shows, this study looks at the ten year period on the extended time line from 1973 when DST was born.

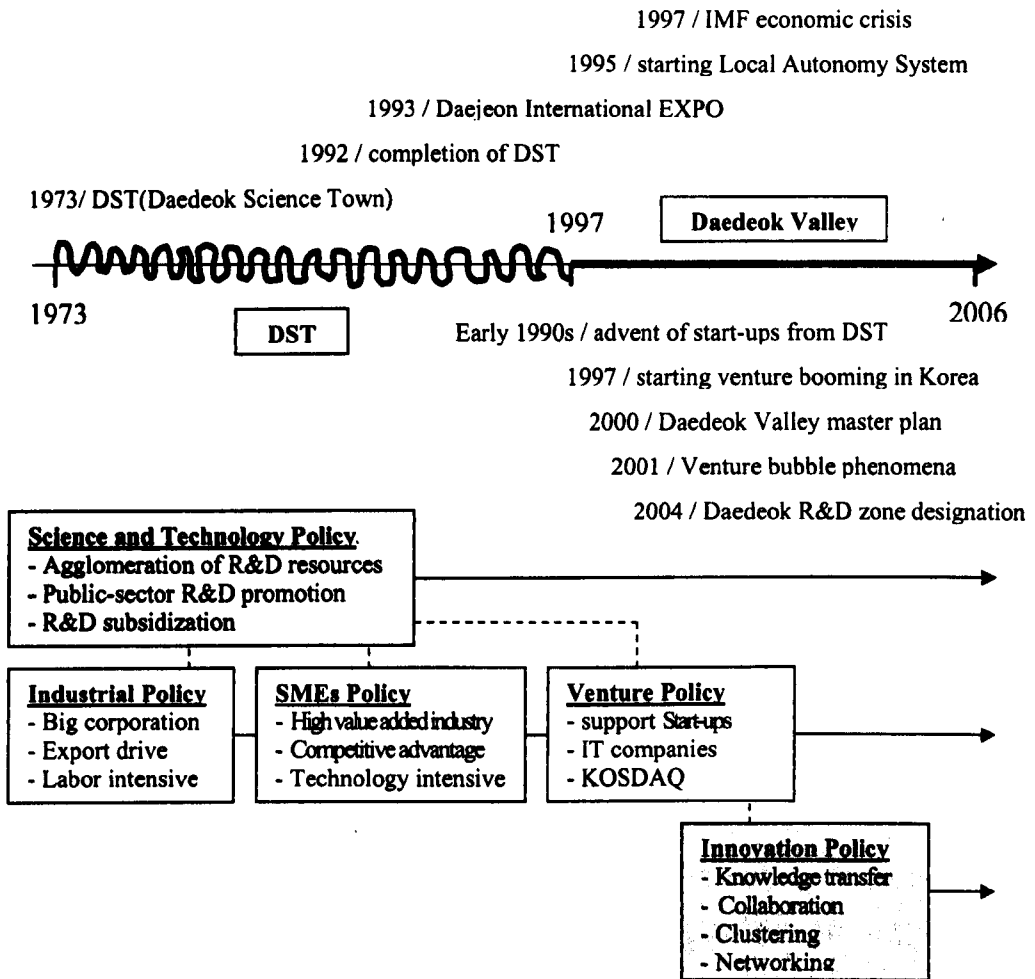


Figure 10. Major events and policies in Daedeok (Source: Author)

This seems to be inevitable in that the history of DST as an origin of Daedeok Valley goes back to that time. But, the main interest is laid on the ten year period from 1997 to the present in relation to the venture policy. There have been many significant events and policy changes during this period of time. Venture policy which was initiated

mainly after 1997 is the target policy in this study, but it needs to be reviewed in the perspective of other background policies such as science and technology policy, industrial policy, and innovation policy. The changes in these background policies seemed to function as a legacy in policy regime in shaping venture policy.

5.2.4 Translation issues

In this type of research which is using not mother tongue (Korean) but foreign language (English), translation issues can be crucial in conducting research. Although this study was not designed to interview English-speaking respondents, there still exist several possible translation issues. In this vein, those issues in relation with language or translation are raised with respect to mainly written communication with the readers of this PhD thesis rather than verbal communication with interviewees.

In this section, translation is defined as the transfer of meaning from a source language such as Korean to a target language such as English (Esposito, 2001, p. 570). As a matter of fact, translation issues may be raised at nearly every stage of this research. Much literature written in Korean was reviewed and many Korean statistics or policy documents were analysed. Some quotations from these Korean texts were interpreted in English by the researcher and put in this thesis. References for the sources of them were also transcribed into English. These attempts might cause the limitation in not only the expressions for cited data but also the accessibility to data sources. This study tries to use literature or data about Korean contexts written in English as far as possible. It, however, can cause another problem in that it is utilizing the translation by somebody else in secondary sources which must be done in different contexts from this research. Although this study tries to use Korean literature or data written in English already published in journals or books, this matter of translation seems to be still tricky in this study. Accessibility to the data sources written in Korean but put in references in English can be also problematic. In many studies which are dealing Korean contexts but written in English, Korean references are put in English. Contrastingly, English references are put in English even in the studies written in Korean. It may reflect a sort of English

oriented language hegemony in conducting academic researches particularly in Korea. This thesis adopts 'paralleling reference' which means putting Korean reference together with translated version of English reference in case of Korean written literature or data.

Another critical language issue is arisen from the way of conducting interview and analysing data. This study conducted interview and transcribed interview data in Korean but this thesis is written in English. Whereas some expressions used in secondary Korean sources written in English are seen to be already generalized to some extent through publications, empirical data in this study is mostly containing terms or expressions which need to be interpreted differently from the previous literature. Some of them can be, of course, refer to similar usages from previous studies, but it is not appropriate to borrow them in same manner in this study. A few expressions from interviewees seem to imply a quite specific Korean context which can not be easily understood by foreign readers. It demonstrates the matter of cultural differences rather than reflecting just the matter of language. In this case, attempts for direct translation of these expressions in English may often not work properly in describing them. As Esposito (*ibid*) notes, the researcher as the translator needs to conceptualise the meaning of the statement from the raw data in informant's language (Korean) for understanding and reconstructing the meaning of it in a new cultural (English) context. In case of qualitative studies particularly interview based researches, translation needs to include connotations and contextual meaning (*ibid*, p. 571). In line with this, translation was done in this study as accurate and natural as possible to reflect their original meanings exactly in terms of Korean context rather than just sticking on literal translation. In some cases, however, original expressions in Korean were also used within brackets together with translated English expressions to give better understanding to Korean readers.

5.2.5 Ethical Issues

As Mason (2002, p. 79) notes, the use of qualitative interview as a data collecting method raises a number of general ethical issues, and there will also be specific ethical concerns connected to the particular research project. Ethical issue in this study is also

not so different from her statement. In this study, there are some ethical issues to be taken into consideration in that individual interview method which involves personal opinions is to be used. Moreover, this study is dealing with problems of policy intervention and I, as a researcher, am a civil servant who might be in charge of policy making again for most of interviewees when I return to my country. Thus, the ethical issues are mainly related to two matters: one is about research methods and the other is about researcher's position. These two matters seem to be closely interrelated in that interviewees may be influenced by researcher's job as a civic official of Daejeon where they are doing business at the moment. In this sense, the researcher is seen standing in the middle between 'insider' and 'outsider' in conducting the interview. This equivocal position may cause ethical or methodological problem. Considering this potential problem, the researcher tried to be as neutral as possible not only in conducting interview but also in treating all collected data through whole process of research.

General ethical issues

General ethical issues in interview based researches mainly arise from obtaining the consent from interviewees and dealing with the information from them in terms of confidentiality. The consent, if necessary, needs to be gained from informants before interview on the basis of the statement how interviewer will guarantee confidentiality regarding all gathered information. The judgement of this depends on the nature of researches. The interview in this study was designed to gather personalised opinions which may contain informant's value or belief. Moreover, interviewees' statements may reflect their pros and cons about government policies. Thus, it can be important for the researcher to gain the consent beforehand. The consent could be obtained through email or telephone. Some of them sent their consent by email in advance, but some of them recruited by 'snowballing' in Korea gave the consent through telephone contacts. Most of interviewees were not interested in the detail of interview such as interview questions or interview time. However, it was clearly emphasised in gaining the consent that collected interview data would be used only for academic purposes and all interviewee's name would be treated anonymously by allocating serial numbers. It was agreed to use just company names on the interview list which will be put in an appendix of this thesis.

Before every interview began, the purpose of interview and the way of using it in this thesis were briefly introduced again to respondents, although it was already informed to them in the process of gaining consent. At the same time, recording the interview was agreed by each interviewee in advance. Most of interviewed entrepreneurs did not object to being recorded, but some of them showed some reluctance about that in the beginning. However, once they had checked again that their responses would not be opened to the public, they then agreed with recording. In the course of interviewing, some interviewees showed a bit conscious attitude about the fact that their saying was being recorded when they were going to say some sensitive matters. In this case, they could be relaxed again by reconfirmation of the previously mentioned anonymity and confidentiality in treating interview data. In the process of data analysis, all interviewees were treated in just serial numbers for citation. Interviewees' company names are arranged on the interview list according to their alphabetical orders and each serial numbers are not matched with this order. In this regard, no personal data is identifiable within the results of this study adhering to the 1998 Data Protection Act.

Specific ethical issues in this study

As noted before, the researcher has long working experience as a civil servant in the field of providing business support for start-up companies in Daedeok. Therefore the researcher has already known some of informants even though it is not very close relationship. As seen in later section (5.3.2), it did not influence sampling or the selection of interviewees in this study. Nevertheless, it might be difficult to completely exclude the researcher's bias from this background. At the same time, interviewees might also have a certain bias or even prejudice toward the researcher. This acquaintance and the researcher's position as a civil servant can be expected to affect the proceeding of interview in any way. For example, contacting some interviewees whom the researcher has already known was relatively easy and interviewing them was done in a favourable atmosphere. Given the power relationship between public and private sector in Korea, however, this might be a disadvantage as well in that the researcher's position as a city official can influence the interviewee's answers. Basically this possible

problem was partly tackled by preparing interview questions and conducting the interview according to cautiously planned interview guide. In addition, it was also addressed by cross-checking start-up firm's interview data in the process of data analysis with other actor's interview data such as venture capitalists or government officers.

5.3 Fieldwork and research methods

5.3.1 Utilization of secondary sources

This study used a wide range of secondary data such as policy documents, government statistics, web data bases, previous surveys, and so on. Secondary sources were mainly used for interview design and institutional analysis of the field (Daedeok and Korea). Firstly, various statistics and policy documents from the central and local governments were reviewed together with previous studies to provide descriptive information of study area and policy context. At the same time, this data was also carefully examined for institutional analysis about Daedeok and venture policy through path dependency perspective. Policy documents from the central government ministries such as MOST (Ministry of Science and Technology) or SMBA (Small and Medium Business Administration) could be collected in the form of publication or online document from the websites and local government documents could be obtained during the period of fieldwork in Korea. This data was mainly used to understand the change of policies and the characteristics of studied area.

Secondly, in interview design, government statistics issued by mainly SMBA were used to obtain the necessary information for sampling and selection. SMBA website and its portal site 'Venture net' contain various online policy documents and annual statistics of certified venture firms. Daejeon Metropolitan City (DMC) has also managed a quite well updated database on start-ups in Daedeok. DSSC (Daejeon Small & Medium Business Support Centre) has updated this database annually since 2000. This database covers nearly all types of start-ups in Daedeok and it contains quite detailed information on

venture firms. It was very helpful for the researcher to use these official websites or databases here in conducting this empirical study about Korea in the UK. Secondary online data could considerably complement the limitation of offline data accessibility in this research.

In addition, previous survey data was also used to find more detailed information of the start-up firms in Daedeok. There have been several surveys on start-ups in Daedeok for the last a few years (DSSC, 2001; DSSC, 2003; DSSC, 2004; DSSC, 2005). Most of them were mainly conducted by DMC or its subsidiary organisations. DMC has exerted to transform DST into more innovative cluster since the mid 1990s. In particular, after the official declaration of Daedeok Valley in 2001, DMC has launched survey works almost every year although their purposes, methods and scope were slightly different. In this study, these secondary data were used for mainly fieldwork design. A recent survey (DHIPF, 2004) was used as a main secondary survey data. This data can be relevant to be used in this study in that, firstly, it is quite recent one, secondary, its target companies cover various types of start-ups including certified venture firms, thirdly, its sample size is big enough. This study also referred a recent national survey on venture firms as well which is titled 'Fact-finding survey on venture firms in Korea' (SMBA, 2004). At the same time, a few similar large-scale surveys on SMEs and venture firms recently conducted by DSSC were also used to review the major changes in venture firms. Utilization of these previous surveys provided very useful and reliable data for picking up interview firms. However, the results of these previous survey researches were used very carefully and limitedly not only because it targeted various types of technology-oriented small firms including certified venture firms, but also because their purposes and employed methods were slightly different each other.

5.3.2 Interview design

Qualitative research in general uses a naturalistic approach that seeks to understand phenomena in context-specific settings. While quantitative approaches seek causal determination, prediction, and generalisation of findings, qualitative approaches usually

seek illumination, understanding, and extrapolation to similar situations (Hoepfl, 1997). However, these two research paradigms are not always in conflict with each other in terms of methodological appropriateness, but instead those can be effectively combined in the same research project (Patton, 1990). As already noted, the objectives of this study are, firstly, to construct a conceptual framework of 'government dependency', and secondly, to apply it to the study area to explore how policy intervention induced start-up firm's government dependency and how it has been reproduced. According to these research objectives, two primary questions were raised as follows:

- How and why has the reliance of start-up firms been produced in the process of starting their business?
- How have start-up firms responded to support measures of government in getting on their business and why they came to respond in that way?

To address these questions, this study adopted qualitative approach as a main method. Quantitative approach has been commonly employed in many previous innovation researches. For example, some indicators were selected to quantify possible variables such as the portion of public R&D expenditure, start-up's public fund dependency, the ratio of public fund in venture capitals, the portion of patent citation which produced through public collaboration programmes, etc. However, these quantitative variables seem to have limitations to fully represent various qualitative factors of the research problem. Furthermore, it might be nearly impossible to explore changes influenced by policy intervention such as start-up venture's motivation, attitude, expectation or behaviour by single quantitative methods. This study was done on the basis of mainly qualitative paradigm, but it uses a range of other types of data as well such as statistics, secondary survey data, and policy documents. It worked well to reinforce qualitative data in understanding the phenomenon at the field.

For conducting this empirical work through interview, six sub questions were produced from three primary questions (see the introduction of this chapter). As stated in above chapter, the major concepts of the fieldwork are 'risk perception' and 'self-reinforcing expectation'. Considering the objective of this study and the abstract characteristics of these two constructs involving the examination of feelings or tacit perceptions,

qualitative interview can be naturally proposed as a way of eliciting rich data (Arksey and Knight, 1999). Basically, main interviewees in this study are start-up founders. However, start-up firm's innovative activities (e.g., firm formation, financing, investment, marketing, cooperation with other actors, etc) are influenced by a range of factors from several actors. Thus, besides the founder of start-up firms, venture capitalists and government officers were also interviewed for the purpose of cross-checking.

In this study, semi-structured interview was adopted for probing respondents' subjective meanings of varied risk perceptions in their business history. It means that a list of issues and questions to be covered is prepared in advance, but it does not deal with all of them in each interview. Interview questions are structured to some extent, but their order may change depending on how the respondent answers (Gray, 2004). Thus, the planning and conducting this type of qualitative interview must be very difficult and creative work. It is necessary to establish the structure and the flow of interview in this planning stage. Then data analysis could be also well carried out. The process of data collection and interpretation needs to be understood as an interwoven procedure rather than the linear process like the fashion of 'first collecting and later interpreting' (Flick, 2002, p. 176).

Interviewing is seen as a kind of social interaction between interviewer and interviewees. The interviewer may face varied challenges in real interviewing. Thus, a possible first step in initial designing stage of interview is to address the questions of 'what kind of data and how and from whom it can be generated'. In interview design, one of the most important things is that every interview questions and preparing steps should be focused on research questions. In other words, interview design can start from the deep thinking about what the researcher want to ultimately know through this interview. Then it needs to set out detailed necessary steps: such as the type and the order of questions, the depth and the width of questions, the way of asking questions and how to express it (Mason, 2002).

With regard to the selection of interview population, it is important to recognise how start-ups develop. Many previous studies use 'organisational stage model' or 'life cycle model' to analyse the development process of start-ups. It has been the dominant framework in both theoretical and practical literature. This model recognises the growth and development of new firms as linear, sequential and identifiable stages. Many scholars adopting this model tried to articulate various stages or life cycles of start-ups (Galbraith, 1982; Block and MacMillan, 1985; Bhave, 1994; Kazanjian, 1998; Kaulio, 2003). But in the meantime this perspective has been criticized in that the process of start-up development should be recognized as a more complex and dynamic one (Lichtenstein, 2000; McKelvey, 2002; McKelvey, 2004). This criticism from the complexity theory seems to be very persuasive considering the complexity and dynamism of start-up process in the field of real practice. However, this study followed a conventional 'stage model' in terms of practical and methodological consideration. It was because this study used this model just for grouping the start-up firms in Daedeok for the selection of interviewees. However, this study does not basically regard the development process of start-ups as a linear, static and easily predictable one. This study classified the stages of start-up development into three stages: 'initial stage', 'growing stage' and 'mature stage'. Initial stage includes the phase of inception, start-up and early stage of development. Growing stage includes the phase of business expansion in finance and production. Mature stage means the phase of stability including for example IPO stage. This distinction can not be clearly accepted in various situations in real practice. In Daedeok and Korea, it seems to be accepted that 'growing stage' of start-ups usually covers the periods between around 3~4 years and 9~10 years of their business careers. According to surveys conducted by DMC from 2001 to 2005, average business careers of start-ups in Daedeok are between 4 years and 9 years (over 60%). More specifically, it is around 40% between 4 years and 6 years, and around 20% between 7 years and 9 years. It reflects many venture firms were established from mainly the end of 1990s. Considering the fact that 'venture-certification' started from 1997, start-ups who were established between 1997 and 2001 (who have business careers of between nine years and four years) would be targeted for interview in this study. On the other hand, previous surveys show that the majority sector of industry in Daedeok start-ups is

IT (Information Technology) sector including manufacturing and information services. Its proportion is around 50% of total start-ups in Daedeok. The second big proportion is BT (Bio Technology) including precise chemistry – around 30%. This study targets on start-up firms in mainly IT sector. It is widely agreed by venture capitalists that the period from initial stage to growing stage in the case of BT sector is relatively longer than that in IT sector. Thus it could be not relevant to include start-up firms in BT sector with IT sector firms.

On the basis of above discussion, first of all, this study picks up start-up firms on the growing stage as interviewees. This is because venture firms on the initial stage (between from the beginning to 3~4 years) may be more likely to have a natural reliance on government support. However, it is hard to distinguish this natural reliance from real 'government dependency'. Secondly, as noted above, interviewees would be basically confined into CEOs of spin-offed venture firms from DST considering the characteristics of Daedeok. At the same time, these firms are divided into 3 groups in relation to the 'venture certification'. The first group (*'never' venture group*) is the firms who have never been certified by the government as venture firms. The second group (*'once' venture group*) includes the firms who have certified as ventures once but are not now certified. The third group (*'still' venture group*) contains the firms who continuously maintain venture certification up to now. Among these three groups, second and third groups are targeted for interview in this study. It is because the first group (never venture group) does not have its accumulated statistics. In cases of once venture group (OVG) and still venture group (SVG), some interesting questions are raised: why some venture firms did not renew their venture certifications, and why some of them keep their certification up to now. Unpacking these questions must be very useful to identify how and why venture firms have tried to embed themselves into the institution of 'venture certification'. This certification in venture policy looks a selection of target firms for policy support by the government. In this respect, the response to the venture certification might be a key in approaching to the behavioural change as the response to policy supports. It is assumed that there might be meaningful variation in behavioural changes between these two groups. On the other hand, a few successful

(IPO firms can be regarded as successful firms) and failed (bankrupted) firms were interviewed as well. These two additional groups (IVCs: IPO Venture Companies and FVCs: Failed Venture Companies) provide useful checking points with the above two main groups.

These two groups are selected randomly among target population which is filtered according to three steps as follows:

- Spin-off start-ups from PRIs in DST
- Start-ups in IT sector
- Start-ups in growing stage (from 4 to 10 years of business career)

From this filtering, 20 start-ups were selected respectively as one group. Interviewees were the firm representatives who are founders and at the same time CEOs of those firms. In addition, statistics of certified venture firms issued by SMBA on monthly basis since 1998 were also used for the selection of population. The number of certified venture firms in 2001 when venture boom reached at the peak in Korea is 503 firms. Among them, it is only 181 firms to maintain venture certification up to now (as of the end of October in 2005). These firms can be categorized as SVG, and then the rest of once certified venture firms (322 firms) in 2001 can be firstly classified as OVG. In the case of OVG, some firms had already disappeared due to bankruptcy or M&A or moving into other regions. Thus these firms need to be excluded from sampling. For the relevant sampling, this study used another database which is being updated annually by DSSC on the basis of survey works. By the above mentioned three additional sampling criteria (sector, business career and spin-offs), finally 28 firms of OVG and 39 firms of SVG are left as follows.

[Summary of population and sampling]

1. Population
 - 2001 certified venture firms: 503
 - 2005 certified venture firms: 395
2. Sampling criteria
 - First sampling: Venture certification
 - OVG: 322 firms, SVG: 181 firms
 - Second sampling: Sector/ Business career/ Spin-off
 - OVG: 28 firms, SVG: 39 firms

- Additional sampling: Successful and failed firms
- 9 IPO firms (IVCs) and a few bankrupted firms (FVCs)

This study was designed to recruit 10 firms respectively as interviewees from each group, and additionally 5 IPO firms which are registered in KOSDAQ market and 5 recently bankrupted firms. As a result of this sampling, totally 30 start-up entrepreneurs from selected firms were planned to be interviewed in this study. In addition, for the cross-checking, 5 venture capitalists and 5 government officials were also planned as interviewees. Table 13 shows the interview design and the number of interviewees.

Table 13. Interviewees – Groups, Population, Sampling and Numbers

Group		Population	Sampling	Target No. of Interviewees	Actual No. of Interviewees
Start-up founders	OVG	322	28	10	9
	SVG	181	39	10	10
	IVCs	9		5	5
	FVCs	(Many)	-	5	5
Venture capitalists		(A few)	-	5	5
Government officials		(A few)	-	2~4	3
TOTAL				37-39	37

Source: Author

5.3.3 Conducting interview and analysing data

The interviews were carried out in a two month period between February and April 2006. Email contact was used to approach interviewees in Korea from UK. Most of their email addresses were collected from the data in 'Venture Net' of SMBA website. This annual data contains quite detailed information about certified venture firms. A few changed addresses for interviewees could be renewed from the website of their companies. In the case of non-entrepreneurs, such as venture capitalists and government officials, it was not easy to obtain email addresses from UK. Thus, recruiting through 'snowballing'

needed to be used. Staff in Daejeon city hall provided the necessary telephone numbers of selected contacts, and they also introduced relevant phone numbers and email addresses for potential interviewees. Many potential interviewees showed a positive reaction. Most of them agreed to be interviewed. There were, however, a few who were not available during the fieldwork period. Detailed interview dates and times could not be firmly fixed with all interviewees in advance. This was particularly true for start-up entrepreneurs who had busy schedules. Thus, approaching interviewees had to depend largely on time in the field. In the end, the number of potential interviewees agreed to participate was more than the target number in each group. The list of interviewees contained exact addresses, contacting telephone numbers, and brief information about the firms collected on the basis of the statistics on SMBA website.

After arriving in Daejeon, Korea, interviews were started with CEOs of previously arranged target firms. Most of interviews were recorded by MP3 player under the respondent's agreement. Three interviews could not be successfully recorded due to some problems: one of them was terribly recorded because it was conducted in open spaced office environment, and the rest two of them were not recorded because interviewees seemed to be reluctant about recording. Note taking was done for all interviews including three unrecorded ones. In note taking, it was also focused on catching a certain notable interview atmosphere or non verbal expressions such as body language. Most of interviews often lasted longer than expected due to respondent's active and even enthusiastic attitude. Usually one or two interviews could be carried out per day and most of them were done in quite silent and non-intervened environment such as interviewee's office or meeting room. Interview questions were asked according to basically prepared interview guide, but in many cases, contingent and situational questions were often added, and some questions were not asked in case interviewees already replied to previous question. In the courses of interviewing, some interviewees who told a lot were allowed to keep talking as they could, but some who tend to reply just shortly to the questions were often encouraged by asking contingent sub-questions or providing more information. Contacting details for potential interviewees could be obtained from the interviewees who were already interviewed. They often recommended

a few start-up founders worth interviewing. It was very helpful for recruiting interviewees particularly in case of failed companies in that relevant interviewees could not be recruited in the UK. Interview was conducted as planned, and consequently field work in Korea could be completed within two months. Number of interviewed people was totally 37: start-up entrepreneurs are 29, venture capitalists are 5, and government officials are 3. One interview in once venture group was missing because it could not be arranged before the date for already booked returning flight to the UK due to his busy schedule.

Collected interview data is analysed to address how policy matters in the formation of start-up firm's 'government dependency' and its reproduction. Methods of analysis are following the ways of typical qualitative data generation and interpretation. Most of recorded interviews could be transcribed into word processor files within at least a few days after those interviews were conducted. It was quite useful to improve the way of interviewing. Listening to interview records during fieldwork provided some lessons for later interviews. A few interviews were transcribed in the UK where this work could be done more easily by using specialized transcription software named '*F4 for Windows*' which was downloaded from a website (<http://www.audiotranskription.de/english/>). This German freeware could save time and effort considerably. Transcription was done to contain all recorded data as complete as possible.

Transcribed text data was sorted into each interviewee groups: entrepreneurs, venture capitalists, government officials. Among these groups, entrepreneurs were divided again into four sub groups: once venture group (OVG), still venture group (SVG), IPO companies (IVCs), failed companies (FVCs). To organise this sorted data, it was sliced into several indexed data. Particularly, two entrepreneur groups of OVG and SVG were divided into 14 indexing categories each. Other groups were also categorised into several necessary slices. This indexing was carefully done according to the direction of already developed interview design for analytical purpose. Reading qualitative data in interpretive sense was very helpful to build relevant explanations and arguments (Mason, 2002, p. 148). The degree of indexing depends basically on the direction of analysis.

Too shallow indexing can cause difficulties to grasp meaningful points in qualitative data reading, but too detailed indexing may also bring about risks to loose broad analytical frame. Here in this analysis, it was focused on making each indexing category represent enough meaningful data in terms of analytical view point. Creating the right indexing categories from data set was not easy because the data set itself in this study is very large. This problem could be solved only by the cross checking between continuous interpretative data reading and going back to research questions and intellectual puzzle (Mason, 2002). This becomes the basis of interpretative explanation and raising argument.

As stated earlier, one of the research objectives is to explore the reproduction of government dependency in Daedeok by understanding reliance and persistence. Methodologically, empirical investigation about these two elements was conducted on the basis of the examination of institutional settings in Daedeok. Secondary data was used not only to prepare the qualitative interview in Daedeok, but also to produce the description and analytical explanation about Daedeok and Korean context (See following Section 6.4 and Chapter 7). The consideration of institutional settings of Daedeok-RIS (Chapter 7) focuses on addressing what institutional legacy of policy intervention have contributed to the reproduction of government dependency in Daedeok and Korea. Interview data analysis was conducted to address two main analytical elements ('reliance' and 'persistence') that have qualitative features.

6 LEGACY OF POLICY INTERVENTION AND INSTITUTIONAL PATH DEPENDENCY IN 'DAEDEOK - RIS'

6.1 Introduction

This chapter analyses Daedeok-RIS through a lens of a path dependency perspective to understand institutional settings that influence actor's business behaviour or strategy. The notion of path dependency is "*useful to understand why economic actors who face a fundamental change in the overall incentive structure behave in a way that would appear irrational to the external observer*" (Meyer-Stamer, 1998, p. 1495). Policy intervention affects this overall incentive structure particularly with its inevitable nature of selectivity. In this vein, an analytical review of the legacy of spatial and entrepreneurial selectivity in policy would be helpful to understand findings from the empirical field work in the next chapters. Daedeok can be seen, in some sense, the production of technopole policies to build a national innovation system. Establishing public research institutes and the continuous subsidising of their R&D activities have been concentrated on DST. This R&D orientation of Daedeok seems to have contributed to the formation of a regional growth trajectory. It can be seen as a comparative regional advantage, but at the same time, it may also be the possibility of regional lock-in. On the other hand, selectivity of firms as main actors in innovation systems is strongly found in overall Korean industrial policies. As seen in the case of *chaebols*, selection has been done by the government to choose promising firms worth concentrating national resources. Selected firms could get exceptional benefits and protection. The mode of this policy intervention is found in policy support for newly emerged economic actor 'venture' firms. Venture certification looks a typical selection mechanism to choose start-up firms for policy support. This selectivity makes firms respond not only to a market signal but also to a policy signal. In Korea, the selection and support mechanism in policy has been common and a long lasting mode of intervention. In this situation, firms may think that selection by the government can be very helpful for their survival in the market. Institutional reproduction of this selection and support mechanism in policy

regime can generate the expectation of benefit from policy exploitation and it can also influence firm's risk bearing strategy. In first section, policy intervention for supporting high-tech start-ups in Korea is reviewed. In second section, 'spatial selectivity' in policy and its regional legacy is discussed. Third section examines 'selectivity' in business support and its entrepreneurial legacy. This analytical chapter provides the basic understanding of policy intervention and institutional settings in Daedeok-RIS. It is expected to be a helpful basis in examining reliance and persistence through the qualitative interview analysis.

6.2 Policy intervention for supporting start-up ventures

6.2.1 Role of government for start-up promotion

The role and function of the government was absolutely crucial in shaping and promoting overall start-up sector in Korea. The history of policy initiatives for nurturing high-tech start-ups in Korea can go back to the attempt for facilitating venture capital company establishment in the mid-1980s. The first venture capital company was established in 1974 in the name of 'Korea Technology and Advanced Company' (KTAC), but its mission was focused on commercialising the R&D results from the Korean Advanced Institute of Science and Technology (KAIST). In 1981, 'the Korea Technology and Development Company (KTDC) was established by the government. Two more venture capital companies were consecutively established by financial institutions: 'the Korea Development and Investment Company' (KDIC) in 1982, and 'the Korea Technology and Finance Company' (KTFC) in 1984. These firms constructed the basis of venture capital growth in Korea under the umbrella of government protection and promotion (Seong, 2004, p. 161). At the same time, the government prepared statutory and institutional frameworks such as the '*1986 Support for Small and Medium Enterprise Establishment Act*' which defined the legal status of and benefits bestowed upon 'Startup Investment Companies' and the '*1986 Financial Assistance to New Technology Business Act*' which provided the legal framework for

another type of venture capital company, 'New Technology Financing Companies', which operated under the supervision of MOFE (Ministry of Finance and Economy), rather than SMBA.

In the United States, venture capital has developed in response to the market demand for high-risk/high-return investments. However, in Korea, after these laws were enacted, the government granted various forms of preferential treatment and relieved the regulations applicable to venture capital companies. In the discourses about government intervention, this was justified from a market failure perspective. It was argued that growth in the start-up sector could not be done without the existence of a mature and well-operating risk investment market and stock market. Equity investment by venture capitals or angel investors was a vital source for start-up firm's fundraising, but it could be risky due to several features of the start-up sector, such as information asymmetry between start-up founders and investors. Moreover, it is difficult if there is no 'exit market' such as initial public offerings (IPOs) through a stock market. In this regard, government promotion or protection to some extent may be inevitable when the market is not mature enough or underdeveloped. Ko and Shin (2000, p. 470-471) argue that "*the nature of venture capital is the appropriate allocation of the high risks that accompany projects with potentials for high returns among stakeholders, combined with heavy monitoring to reduce risks*", but the Korean scheme grants "*direct and indirect subsidies to a selected group of venture capital companies as indicated by law*".

These institutional efforts made the availability of venture capital easier by lowering the minimum criteria for initial capital investment. Moreover, the government encouraged VCs to establish a 'venture investment fund' with other investors and directly invested a considerable portion of the total capital fundraising. Most of venture capital in Korea operated two kinds of fund; their own funds and outside funds. Considering the big proportion of outside funds in VCs' fundraising (the proportion of VCs' own funds was usually 10% or even under), the possibility of a serious moral dilemma could exist in making investment decision for uncertain and risky businesses from their own funds or outside funds (VCs could be tempted to invest money for riskier projects from outside

funds not from their own funds). Although the scale of venture capital fundraising expanded remarkably since the mid 1990s, the dependency on external financial resources particularly public funds from the government still took the dominant position in the Korean venture capital industry. In this situation, early venture capitals in Korea were mainly a vehicle for implementing government-sponsored loan programs for start-up businesses, and there were difficulties in attracting outside funds or increasing VCs' own capital. Considering the risk of start-up investment, this structural feature of the Korean venture capital market looks problematic.

Since the end of 1999 through the year 2000, the venture capital market began to freeze because of the shockwave of the bursting of the venture bubbles, the experience of several incidents of fraud and associated market fluctuations. This phenomenon was partly influenced by the global economic downturn started by the stumbling US 'New Economy' in 2000 that even affected the Silicon Valley economy. However further fundamental reasons included market immaturity and institutional loopholes which were caused by the gap between the rapid growth of external factors and actual maturity of institutional infrastructure. Venture firms as well as venture capitals have relied too much on the government for funding (See Table 14 and 15).

Table 14. Investors in Investment Funds by periods (% of total commitments)

Period	Venture Capital	Government	Pension Funds	Institutional Investors	Corporations	Foreign Investors	Individuals
Before 1995	29	11	6	3	30	18	3
1996~1998	17	14.3	-	26.2	33.6	0.3	8.6
1999	15.2	15.3	-	13.6	33.3	1.4	21.2
2000	15.9	18.1	1.8	9.3	32.8	4.4	17.7
2001	20.2	32.2	4.6	5.3	27.6	1.1	9.0

Source: KVCA (Korean Venture Capital Association)

Table 15. Investment funds with and without government participation

		Number (%)	Million Won (%)
1996~1998	With Government	15 (57.7)	94,900 (55.5)
	Purely Private	11 (42.3)	75,950 (44.5)
1999	With Government	16 (21.6)	207,700 (45.6)
	Purely Private	58 (78.4)	247,668 (54.4)
2000	With Government	77 (41.2)	738,370 (52.2)
	Purely Private	110 (58.8)	675,625 (47.8)
2001	With Government	68 (76.4)	660,020 (90.3)
	Purely Private	21 (23.6)	70,980 (9.7)

Source: KVCA (Korean Venture Capital Association)

The government provided a wide range of direct and indirect benefits for both venture firms and venture capitals. ‘Certified’ venture firms and ‘registered’ start-up investment companies could enjoy explicit advantages and benefits such as tax abatement, grant or subsidy, cheap physical space supply, and so on. Venture firms can borrow money from commercial banks at a low interest rate and favourable conditions for redemption (but the detailed conditions differ in different cases and regions). The financial resources for these benefits come from the government budget. Both VCs and investors in VC funds are exempted from capital gains tax and securities transaction tax. In addition, investors in VC funds can deduct 30% of their investment from their taxable income (Kim and Lee, 2002).

In the history of government intervention in venture capital development in Korea, venture capitalists could not predict whether they could consistently receive special treatment from the government because of volatile political environment. Moreover, too much power in the hands of a few government officials had been a breeding ground to foster ‘rent-seeking’ behaviour or the chain of corruption. In the end, venture capitalists may have to assess non-economic factors in measuring the possibility of success of their venture capital projects. This set of political interventions was quite different from a venture capital driven system in United States (Ko and Shin, 2000, p. 474).

Throughout 1999 and 2000, the issues of a venture crisis or a venture bubble began to be raised seriously. Many start-ups were on the verge of bankruptcy and some of them began to collapse. Consequently, the investment of venture capitals withered. The government expanded the expenditure of public funds to revive dying venture firms. A representative example was the so-called 'Primary CBO' (Primary Collateralized Bond Obligation; hereafter 'P-CBO'). Originally this was a financing scheme through issuing high-credit CBOs with the basic asset formed by pooling newly issued low-credit corporation bonds. In this process, CBOs are treated as corporate bonds on the ground that they are issued through 'SPC' (Special Purpose Company) and the credit guarantee is provided by the 'Korean Credit Guarantee Fund' (KCGF) which charges a 1.5% fee for this service and screens the companies wishing to participate in this program (Shirai, 2001; MOFE website). In the second half of 2000, the corporate bond market in Korea was virtually paralyzed and the financial intermediary function did not work well. This market failure could have brought about a chain of insolvencies in the corporate and financial sectors. As investors became more sensitive to credit risk, firms with low credit rating faced difficulties in issuing corporate bonds. Furthermore, those bonds that were issued in 1998 during the venture boom period were maturing in 2001. The bond issuers have found it very difficult to rollover their bonds.

The government (MOFE) has argued that although the P-CBO might cause difficulties of financial propriety for firms that issue corporate bonds, it was inevitable to introduce the P-CBO in order to revive many promising venture firms dying because of credit crisis. However this policy measure has been criticized because it caused a serious vicious circle of public fund expenditure. In 2001, the Government issued the P-CBO with a value of 2.2 thousand billion Korean Won on the security of 808 venture firms' CBs (convertible bonds) and the KCGF provided credit guarantees for this P-CBO. But in 2004 the KCGF had to pay back about 700 billion Korean Won because it could not be recovered from the venture firms (MOFE, Joong-ang daily news dated 16/08/2005). As a consequence, the government had to consider how to avoid the default of the

KCGF. This phenomenon could be interpreted as a kind of path dependency caused by the large 'sunk-cost' which makes it difficult to escape from the existing path.

In summary, start-ups in Korea have been grown by the strong initiative and supportive policy of the government. Particularly, 'venture firm certification' by the legislation of '1997 Act on Special Measures for the Promotion of Venture Businesses' provided an overall framework for the government's venture promotion policy in the last decade. The government also enacted various other legal and institutional backup measures such as the low-interest loan program, venture capital promotion and participation in public venture fund establishment, provision of credit guarantee and P-CBO, KOSDAQ market opening. By being certified, the venture firms enjoyed not only these explicit benefits but also other implicit benefits. The government which took office shortly after the breakout of the crisis tried to push the reform in four major areas: the corporate sector, the banking and financial markets, the labour market, and the public sector. Venture promotion policy was considered as a way of breakthrough for the government to overcome the crisis and to accomplish the four major sector reforms in a short period of time. Consequently, the Korean economy bounced back to a surprisingly positive 10.7% growth of GDP in 1999, from its worst ever performance of -6.7% in 1998 (Ahn, 2001, p. 452). However, by the end of 2000, Korea's economy began to show 'reform fatigue' syndrome following the hasty complacency about the faster-than-expected economic recovery in 1999. Critics attributed this phenomenon to the government slowing down its efforts to eradicate bad debts within the corporate and financial sectors (*ibid*, p. 453). On the other hand, some people questioned whether the leading role of government in this reform and restructuring process could possibly cause other unexpected side effects in the near future. In other words, even though the government is pushing forward the reform in the public sector, the results can be called into question in that the government could be the subject of reform but simultaneously could be the object of it.

6.2.2 Institutional arrangements for 'venture policy'

In Korea, the beginning of venture-business support policy goes back to the *Plan for Vitalizing Venture Businesses* in March, 1997 and the *Act on Special Measures for the Promotion of Venture Businesses* in August, 1997. SMBA, established in December 1996, had a determination to promote venture firms and prepared the *Draft of Five Year Plan for Fostering Venture Businesses* in February, 1998.

Brief history of venture business support policy in Korea

Before 1997: The birth of venture firms

- 1986 *Act on Support for Small and Medium Enterprise Establishment* was enacted
- 1986 *Act on Financial Assistance to New Technology Business* was enacted
- 1995 KOVA (Korea Venture Association) was established
- 1996 SMBA (Small and Medium Business Administration) was established
- 1996 *KOSDAQ market* was opened

Between 1997 and 2000: Venture boom and recession period

- 1997 '*Stock Option System*' was introduced
- 1997 *Act on Special Measures for the Promotion of Venture Businesses* was enacted
- 1997 '*Venture Certification System*' was began
- 1998 *Special Committee for SMEs* was launched
- 1998 '*Tax benefit programme for venture firms*' was prepared
- 1998 '*Measure for vitalizing KOSDAQ market*' was launched
- 1998 '*Master Plan for fostering Venture Firms*' was presented
- 1998 '*In-lab start-up system*' was introduced
- 1999 '*Supporting measures for the start-up investment funds*' was prepared
- 2000 '*Designation of Venture Promotion Zone*' was began
- 2000 Entered to venture business stagnation (from April 2000)
- 2000 Venture crisis was deepen (from October 2000)

After 2001: Recession and revival period

- 2002 Strengthening of the criteria for the Venture Certification
- 2003 '*Measures for enhancing the transparency of venture capitals*' was prepared
- 2003 Strengthening the criteria for exclusion from KOSDAQ market

Source: Revised from Seol *et al* (2002, p. 63) and
Measure for the revitalizing venture firms (Korean government, 2004)

The above summary shows how the venture-business support policy commenced and changed from the beginning. According to the *Master Plan for Fostering Venture Firms* (1998), the government planned to foster twenty thousand venture firms in the five years from 1998, and to create 400,000 jobs through the fostering of these venture businesses;

half of the targeted number of venture firms created from new business start-ups, and the other half created by the transformation of existing firms to venture firms. To achieve this ambitious quantitative target, the government designed a 'total service package' for the fostering of venture firms that consisted of financial support, technology development, tax incentives, the provision of physical space and information, and other assistant measures. More detailed policy measures can be summarized as follows;

Start-up

- Introduce venture firm certification system
- Support firm formation of university students
- Provide information and incubating service

Financing

- Provide favored start-up loan program (low interest, extended pay-back term)
- Support venture capital establishment
- Allow venture investment from pension funds
- Introduce angel investment system
- Open KOSDAQ market

Physical business space

- Provide business incubation centres
- Venture building designation (provide benefits)
- Support 'venture park' development (low-interest loan)

Technology

- Introduce 'technology-secured credit guarantee' system
- Operate 'R&D support program' for venture firms
- Establish 'technology-support centre'

Labour (Human resources)

- Allow temporary retirement of professors/researchers to start their business
- Introduce and activate 'stock-option' system
- Expand 'exceptional military service benefit system' to venture firms

Tax

- Income tax deduction for venture investment
- Provide tax reduction and exemption incentives for venture business

The venture-business support policy started from focusing on stimulating new firm formation and gradually changed to backing the growth of prominent firms. In the beginning, for the government, the first step was to select the target firms. The government's venture certification system is a quite exceptional and unique institution in Korea. To provide financial support for firms must be always controversial in that it

allocates limited national resources not to all but to a few selected ones. In this respect, the venture certification system can be interpreted as a selection mechanism for the strongest firms who are worthy of benefits from the government. At the same time, it had the indirect effect that the government gave signals of trustworthiness to other players in the market. This system was fully operational in less than four years, creating over 10,000 venture firms. However, since 2000, it began to be criticized because of the reported wrongdoings of several certified venture firms. The increased number of certified venture firms began to undermine the belief in the system's ability to select competent firms. As neo-institutional economists assert, "*when the institutional environment is firmly established, organizations try to embed themselves in it, since such a maneuver dubs them as legitimate members in the given field*" (Jung, 2004, p. 124). Once a firm has been selected as a venture firm by the government, this recognition in a 'preliminary match' is likely to be misunderstood by other players who see it as a successful firm in the main game. It is possibly connected to the belief that if certified venture firms are in trouble or at a crisis, then the government will bail them out. This concern became reality after 2001 when many certified ventures were on the fringe of bankruptcy due to the busting of the 'venture bubble'. The government injected a huge amount of public funds to save dying ventures.

The effect of venture certification has not been studied much in Korea, but it is widely agreed in previous researches that market failures can exist in start-up sector and consequently governments need to intervene to correct them (Lee *et al*, 2003). Market failures in start-up sector can take place mainly because of high uncertainty and risk, information asymmetry or information gap, intangible asset of start-ups, etc. Particularly the existence of information asymmetry between entrepreneurs and external investors can be connected to the matter of 'moral hazard' or 'adverse selection'. Market failures can be found in venture capital industry as well due to mainly so-to-speak 'short-termism' of venture capitalists. It means that most of venture capitalists tend to be interested in firms which can provide profit for them in short period of time. These factors make it difficult for new start-ups to finance from banks and even venture capitals. As market failure perspective has been traditionally accepted by policy makers

as the justification of public intervention in the field of science and technology policy, it can be also powerful to justify why government should intervene in start-up sector. But as discussed before, recent system failure approach is providing a different justification of policy intervention. It is focusing on encouraging start-ups to interact with other actors for learning. Venture policy in Korea seems to cover both market failures and system failures in start-up sector.

Venture certification has been a starting point for policy intervention in Korea. However, it is questionable whether this role of certification should be undertaken by the government. In United States, this certification is generally conducted by mainly venture capitals in the market. According to the venture survey in 2004, the portion of certified venture firms by the first criterion (venture capital investment) was just 7% in national total and around 4% in DMC. On the contrary, the proportion of the third criterion (technology evaluation) was 73.5% in total and around 72% in DMC. Considering that over 90% of certified venture firms attracted investments from venture capitals (Lee *et al*, 2003, p. 84), these statistics show the considerable gap between 'market certification' and 'government certification' that existed in the Korean start-up sector.

This type of policy initiative can contribute to institutional settings, and institutions influence the economic activities of firms (Dobbin and Dowd, 1997). Yet, "*the effect of economic institutions is not always in its regulatory power, rather, in many cases, institutional measures are designed to affect a firm's behaviour in an indirect and subtle way*" (Jung, 2004, p. 124). In this respect, venture firms could get an institutional guarantee heightening their reputation in the market by the certification. This argument can be helpful to explain why firms were trying to secure venture certification. According to Baum and Oliver (1991), the survival rate of organisations is higher if they are closely linked to the institutional environment. This perspective from a neo-institutionalism can be partly helpful to explain why the survival rate of venture firms in Korea is much higher than start-ups in Silicon Valley.

After the selection of target firms for support, the next step was the provision of mainly financial aid. Financial and administrative support that accompanied venture certification could be very helpful for new start-ups who might be struggling to survive under the highly uncertain situation of their early stages. Potential investors might be encouraged by the positive impression of venture certification if they do not have enough capabilities to judge the firm's value accurately. Moreover, venture capitalists who received the government financing or fund managers of public funds might find it difficult not to be influenced by institutional recognition. The government wanted to make start-up financing easy, but could not find the solution within the banks as it did in the past when they supported the *chaebols*. Considering the characteristics of high-risk and high-return in venture business, the supply of risk financing can not be undertaken effectively by a conventional bank loan. The government tried to take advantage of venture capitalists as an intermediary function connecting venture firms to investors. In the United States, well-developed systems of venture capitals and angel networks take a crucial role in providing risk money. The distinct features of high-risk and high-return involves with a well-developed equity market like NASDAQ. Venture capitals can reap high returns from the invested firm's IPO and thus they are willing to bear high risks. The virtuous food chains among 'start-ups', 'venture capitals' and 'equity market' have been formed and operated by competitive market mechanisms in US. This interdependent network is called the core of 'start-up eco-system' (Moore, 1996).

In Korea, however, the government played an active role in formation and development of the venture capital industry. First of all, as noted before, significant legislation for securing the legal basis of the support was already in place. KOSDAQ market as an equity market for venture business was also installed by the government. To some extent, these institutional settings seemed to construct an external framework for a 'US type start-up eco-system'. But such a highly motivated institutional experiment must be very difficult to implement in the short term following the long tradition of a bank-loan centred system. The significant role of the government was likely to influence the high-risk and high-return mechanism of the venture capital industry. In the end, "venture

capital in Korea has become identified with limited-risk and limited-return investment” (Ko and Shin, 2000, p. 459).

In summary, the Korean government took a leading role in setting up an institutional framework for the growth of venture business. Start-up venture firms had to embed themselves in this institutional setting. They attempted to get venture certifications with the expectation of taking more benefits from the government. Venture capitals were also similarly influenced by the institutional setting. As discussed before, institutions tend to change following a path dependent way. Institutional inertia due to path dependency can be found in the change to ‘venture policy’ in Korea. Comparing it to the previous industrial policy, the new mode of government support for the *ventures* had a very close resemblance to the one for the *chaebols* because of the common ‘selection and support mechanism’ underlying both approaches. In this regard, it seems to be possible to suggest that the path of ‘government dependency’ might have been prevalent in nearly all of the Korean systems.

Then why, despite its inefficiencies, was this path persisted with? It might be partly explained by the historical and cultural factors in Korea. The Korean government has always undertaken heavy burdens from the beginning to develop the country. In this process, the government particularly which had a weak political legitimacy needed to show some visible economic performance to the people. The successful experience of rapid growth in the early stage of economic development was embedded into all Korean people. It created a path and this path had a strong inertia to a changed environment.

6.2.3 Implementation structure

Venture support programmes contributed to the rapid growth of high tech start-up and venture capital market. However, there have also been problems and side effects in the process of government intervention. Policy programmes in the meantime were mainly oriented to the quantitative expansion of start ups through ‘direct’ government intervention. The government tried to build up the ‘risk finance’ market for stimulating

venture investment which is crucial for the growth of high-tech start-ups. These artificial and direct interventions caused some unanticipated phenomena in a relatively short period of time. It might be argued that selection mechanism by the government of 'venture certification system' impeded the operation of market mechanisms, and consequently brought about the distortion of resource distribution in the market. Moreover, the concentration of benefit and protection for selected venture firms might interfere with natural entry to and exclusion from the market. The ability of government to control or manage complicated market mechanisms properly has always been questioned (Datta-Chaudhuri, 1990; Grand, 1991; Hefetz and Warner, 2004).

On the other hand, most of the venture policy was initiated by the central government. Even though SMBA, which is a sub-ministry level of administration, undertook central functions for venture policy, several ministries got involved in preparing and implementing various support programmes. Sometimes they were overlapped or mismatched due to the lack of integration among different ministries. However, unlike this overlapping and competitive involvement of ministries in central government, local authorities played a relatively limited role. The reason for this was partly due to most of the policy measures being constrained by the institutional or legal settings, and partly because local authorities could not undertake major roles due to their limited disposable budget. The weak role of local authorities made policy programmes in different regions very similar. Most of the local authorities in Korea could not afford to develop independent policy programmes which require a huge budget investment. Local authorities prepared detailed implementation plans to fit central government's institutional framework, taking cognisance of their own situation or capabilities. In many cases, policy programmes required local authorities to invest a certain portion of their budget as a way of 'matched funding'. For local authorities, participation in these matched funding programmes prepared by the central government could be a big burden on their finances. As a consequence, most of the local programmes focused on providing 'non-budget' services, or adding some more benefits for venture firms. Considering the competitive efforts of local authorities to make their cities or provinces more business-

favourable and innovative regions, similar local policy programmes were not a strange phenomenon at all.

As noted before, there were two special regions in terms of innovation in Korea: one was the capital region including Seoul city, and the other was the Daedeok region including Daejeon city. Seoul and its surrounding area (mainly Gyung-gi Province) showed an extraordinary concentration of nearly all the national resources and service functions. According to the large scale survey of venture firms conducted by SMBA, KOVA and KVRI (Korea Venture Research Institute), as of March in 2004, over 70 percent of certified venture firms were concentrated on Seoul Metropolitan City and Gyung-gi Province. Daejeon city and its surrounding area (mainly South and North Chung-chong Provinces) showed a high concentration of R&D oriented venture firms (23% - this percentage includes Gang-won Province but its portion is very minor). This was influenced by the existence of DST in Daejeon city. However, the total percentage of venture firms in Daejeon city and its surrounding regions was still not as big compared with the capital region – being respectively 5.5% and 7.2% in 2003, 2004. Except for these two extraordinary cases, most of the other regions showed similarly minor percentages. The agglomeration of innovative resources in Daejeon was unusual in Korea considering the situation that most of the national resources were concentrated in the Capital, Seoul. This exceptional case was undoubtedly enabled by the policy decision to build DST as a national R&D hub.

6.2.4 Support programmes for venture firms

As mentioned before, venture policy is closely related to other policies such as industrial policy, S&T policy, innovation policy. In practice, policy measures are also actualized through various forms of programmes. In this study, the main focus is on those policy programmes particularly providing financial incentives or benefits for start-up venture firms. It is because the 'select and support' mechanism (particularly financial support) gives a good indication of how start-up firms try to be certified as venture firms to take advantage of benefits from selection. As many previous surveys (DSSC, 2001; DSSC,

2003; DSSC, 2004; DSSC, 2005) indicate the majority of the start-ups in Daedeok were very keen to utilize financial support from the government. Financial support programmes can be broadly classified into following five categories:

- Subsidy or grant (for R&D, cooperation or collaboration, etc.)
- Favourable policy loan (credit guarantee, lowered interest rate, etc.)
- Venture investment (public funds, venture capital, stock market, etc.)
- Indirect financial support (providing cheap business spaces, tax benefit, etc.)

• ***Subsidy or grant provision***

Government ministries provided subsidy or grant for start-ups to support their R&D activities or to encourage cooperation with universities or research institutes. MOST usually provided the R&D budget for public research institutes through KSEF. Unlike R&D subsidies in the past, most of the public R&D programmes imposed conditions that applications score more highly in the screening process if those applications contained a scheme of collaboration between research institutes or universities and industries. In this regard, spin-off and certified venture firms in Daedeok could take advantage of R&D subsidy or grant through the cooperation with public research institutes in DST. In some cases, public research institutes suggested a kind of sub-contract for joint R&D with venture firms spun out from them. This cooperation provided a few merits for both the research institutes and the venture firms in that research institutes could secure more R&D budget from the government and could solve the problem of the lack of a capable R&D workforce; on the other hand, venture firms could save on their own R&D spending and utilize the high-priced R&D facilities in public research institutes. Most of the government ministries such as MOCIE (Ministry of Commerce, Industry and Energy), MIC (Ministry of Information and Communication) had their own programmes to encourage the cooperation between industry, university and research institutions. Certified venture firms were in an advantageous position to take part in and win these programmes. Once a venture firm won a government programme, then it could gain the advantage of meeting not only its R&D needs but also its ordinary running expenditure such as personnel expenses. Government grant regimes imposing conditions requiring collaboration could be

evaluated positively at least in terms of quantitative performances. It contributed to the induced behavioural changes of the actors not to act independently but to cooperate with others. However, previous studies were quite rare indication how these outputs have been actually utilized by venture firms. If the induced collaboration was just superficial cooperation for getting grant or subsidy from the government, then any benefits could be partially eroded by this grant-chasing behaviour.

- ***Policy loan and credit guarantee***

The government provided very favourable 'policy loan' programmes for venture firms. Relatively lower interest rate and longer pay-back term than general loan were given to them. The central government established a special fund for SMEs through a scheme of matched funding with local authorities. This fund was usually lent to commercial banks via the annual budget of local authorities including the above favourable conditions. In this process, most of the local authorities provided this lower interest rate through their own budget. Certified venture firms could usually lend money from this government fund through most of commercial banks on the most favoured condition. For example, Daejeon city has suggested an additional 5% lower interest rate for certified venture firms. If the current interest rate for loans from commercial banks was around 10%, then the interest rate of the government fund for SMEs was suggested between 7~8% to local authorities, and then local authorities compensated the gap of interest rate between the suggested rate by the government and the interest rate which local authority suggested to commercial banks. As a result, venture firms in Daejeon city could lend money at rate of interest between 2% and 3%. This policy loan programme was particularly helpful for venture firms in the period of high interest rates. However, this scheme might not be attractive for venture firms because most of the start-ups did not have sufficient financial security as required to be provided by the banks. Thus, the government prepared a credit guarantee programme. A few credit guarantee funds or foundations were established on the initiative of the central government. They provided credit guarantees for venture firms through credit screening and technology evaluation. There were three kinds of credit guarantee agencies in Daejeon such as the branch of KCGF (Korea Credit Guarantee Fund), KTCGF (Korea Technology Credit Guarantee Fund), and DCGF

(Daejeon Credit Guarantee Foundation). The credit guarantee system could make the policy loan programme very practical, but if the credit guarantee agencies did not have sophisticated evaluation abilities, public money could be wasted repaying the debt of bankrupted firms. KTCGF, in particular, evaluates venture firm's technology and issues a guarantee letter if it was judged as an 'excellent' technology. This guarantee letter could be regarded as the same as financial security. On the other hand, start-up firms could apply to KTCGF to undertake technology evaluation to obtain 'venture certification'. However it was questionable how the staff of KTCGF can properly evaluate the level of technology of spin-off start-ups from DST. It could be considered as nonsense if start-up CEOs had to apply for technology evaluation just for getting a venture certification or a guarantee letter, even though they had much higher level of technology than the staff of KTCGF who was in charge of the technology evaluation. The technology of venture firms could be correctly and naturally evaluated in the market. In this regard, it was controversial if this type of administrative technology evaluation by the government established organizations could properly reflect the real market value of technology (Lee *et al*, 2003; Jung, 2004).

- ***Fund-raising for venture investment***

As mentioned before, the venture capital industry could grow rapidly because of the government's policy efforts. However, most of the venture capital companies were located in Seoul and their investment was also concentrated on venture firms in Seoul and the area around the capital. A recent venture survey (2004, SMBA *et al*) showed the percentage of venture firms who attracted investment from venture capitalists was higher in Seoul and the capital area than other regions. This means that venture firms in non-capital regions have largely been excluded from venture capital investment. This phenomenon might be partly because venture firms who were worth investing in were concentrated on the capital area, or partly because venture capitalists did not put in sufficient effort to find promising venture firms in non-capital regions. The first generation of venture firms who led the 'venture boom' were mostly 'dot-com' companies. They were concentrated on 'Teheran Road' in Seoul. However, most of the venture firms in Daedeok had a manufacturing base which required relatively large

initial investment for setting up facilities. This characteristic might be less attractive for venture capitalists than 'dot-com' or software companies in Seoul. During the venture boom period, venture firms in Daedeok could not attract much attention from venture capitalists. Only one branch of a venture capital companies was located in Daejeon until 'venture bubble' started to burst around 2001. The venture bubble could be seen as a result of 'blind investment' by venture capitalists or angel investors to 'dot-com' venture companies. Daejeon city created 'public venture investment funds' to encourage venture investment for start-ups.

The first 'Daedeok Valley Venture Fund' was created in 1999 on the scale of 10 billion Korean Won (approximately 5 million GBP). Since then, five more venture funds were created, so far on a similar scale of the first fund respectively. Venture capitalists, as an operating party, invested around 10~20% of the total size of the fund. Usually SMBA invested 30% and Daejeon city invested 10~20% respectively. The purpose of these funds was obviously focused on stimulating investment of venture capital in Daedeok Valley. However, venture capitalists who had opened their branches in Daedeok for managing Daedeok Valley Venture Funds left Daedeok after the 'venture crisis' from around the end of 2000. In this respect, a question needs to be asked: why venture firms in Daedeok could not attract much attention from venture capitalists even though they have relatively quite high levels of technology?

To answer this question, it is possible to assume that start-ups in Daedeok, in particular spin-offs from DST might be more dependent on their previous path. Most of spin-off start-up CEOs in Daedeok had working experience in public research institutes as researchers or engineers. They were relatively familiar with R&D subsidies from the government due to their long experience of S&T policy. According to the survey report (2003, DSSC), over 70% of start-up CEOs in Daedeok had working experience as researchers (63%) or engineers (10%). On the other hand, around a half of start-up CEOs (46%) in above survey replied that they relied on government support such as subsidy or grant to secure their R&D budget. From the case of Silicon Valley, it has been widely accepted that market-oriented start-ups can be more successful than

technology-oriented start-ups. Venture capitalists are usually more interested in a clear exit strategy from their investment than complicated technology itself. On the other hand, it could be assumed that venture capitalists in Korea did not have enough ability to evaluate the future market value of high technology. Considering the rapid growth of the venture capital industry and its high reliance on government funding, this weakness of venture capitals might be natural to some extent.

- ***Other indirect financial support***

Certified venture firms could rent very cheap physical space for business such as BI (Business Incubator), Post-TBI (Post-Technology Business Incubator), VIB (Venture Integrated Building), VBC (Venture Business Complex). These premises were usually established in universities or research institutes by government funding. In the case of BI, small units were provided for venture firms at the start-up stage for a really cheap rent. Construction costs of BI were funded by the government. Universities or research institutes provided their land for the construction of BI and manage the units. As of the end of 2004, there were 22 BI centres which have a total of 376 incubating units, 13 Post-TBIs and VIBs which provided 148 business spaces, 6 VBCs in which 81 venture firms were housed (Daejeon city, 2005). These various types of cheap physical accommodation were suitable for the growing stage of start-ups: starting from business incubator at the initial stage, moving to a large space for Post-TBI or VIB, and then settling down in VBC or other industrial complexes if they needed to build their own facilities or factories. This programme was very helpful for rapidly growing start-ups who have to move accommodation often because they did not have to invest large amount of money renting high-priced business space. Another indirect financial support was tax benefit for venture firms. Various tax reductions or exemptions were provided for certified venture firms as prescribed by the statute. Thus, tax benefits were usually applied to venture firms on similar conditions.

This section provided descriptive information on the venture policy in Korea as a central context. In summary, the venture promotion, initiated from 1997, has had a wide range of impact on social, economic and regional changes. 'Venture policy' has its

institutional background of 'selection and concentration' like most of other policies in Korea even though it consists of various support programmes. Indeed, the role of the Korean government was central in promoting high-tech start-ups. Providing the concentration of policy support for those selected targets seems to be an efficient and effective way especially in transition economy like Korea. This type of active intervention for 'venture promotion' has been, however, a controversial issue in terms of its performance and side-effect. This study does not, of course, attempt to enter into this issue further, but it provides an implication for this study in exploring how the policy intervention has influenced the business behaviour of start-up firms. As discussed above, 'selection and concentration' can be seen as the core mechanism of venture policy and it seems to have been persistent in most of industrial, regional, science and technology policies. Most of venture programmes focus on providing financial assistances for selected start-ups. This direct and incentive-based support can largely influence firm's risk perception and risk spreading strategy. In this respect, institutional set-ups induced by policy intervention have an impact on actor's business behaviour and strategy.

6.3 Selection of the firms and entrepreneurial legacy

6.3.1 Industrial policy in catching-up model

Science, technology and industrial policies in Korea have largely been shaped by the 'catch-up model' as an overall economic development strategy. The state took a pivotal role in this model. The Korean government was successful in the early stage of economic development by effectively adopting a development strategy based on government initiative (Lucas, 1993). Most of the policy measures by the government were, arguably, appropriate and timely, and the interaction between the government and the market was well-coordinated (Evans, 1995). However, the policy evaluation seems not so simple and easy because over the past five decades policy aims and measures have been variously changed in the turbulent periods of rapid economic growth. As Shin and Chang (2003, p. 42) say, it is well known that "*the Korean 'miracle' was achieved*

on the basis of extensive industrial policy measures.” Since the early 1960s, the Korean government has practiced industrial policy aimed at developing, guiding, and supporting industrial development. It basically focused on shaping Korea’s economic structure. In doing so, the government needed to intervene in the market for correcting ‘market failures’. This seemed an inevitable choice for the Korean government under the condition that national resources available to be mobilised were limited, the private sector was poorly developed, and people were distressed due to the poverty and political uncertainty after the Korean War.

This section briefly examines how policies have changed in different policy environments. Economic policy depends on constantly changing factors such as the nature of market failures facing the economy, the scope and effectiveness of policy instruments available to government (Leipziger and Petri, 1993, p. 1). Korea’s industrial policy has served its economic growth well in many ways, but it has created a few problems as well. Three main areas are linked to these problems: the *chaebol*, the financial system, and past successes (Szamosszegi and Prestowitz, 1997). Among these intertwined problems, in particular, the third problem ‘past successes’ gives a meaningful implication. It seems to be an irony that successful past experience causes problem in future. As stated already, the ‘visible hand’ (Chandler, 1977) of the government intervention have molded Korea’s industrial bases and generated rapid economic growth. Despite this success, however, there has been a growing consensus in Korea that the legacies of the industrial policy paradoxically make the breakthrough of its inertia difficult. In Korea, market failure has been used as a representative logic of justification not only for industrial policy but also science and technology policy. It is impossible to look at industrial policy in Korea without saying ‘*chaebol* policy’ and ‘financial sector policy’.

The *chaebols* can be regarded as a natural ‘byproduct’ of the industrial policy practiced during the period from the 1950s to 1970s. They are large in scale, broadly diversified, and vertically integrated business conglomerates that dominate Korea’s economic landscape. According to Bang and Kim (2003), the relationship between the *chaebols*

and the state has been transformed from the so-called 'honeymoon period' in the early stage to 'conflict period' in the later stage. During the honeymoon period (1961-1979), the government picked a few companies and provided various special favors (benefits and protections) for these selected players. Chaebols could expand their external scale in the process of unbalanced economic growth, and consequently get a monopolistic advantage by this governmental policy. In times of economic crisis like the 'oil shock', *chaebols* showed a strong reliance on government policy intervention rather than seeking their own flexible solutions (*ibid*, p. 11). After the first and second oil shocks, the Korean economy was seriously challenged. It meant that 'sensitivity dependence' and 'vulnerability dependence' in the Korean economy became to deepen structurally (Lee, 1993, p. 211). The government could control *chaebols* effectively by various policy measures through banks, e.g. credit management system. However, during the period of conflict period (1980-1997), the government's view of *chaebols* began to change as it revealed the *chaebol's* problems such as their collusion with banks, unfair intra-group transactions and excessive diversification. Following the collapse of the totalitarian regimes, from the early 1980s, there was a massive demand for democratization in Korea. The rapid growth of *chaebols* and their increasing political influence made the vertical symbiosis between the state and the *chaebols* difficult to continue. The government tried to regulate *chaebols* through economic reform to relieve their dominant influence on the overall Korean economy. The so-called 'real name system in money transaction' was a representative measure for economic reform focusing on *chaebols*-regulation.

Since the economic crisis in 1997, according to Bang and Kim (2003), the Korean economy entered into 'competition period' (1998-Present) between the state and *chaebols*. Far reaching reform programs after the crisis, particularly corporate sector reforms strengthened government intervention in the market. The government promoted 'Big-deal policy' was a coerced restructuring program for *chaebol* regulation. One aspect of this policy was linked to 'venture policy' to foster start-ups. High-tech start-up venture firms were regarded as a promising substitute for *chaebols* and as a new engine for continuous economic growth. The government had been interested in SMEs since the

early 1980s expecting their high flexibility to complement the *chaebols*'s rigid adaptation capability. However, SMEs could not develop as a main player in the Korean economy due to the influential shadow of *chaebols*. However, the unprecedented crisis situation changed the role of venture policy. Thus, venture support policy needs to be examined through the combined perspective of the conventional industrial policy and science & technology policy, particularly in relation to the understanding of Daedeok. At the same time, it is also required to be reviewed from the viewpoint of innovation policy given the greater emphasis placed on its role by the current government.

6.3.2 Selected actor '*chaebol*' and its legacy

In the background to Korea's spectacular economic performance over the past three decades, there was the government's policy initiative. Through the period of rapid growth, it undertook several roles simultaneously: as an owner, a financier, a trader, a cheerleader, and a strategic planner (Szamosszegi and Prestowitz, 1997, p. 90). As discussed above, the heart of a typical industrial policy was a strategic market-conforming intervention on the basis of a cooperative trust relationship between the state and enterprises. The state selected a certain industrial sector strategically and allowed entry to the market for only selected firms who fit with its criteria. At the same time, the state not only provided them with several benefits and protections, but also monitored their performances (Johnson, 1982). In the case of Korea, industrial policy had strong characteristics to support not overall industrial sectors but individual firms like a few *chaebols*. The government used the performance of firms in export markets as a selection criterion in extending financial and other support in 1960s (Lim, 2001, p. 6). It provided selected exporters with various benefits such as tax reduction, tariff exemptions, etc. At the same time, excellent export performers were given national recognitions such as medals, awards, or certificates to encourage them.

In this economic development drive, as stated above, the Korean government has deliberately introduced limited competition by lowering entry barriers over time and by monitoring market failures by major *chaebols* in order to maximize efficiency of limited

resources (Pyo, 2000). For undertaking this role, it adopted active policy measures such as credit guarantee for foreign debts to share the investment risks of private sector by the formation of a risk partnership with the *chaebols*. This type of drastic measure could be operated in effect through the controlling power of the government on banking and financial sector. The government could compensate for the capital market imperfections, and remove the constraints that had made it difficult for firms to challenge profitable but risky projects surpassing their own capabilities. Government-backed debt financing, however, used to create moral hazard problems. Moreover, this type of active government intervention vested government officials with a strong power of discretion, and consequently induced firms to coerce officials in order to be successful in this selection mechanism. Nevertheless, what the Korean government did is seen quite 'right' in the take-off stage in that market failure mainly due to the capital market imperfection could be effectively addressed. In 1970s, the Korean economy began to push Heavy and Chemical Industry (HCI) drive. This sector is quite capital intensive sector to which the scale of economy can be applied. The government focused on selecting a target group of large conglomerates and providing them extremely generous financial support. As a consequence, massive resources were channelled into the *chaebols* to sustain huge-scaled investment projects. During this period, the size of the body to the extent of undertaking excessive investment and consequently competing with big foreign competitors became an important selection criterion from the government's point of view. This strategy seemed to be inevitable considering the situation of the Korean economy pursuing catching up formidable foreign forerunners within short period of time. The *chaebols* could gain their gigantic size in this process, and it was making the myth of a 'too big to fail' for them. They were gradually becoming the 'Goliath' in the Korean economy through 1970s and 1980s. As a result, it became increasingly difficult for the government to control them like before. This indicates that increased systemic risks were growing in overall Korean economic system.

In 1980s, fundamental claims about the desirability and effectiveness of government intervention used to be suggested by scholars and technocrats. Behind these claims, there was the recognition of increased domestic and foreign pressure for liberalisation

and democratisation (*ibid*, p. 15). The necessity of more market-oriented economic system was raised on the basis of the concern that the government intervention had cast menacing shadows over the country's economic landscape. Scepticism about the model which produced past success began to be emerged. Amid a rapidly changing global economic environment, the previously adopted 'factor-input oriented' and 'export-led' growth strategy on the basis of government intervention appeared to be no longer feasible for sustainable development. Rapidly rising labour costs and fierce global competition forced Korea's policy makers to consider a new strategy for the future. Given the situation, the government began to pay more attention to, on the one hand, the openness, deregulation, liberalisation in the market, and on the other hand, the global technology competitiveness. When it comes to the former attempt, however, it seemed to be ambivalent in that the inertia from previous path of intervention such as protection or promotion could not be easily harmonised with the newly imposed policy challenges like deregulation. Before the economic crisis in 1997, the government-led controlling or monitoring schemes were remarkably reduced, but a transition to a more market oriented system had produced several dysfunctional problems. Institutional settings and socio-cultural norms are not likely to be changed within short period of time, although the planners intend to drive rapid reforms. In this regard, it can be said there was a sort of mismatch between intervention mode and socio-economic changes.

As mentioned already, major industrial sectors in Korean economy were changed from the light industry to the heavy chemical industry in the process of rapid industrialisation. Its manufacturing competitiveness in those sectors was mainly coming from low costs for factor-input like labour forces. The comparative advantage based on low labour cost, technology imitation, and foreign debt could make Korea's catching-up model in effect. However, simply increasing factor-input became no longer feasible under the transition of global economy toward more knowledge-based one. The Korean government has taken an active role in financing R&D since the early 1970s, but most of R&D projects by public subsidising have not well connected to technology transfer or technology commercialisation. As the private sector grew fast, the locus of R&D function began to be shifted from the government to private firms. This forced fundamental changes in

Korea's science and technology policy. Changes in science and technology policy were closely associated with changes in industrial policy. In 1990s, the Korean government began to target the high-tech industries to improve its technological capabilities in line with those of the G-Seven countries (the Group of Seven industrialised countries). Particularly, information and communications industry was adopted as one of fastest-growth sectors, and huge investment began to be concentrated on it. This change in environment and policy can be seen as the basis of 'IT venture boom' in the late of 1990s.

This industrial and entrepreneurial legacy faced serious criticism by the outbreak of IMF crisis in 1997 (Hong, 1998; Ahn, 2001; Hart-Landsberg and Burkett, 2001; Crotty and Lee, 2002). Since 1998, the Korean government has promoted the policy of a full-scale venture-business support package. At that time, after the outbreak of the IMF crisis, *chaebols* were regarded as the first target to be reformed, and due to serious credit restrictions, SMEs suffered from the occurrence of bankruptcy, and the financial sectors were not operated at all. The government needed to find an escape hatch from this unprecedented crisis. As IMF (2003) described, the economic crisis in 1997 can be basically seen as a twin-crisis: a combination of domestic banking crisis and foreign exchange crisis. Under the IMF mandated bail-out schemes, Korean industries had undergone a massive restructuring. In the process of this extensive reform, high-tech start-up ventures emerged as a new growth engine, an alternative actor replacing *chaebols*, and the catalyst of job creation. As noted in previous chapter, the government first of all prepared the institutional basis through the enactment of the special law in 1997. According to this law, venture certification system was firstly introduced to select promising start-ups worth supporting. For certified start-ups as 'venture firms' by the government, various supports mainly financial assistances were provided. The creation of this venture policy is similar to conventional industrial policy in that the state strategically selects target firms and establishes criteria to support and provides financial benefits for them. It appears the risk partnership between the government and business which have been formed from the past is still operated in venture policy. According to path dependency perspective, a previously chosen path is more likely to be persistent

when it has successful history in the past. In Korean context, government policy intervention in the way of promotion and protection has successful memory in terms of particularly effectiveness and efficiency. Then, it can be assumed this successful mode of policy intervention in the past may persist in the future even in newly emerging sector and a new field of policy. As Lim (*ibid*, p. 21) argued, ‘*old habits die hard*’ and old legacies can remain in the future, particularly in case they were successful in the past. This issue would be further argued in following section.

6.3.3 Revival of ‘select and support’ mechanism in venture policy

Venture firms emerged into the Korean economy as a new growth engine in the process of overcoming the economic crisis. Their rapid growth and several successful stories encouraged not only young entrepreneurs to dream of becoming a millionaire, but also enabled policy makers to escape from the inefficiency of the *chaebol*-dominated economic structure. However, when the Korean economy was boiling over into ‘venture boom’, ironically venture firms began to reveal similar growth paths to those *chaebols* followed in the past. Financial impropriety and corruption began to be prevalent in the overall venture business sectors including the venture capital industry, KOSDAQ market, supporting agencies, government officials and politicians. The government established a few ‘credit guarantee funds’ to secure loans made to the venture firms by the banks. Venture capitals could establish ‘outer funds’ by the investment from the government. These are quite similar to the credit allocation for *chaebols* through the scheme of ‘policy banking’ in the past. As fundraising became easy, some ‘certified’ venture firms by the government did not know what to do with the excessive money attracted from investors, and some of them even invested the money in other venture firms expecting capital gains. This reminds the past that the *chaebols* tried to increase their controlling power over the financial sector since the government divested itself of the banking sector in the early 1980s. They began to move to acquire shares of major banks or to gain ownership of new sources of capital. Most of *chaebols* were keen to have insurance companies for receiving funds from them in the way of shareholdings or loans. It is ironical that this type of transaction and investment of *chaebols* is similarly found in

newly emerged start-up sector. Some IPO venture firms who made large amounts of money through the stock market tried to expand and diversify their business domain under the pretext of strengthening their 'core competence'. This also resembles chaebol's extreme diversification in some sense.

Path dependency perspective provides useful insights to understand the irony that why and how venture firms as the 'anti-chaebols' became paradoxically locked into a path which *chaebols* have trodden. The cause of this phenomenon might be variously argued according to different points of view, but there are two main probabilities which could be suggested in this study: government intervention and weakness of basic economic structure. Policy intervention in Korea has undoubtedly contributed to the makeup of the institutional setting, and these changes influence the economic activities of firms. As argued by neo-institutional economists, when the institutional environment is firmly established, organizations try to embed themselves in it. Thus, it can be assumed that if institutional changes are path dependent, then firm's entrepreneurial activities would also be path dependent.

The purpose of policy intervention in Korea has been considerably changed and diversified up to recent years, but the mode of intervention has followed typical path dependent ways, particularly in the field of industrial policy. Two central patterns of intervention are found in both conventional *chaebol*-oriented industrial policy and recent venture-oriented policy. The first one is a 'selecting' mechanism and the other is a 'supporting' mechanism. As seen in supporting the *chaebols*, the state selected some promising target companies according to a certain criteria like the performance of export, and then concentrated various resources and financial aids on them mainly through financial organizations like banks. One of the most powerful policy tools for shaping the process of economic development is controlling the flow of money, or more broadly, the flow of credit through financial system. It is because this tool can have a vital impact not only on economic activities but also structural development of economy. Government policy, in the meantime, tried to not only enrich the *chaebols*, but also create the environment to encourage them risk-taking. The government was a risk partner in

supporting these strategic enterprises. It shared risks mainly by financial tools such as by guaranteeing foreign debt, by providing debt relief for companies in distress, and by setting lowered interest rates for launching big projects than market-determined rates. This type of implicit guarantee could encourage a few selected enterprises to venture into new industries, to dare to invest huge money in building production facilities in excess of their capacity levels. In this process, however, the average debt-to-equity ratio of these companies began to be sharply increased. This problem became eventually one of the main reasons of IMF crisis in 1997.

The combination of this 'select and support' mechanism is found in venture policy, and its impact seems to be also quite similar to *chaebol* policy in some sense. 'Venture certification system' by the government has played a sort of selection scheme to pick up promising high-tech start-ups. As the *chaebols* showed strong reliance on government support and protection for a long time, certified venture firms showed similar strong reliance on governmental financial supports and protection. In particular, through the government selection mechanism, there is a belief that if certified venture firms face a crisis, the government will bail them out. This concern came true in reality from 2001 since many certified ventures were on the fringe of bankruptcy due to the bursting of the 'venture bubble'. The government injected a huge amount of public funds to save dying ventures as seen in the case of 'primary CBO'. This looks quite similar resemblance found in a few cases of bailout by the government for *chaebols* at bankruptcy crisis. On the other hand, support mechanism of the government for selected venture firms has been used in the way of mainly direct financial support such as grant provision, credit guarantee and tax relief. When it comes to this type of support, it is not so strange at all comparing with policy schemes previously adopted for the *chaebols*.

As noted before, venture policy was initiated in the beginning as a relief programme at a time of crisis to create jobs and to replace traditional actor '*chaebols*'. This circumstance at that time seems to be linked to the above mentioned paradoxical phenomenon. It implicitly indicates that venture policy in Korea was launched with a framework of industrial policy rather than innovation policy. In this argument, innovation policy is, of

course, understood through a systems approach. Start-up policy can be said to have two aspects: one is to foster new firm formation, and the other is to promote interactive learning in business. Unlike a linear model approach that emphasize the input factor increase, innovation system approach focuses on encouraging firms to cooperate with other actors for the acquisition and utilization of knowledge. According to system failure perspective, this purpose of intervention is seen as an attempt to correct 'system deficit or imperfection' such as path dependency and lock-in. The lack of networking, interaction, or collaboration has been suggested as a source of path dependency that can lead system to fail. In Korea, there have been, of course, policies for encouraging cooperation between firms and other actors, but those policy measures have not been closely combined with start-up policy (more specifically venture policy) at least until new presidential term of Roh, Moo-Hyun government started in 2003. When the venture policy was born in 1997, the ex-president Kim, Dae-Joong put venture promotion on the top place of policy agenda to primarily create more jobs. According to this policy aim, new firm formation in numbers as many as possible was more emphasised than its dynamic entrepreneurship in the market. In this regard, the period of venture boom between 1998 and 2000 can be seen as a consequence of this active policy intervention. In the wake of political power shift, however, regional innovation and balanced regional development began to be more emphasised than venture promotion. It brought considerable policy changes in the field of venture businesses. However, venture policy has still maintained its basic skeleton to some extent, and the combination of 'select and support' mechanism in terms of policy tool is also still in operation.

6.4 Selection of the space and regional legacy

6.4.1 Spatial selectivity in unbalanced regional development in Korea

As mentioned above, an 'imbalanced development strategy' was one of the main factors which made rapid economic growth possible in Korea. During the 1960s through 80s, the Korean government exercised a 'growth pole' concept (Perroux, 1970; Parr, 1973;

Parr, 1999) of regional development. This strategy calls for the rapid growth of the national economy focusing on export oriented mass production on the basis of cheap labour forces. It was expected that the economic wealth produced and the employment created in the growth pole would permeate into other sectors and regions. The government prepared some main legal frameworks to support this policy such as National Physical Development Planning Law in 1963 and the Export Industry Estates Development Law in 1964. On the basis of these institutional instruments, the government constructed industrial complexes for large export-led firms in selected and favoured regions (Park, 1998). In this regard, regional development policy in Korea has been traditionally developed in association with the strategy in industrial policy. The Korean government developed several large industrial complexes to establish national production systems especially in the south-eastern part of the country. The location decision of this spatial industrial agglomeration was influenced by several economic and political factors such as locational advantages, decentralisation, and other political considerations. *Chaebols* also contributed to the growth of industrial cities by establishing large branch plants. As a result of this spatial industrial policy, major industrial cities or production clusters were created in Korea. However, these industrial complexes in some regions were just simple agglomerations with only limited local inter-firm linkages or significant intra-regional production networks (Park, 2001, p. 32).

According to the Keynesian theory of 'cumulative regional growth' (Chisholm, 1999), once a leading manufacturing company is induced into a growth pole region, it is expected to create a successive chain of subcontracting firms supplying components and materials. Then there would be growing numbers of employment in that manufacturing sector. Consequently this would be connected to the population growth and lead into increase in the revenues of local authorities, enabling the local governments to invest more in infrastructure development. This chain of effects in the leading region would spread out to the surrounding regions through the forward and backward inter-regional linkage before attaining an equilibrium growth. This model has legitimised the government intervention in regional development to achieve the goal of growth pole driven economic development. However the negative aspects of this model have been

raised such as the increasing government role, the growing bureaucracy, the deepening regional dependency on national subsidies for provision of public services.

Reflecting these negative issues, many scholars and policy makers have paid much attention to the new possibility of endogenous development models (Markusen, 1995; Park and Lee, 1997; Park, 1998). This newly emerged model is a more dynamic and evolutionary one. It places more emphasis on the technological development and regional innovation than the traditional approach. According to this new approach, a 'competitive advantage' in a region is more important than a comparative advantage. This point of view is found particularly in regional innovation system theory (Braczyk, Cooke and Heidenreich, 1998; Cooke and Morgan, 1998) or cluster theory (Potter, 1998). The economics of agglomeration in a specific location is important in terms of a geographical perspective, but simple agglomeration is not enough to create a synergistic effect in a region. As Krugman (1994, 1998) says, regional competitiveness comes from high productivity created by geographical and functional clusters of interrelated industries and their production factors. A regional innovation system requires coordination with various actors, including firms, universities, venture capitalists and local governments, etc.

In fact, Korea has suffered from serious problems of regional imbalance and disparity. In the process of rapid industrialisation and urbanisation, most of national functions or resources have been overwhelmingly concentrated in Seoul and its surrounding capital region. There have been a few policy efforts for decentralisation to sort out much inefficiency from this problem. However, the capital region have increasingly absorbed more resources like a 'black hole' on the basis of its ready made favourable factors such as advanced infrastructure, easy access to financial and other services, the availability of high skilled human resources. As the government has made an effort to improve knowledge-based high-tech industries, the capital region's advantages became more powerful to attract firms in that field. In 2003, the new presidential term began as the president Roh, Moo-Hyun administration was launched. The government put 'balanced national development' and 'regional innovation' on the top of policy agenda. It

emphasised the importance of innovation-driven economy, and suggested the building of regional innovation capacity to pursue it. In this regard, regional innovation policy needs to be approached basically by the connection of regional development policy and innovation policy.

6.4.2 Selected 'techno-pole' Daedeok and its legacy

Spatial selectivity in Korea is also applied to the government intervention in science and technology policies. The Korean government tried to promote national R&D capability through mainly public research institutes and R&D subsidising. As reviewed in section 6.4, DST has always been at the centre of these policy initiatives in Korea. In the mean time, DST has often been studied through a lens of techno-pole or technopolis (Oh, 1995; Oh and Kang, 1997; Luger *et al*, 1998; Oh, 2002). The term 'techno-pole' has its origin in French, meaning planned centres for the promotion of high-technology industry. It has been frequently used in the literature since the end of the 1970s. Castells and Hall (1994) distinguished three types of technopole: industrial complexes of high-tech firms; technology parks; and science cities, and they classified DST as a case of science city or technopolis which is the Japanese version of techno-pole. However, it is not easy to define a techno-pole with a single concept founded upon one theoretical model. In relation to the above mentioned term 'growth pole', techno-pole can be interpreted as the growth pole driven by high technology industries. The techno-pole as a pole of technological development represents a specific form of polarisation process. It is "*more a spatial concentration of technology transfer than a policy instrument for regional development*" (Benko, 2000, p. 166). In this sense, DST was not designed as an industrial based techno-pole but instead a R&D based one. As witnessed in cases of many countries, the attraction of companies or the promotion of technology transfer is an essential part of successful techno-poles. But Daedeok showed a lack of industrial basis and production systems. Furthermore, DST was initiated by the central government rather than local authorities. Thus it has not much contributed to the regional economic development since its initial stage. The government has located many public research institutes, universities, and other supporting organisations in DST. It has also provided

huge R&D subsidies for them. However, these organisations have been '*poorly connected*' (Cooke, 2001, p. 23) to each other, and consequently there has been quite weak interactive innovation in Daedeok.

In order to understand the R&D oriented techno-pole policy, it is necessary to look at the changes in science and technology policy of Korea in a broader sense. Under the catch-up model, Korea could borrow technologies from advanced foreign countries and utilize them effectively. This meant that Korea as a late-industrialising country could enjoy 'late-comer's advantages' during the early stage of economic development. However, as the scale of the economy grew and economic structures moved towards more technology-intensive industries, these advantages could not be applied any longer to the Korean economy (Suh, 2000). Thus, the development of indigenous technological capacity became important for continuous economic growth. By this legacy of the catch-up model, the R&D sector in Korea has been operated by mainly governmental R&D programmes which have been mostly mission-oriented rather than diffusion-oriented. While developed countries have placed emphasis on the importance of knowledge diffusion to foster innovation, the Korean innovation system has been focusing more on knowledge generation. From the viewpoint of innovation system, the close interaction and overlapped interface between public research institutes (PRIs), universities and private firms are generally regarded as ideal conditions for generating innovation. In Korea, however, it has been considered that PRIs are largely dependent on the governmental financial support and the knowledge diffusion from PRIs to industry is very small. At the same time, this legacy of government dominant R&D caused the weakness of universities' research capabilities in Korea. For example, over 60% of national R&D programmes in 1998 were commissioned to PRIs as main contractors, whereas universities received only 9% even though university researchers participated widely in most of these programmes (*ibid*, p. 43). This means that, unlike universities in other innovative clusters like Silicon Valley, universities in Korea have focused more on the function of general education.

In line with this stage of economic development, the Korean government has successively changed the orientation of its science and technology policy. In the early stage, most of policy measures focused on building the infrastructure for technological development. A few institutions were established such as KIST (1966), MOST (1967), KAIST (1971); KIST (Korea Institute of Science and Technology) has played the role of technological functionary in responding to industrial demands for rapid economic growth; MOST (Ministry of Science and Technology) has been the main designer of Korea's overall S&T policy; KAIST implemented the concept of the research-oriented university into the Korean higher education system. National R&D Programmes, first introduced by MOST in 1982, were clearly aiming to develop technology in order to enhance industrial competitiveness. The implementation of these programmes is closely related to the role of the PRIs. The rationale of these programmes and public research were originally intended to complement research areas that would not be pursued by the industry alone. Up to the early 1980s, a substantial part of the PRI budget had relied on 'contract research' from industry, but the needs of the private sector decreased as corporations began to increase in-house research to strengthen internal technological capabilities. Consequently, the government tried to restructure PRIs and defined their role as *"leading cooperative research among industry, academia and research institutes, conducting creative generic technology and long-term complex big projects with the emphasis on basic and applied research areas, and being fully responsible for developing public/welfare technologies"* (MOST, 1997 cited in Suh, 2000, p. 41).

At the early stage of economic development, the role of R&D subsidy and public sector R&D was dominant in Korea. However, as the world economy entered into a 'knowledge based economy' and globalisation, the Korean economy faced serious challenges. Public sector R&D could not satisfy the technology demand from private firms as the industrial structure is gradually transformed from light industries to heavy and chemical industries during 1970's. Firms began to consider the need for building their own technological capability, and as a result, to expand in-house R&D activities. The private sector R&D which was motivated by various tax incentives by the government had been oriented toward the application and adaptation of technologies or

engineering know-how. From the mid 1980s, most of the *Chaebols* started to invest in in-house R&D to cope with severe competition in international markets particularly in the field of high value-added industry like semi-conductors. It meant that Korean firms felt the need to develop their own technological capabilities. As a result, the overall portion of private R&D began to dominate public sector R&D in Korea, but only a few *chaebols* could make large-scale R&D investment in this period. This dominance of *chaebols* caused the lack of domestic knowledge diffusion in the Korean economy.

Conventional S&T policy, particularly knowledge generation-oriented policy does not satisfy the needs for innovation in terms of knowledge diffusion. The Korean government has developed and implemented various policy measures in order to promote technological innovation not only in the private sector but also by public sector R&D. These measures to support R&D activities include mainly the provision of incentives such as tax reduction or R&D subsidy, but they are linked with human resources development and procurement systems. Actually, it is very hard to make an objective assessment of the effectiveness of these policy measures because, among other reasons, evidence is incomplete (Suh, 2000, p. 36). It means that a more in-depth and comprehensive study is necessary to discuss the appropriate scale of the government's R&D support. Previous studies show that governmental R&D support measures are not only marginally helpful in promoting private enterprises' innovation activities, but also have some critical problems (Song and Shin, 1998; KITA White Paper, 1998). Suh (*ibid*, p. 37) refers particularly to the KITA's White Paper and suggests that government's R&D support measures are associated with the following problems;

“1) mismatches between the objectives of the government's support measures and industrial needs; 2) the lack of complementarity and substitutability between financial measures and tax-incentive measures; 3) the difficulty of securing credit-loans for SMEs; 4) the limitations of mobilising funds through market capital; 5) high interest rates for bank loans; 6) underdevelopment of the venture capital system; 7) and other factors such as various banking regulations and practices, various ministries' overlapping policy measures”.

These problems have also been connected to the under-utilisation of public R&D results. A study conducted by STEPI (Oh, 1997) indicates that there has been a big gap in

understanding the necessity of technology diffusion between PRIs, universities and firms. According to this survey research, researchers in PRIs or university professors have thought that private firms are not interested in diffusion, and on the contrary, firms have thought that the results from PRIs or universities are not very helpful to solve their technological problems.

Despite these problems found in public sector R&D suggested in these previous studies, it is very hard to simply conclude that governmental policy measures were wrongly designed or implemented. It is also difficult to assess its performance objectively and quantitatively. However, it seems to be clear on the basis of above discussion that public sector R&D has contributed to knowledge generation in the early stage of economic development, but did not contribute much to knowledge diffusion. Although the government tried to implement several programmes aimed at helping SMEs or the involvement of universities, the role of SMEs and universities were consistently not sufficient (Hwang *et al*, 2003; Min *et al*, 2003). It follows that the Korean government had to set up a separate programme for promoting innovation through knowledge diffusion. As noted earlier, innovation does not take place in a vacuum. The linear model of innovation has been replaced by an interactive or systemic model. The rationale of system failure alongside the perspective of market failure created much attention with researchers as another justification for government policy intervention in the process of innovation. It emphasises the importance of interactive learning and networking among various actors. As a result, the government policy measures became more focused on promoting knowledge diffusion, stimulating learning mechanism, improving system linkages. In Korea, since the inauguration of President Roh Moo-Hyun in the end of 2002, as the successor of President Kim Dae-Jung, innovation has been a supreme national task, particularly in terms of balanced national development. In this respect, venture-business support policy needs to be understood as an extension of industrial, science and technology, and innovation policies.

6.4.3 Venture policy in the regional context of Daedeok

As stated in above section, Daedeok has the long tradition of public R&D subsidising for DST. According to the Daedeok Valley Master Plan (2001), it was estimated that around 60% of start-up entrepreneurs in Daedeok spun-off from PRIs in DST. In this regard, venture policy in Daedeok needs to be understood in the close relationship with 'DST' in a context of S&T policy. As noted before, the government has concentrated national R&D resources on DST for the last 30 years, and consequently spin-off start-ups from DST began to naturally emerge from the early 1990s. The government concentrated various policy measures on venture firms from the end of 1997. However, this venture policy did not appear to have close link to the nascent development of high-tech start-ups naturally emerging in Daedeok. It was instead emphasised as a relief programme to create jobs and to replace *chaebols* in a situation of financial crisis. As a result, on the initial stage of venture policy, start-ups in Daedeok could not attract increased attention from venture capitals, the government, and the people. This circumstance at that time seems to represent a paradoxical phenomenon that the mechanism of venture policy resembles the typical mechanism of conventional *chaebol*-oriented industrial policy. It implicitly indicates that venture policy in Korea was launched with a framework of industrial policy not innovation policy. There, of course, have been policies for encouraging cooperation between industry and academy (or research), but those policy measures have not been closely combined with venture policy. This reproduction of intervention mode in policies has contributed in some ways to the formation of the regional context in Daedeok.

The regional context is likely to reflect the changes in a wide range of regional history, culture, institutions over a long period of time. As stated before, the development of DMC as an administrative region encompassing Daedeok geographically has been pulled by mainly exogenous factors like political or strategic decision makings by the central government. Over the last three decades, several significant location decisions were made to set up some important national organisations or institutions in Daejeon or move them to Daejeon. Furthermore, Daejeon could be a host city for international

exposition in 1993. Considerable infrastructure improvement in Daejeon was followed by these strategic decisions by the central government. In this manner, the influence of exogenous factors took a central role in the process of the development of Daejeon. However, this endowment has been mainly focused on the improvement of urban environmental factors like transportation or housing, rather than entrepreneurial factors. As a result of this regional development trajectory, Daejeon came to have a lack of industrial basis and business climate. Considering these regional “*inheritance and endowments*” (Clark *et al*, 2003), DST seems to be weakly embedded in its surrounding region (Daejeon).

In summary, Daedeok-RIS appears to have the characteristics of strong R&D oriented milieu and weakly embedded to the region. In addition, the ‘central government dependent’ regional development trajectory of Daejeon has influenced the evolution of Daedeok-RIS to have the above mentioned characteristics. Recently there was another important decision by the government to designate Daejeon as the ‘Specialized R&D Zone’ (its name was changed into ‘INNOPOLIS’ later). ‘*The Special Law for fostering the Daedeok R&D Specialised Zone*’ was proclaimed in January 2005. This project represents a sort of symbolic transformation of the Korean economy into more ‘innovation-driven’ economic growth from the traditional ‘factor-input oriented’ model (MOST and DMC, 2004). However, in the process of enactment, this law caused big debates mainly raised by other local authorities regarding its criteria and the scope of designation. DMC strongly insisted a logic of ‘choice and concentration’ as a legitimization why DMC needs to be designated as a ‘specialised R&D zone’. When it comes to the difference of specialised R&D zone from DST, the government puts more emphasis on the function of technology commercialization and enhancing the global position of Daedeok. However, apart from its different aims and expanded boundary from the past DST construction, it looks still quite R&D oriented and policy-led attempt initiated by the central government. Its title still contains the term ‘R&D’. Furthermore, the ministry of the central government in charge of this project is MOST which has already been in charge of DST. Designated geographical scope of this special zone contains DST and its surrounding area within Daejeon. In this regard, INNOPOLIS

project might be seen as an experiment to add another policy initiative to DST in the name of transforming it into more innovative cluster. This seems to be a typical path dependency in the development trajectory of Daedeok locked into 'R&D' rather than its commercialisation or business application. This point is not the main interest of this study but it was partly addressed through the empirical work. Spin-off start-ups in Daedeok, as a main actor in the Daedeok-RIS, have had a strong high-tech orientation. They showed, in the interviews, the expectation of continuous policy support to Daedeok. These tendencies represent their 'stickiness' to R&D and policy support.

In summary, this chapter attempted an analytical review of path dependency in Daedeok-RIS and the policy support system for it. Policy intervention can produce expected outputs, but often unexpected consequences as well. In this regard, government dependency can be seen as a sort of unexpected policy consequence which can be induced by institutional legacies and economic structures. In the case of Daedeok-RIS, policy intervention has contributed to the agglomeration of R&D resources within a geographical area. At the same time, however, it produces R&D oriented and central government dependent regional legacy. The construction of DST and continuous subsidization for R&D activities in PRIs for a long time has played an important role in shaping a R&D oriented development path in Daedeok. In addition, the urban growth of DMC has been mainly pulled by strategic decision makings of the central government. This regional inheritance can also be seen influential in shaping a regional development path in Daejeon city. On the other hand, 'selectivity' in industrial policy has influenced on regional and entrepreneurial development in Korea. 'Select and support mechanism' which penetrates through Korean industrial policies has played a critical role in formulating corporate governance. The result of institutional analysis in this chapter suggests that this mechanism contributes to produce 'dependent culture' on government policy support in Korean economy. This legacy in traditional industrial policy influenced 'venture policy' to have the similarity in terms of select and support mechanism. These broad structural and institutional factors become influential in moulding entrepreneurial activities in actor level. Empirical field work in this study focused on investigating start-up firm's policy response.

7 EMERGENCE OF A DEPENDENT PATH: POLICY RELIANCE AND CHANGE OF RISK PERCEPTION DURING START-UP

7.1 Introduction

Chapter 6 provided an analytical understanding of institutional settings in order to explore policy induced government dependency in Daedeok. In terms of a systems approach, this institutional frame is seen as an enabler and/or constraint to influence the dynamics inside the black box of the innovation process. As stated already, this study opens and looks inside this black box with the conceptual framework of government dependency. Using this conceptual framework, the field study was designed to unveil start-up firm's risk perception changes and to explore behavioural persistence in benefit seeking from policy support. This empirical analysis at firm level can be helpful to delineate the path emergence of policy reliance and its reproduction in start-up firm's business behaviour. This chapter, first of all, discusses the emergence of a path which is shaped by the change of risk perception during start-up process. According to path dependency perspective, path formation has a significant meaning in that it is a starting point of path dependent process. As argued before (See Section 4.3), the risk perception of start-up entrepreneurs plays a crucial role in generating their reliance on policy support. Potential start-up entrepreneurs on whom this study focuses are the researchers or engineers in PRIs in DST. In this respect, spin-offs from PRIs can be regarded as relatively high-tech entrepreneurs. To look at their technology orientation in business becomes a basis for exploring changes in their perception of risk. It is because how to perceive risks in business depends on entrepreneur's values, knowledge or experiences. In case of high-tech entrepreneurs in particular, how they understand the importance of technology in business is seen as a crucial factor in exploring the relationship between risk perception and policy reliance. This is discussed in the first and second sections. What factors have influenced the change of risk perception in the process of start-up are discussed in the third section.

7.2 Technology orientation of start-ups

Potential entrepreneurs on whom this study focuses were researchers or engineers in PRIs in DST. Interviewed entrepreneurs were the start-up founders who transformed themselves from PRI researchers into business entrepreneurs. Their job as an occupation in Korean labour market obtained the reputation of being relatively good and stable. They were very proud of their roles, in that they had contributed to the past successful economic development of Korea. Their income level was quite high compared to other similar jobs, and the rate of leaving job was very low (Seol *et al*, 1999). These potential entrepreneurs did not begin to create their own businesses until the end of the 1980s and the early 1990s. There were of course a limited number of spin-offs from PRIs before mid-90s when the government began to actively support start-ups. However, circumstances began to change dramatically after the IMF crisis in 1997, as an interviewee stated;

“After the graduation of KAIST, I decided to enter ETRI among many good occupational choices because PRI researcher as a job looked very attractive. I was so proud of my work in that I could contribute to the development of my country, but later this pride seemed to be gradually disappeared due to mainly the change of PRI researchers in their social status.” (CEO-6, OVG)

As the influence of full-scaled reforms for overcoming the crisis, PRIs had undergone the pressure of restructuring. In line with this situational change, there was a sort of ‘start-up rush’ in PRIs. This unprecedented phenomenon was mainly concentrated on the short booming period between 1998 and 2001. Many researchers, even policy makers, have struggled to reveal what made this happen and to understand what was going on during this period. However, it is quite rare in this field to approach theoretically on the basis of empirical data.

Generally speaking, new start-ups in the USA, particularly in Silicon Valley, have been described as ‘high-risk’ firms. This reputation came from the strong business culture of co-evolution between start-up firms and risk financing actors, like venture capitals or

business angels. On the other hand, in Korea, the 'high-tech' features of start-ups was been a decisive factor to identify target firms worth supporting or protecting by the government. The level of technology can be seen as one of the most critical factor in determining whether newly established firms will survive or succeed in the market. Technology itself, however, does not necessarily guarantee their successful performance. On the contrary, overly emphasised technology orientation may be often not helpful and even harmful in some cases. Start-ups in Daedeok, spin-offed from PRIs in DST in particular, have been generally regarded as 'high-tech' start-ups. Interviewed start-up founders have somewhat long period of working career in government funded PRIs which have advanced positions in high-tech R&D sector in Korea. They have experience to fulfil large-scale R&D projects. These peculiar profiles may be seen to endow them considerable advantages in plunging into business and competing with other firms in the market. Moreover, considering the policy support provided on the basis of technology levels in Korea, high-tech start-ups could easily access to necessary resources by exploiting policy benefits on the early stage of start-up in particular.

However, the result of the interviews proposes quite interesting evidence against the above general assumption. Interviewees responded that their belief in the importance of technology in their business had considerably changed: before the start-up, they thought that the portion of technology in business was really big and significant, but they realised through their business history that technology was not so crucial for the success of business even though it was obviously necessary. This indicated that researchers or engineers in Daedeok started their businesses with an overstretched technology orientation to some extent. Even a few respondents confessed that if they had realised this earlier than their start-up decision, they would have not created their own businesses. This phenomenon can be partly attributed to the influence from their previous working career in research laboratories;

“Researchers like me tend to think implicitly or explicitly that high-tech can guarantee high sales. In most cases of start-up founders including me in Daedeok, we tend to not make products to be sold well, but wait until these will be sold after the production. Successful firms produce something in terms of marketing, but we produce it in terms of high-technology. Is it natural that those firms are not successful in the market?” (CEO-1, SVG)

“In my case, I had worked for a start-up company for seven years before I started up this present company. I think that my experience in previous company has been much more helpful for my current business than the career as a researcher in ETRI. ... High level of technology is important to maintain my comparative advantage in the market. However, I learned from my previous business experience that ‘time to market’ of technology is much more important than high-tech itself. Strictly saying, now I think technology can be purchased if necessary.” (CEO-4, SVG)

This high ‘technology-orientation’ of start-ups in Daedeok was connected to a relatively low level of ‘market-orientation’. Generally speaking, technological innovation has played a critical role in capitalist economic development. Entrepreneurs can be seen as a ‘heroic player’ who transforms technology into marketable innovation through endless ‘creative destruction’ (Schumpeter, 1934). This classical notion about the role of entrepreneurs indicates that they need to have a balanced orientation between technology and market. High technology level of start-up can be a powerful advantage to win market competition, but if only it can be backed by other capabilities such as marketing and management. In this regard, technology and market are inseparable in start-up business, but start-ups in Daedeok reveal different stories;

“The value of a certain technology in business is determined in the market place by customers not by the technology itself. When technology is combined with other factors like financing or marketing, then it can access to customers. But CEOs from PRIs like us could not think about even this basic principle of business. We used to believe that customers will voluntarily come to us, if we hold high technology.” (CEO1-OVG).

Most of the PRIs in Daedeok had traditionally undertaken R&D activities which related mainly to basic technology or partly applied technology. More recently, R&D that resulted in technology transfer or commercialisation had been emphasised in DST. Researchers in PRIs faced no problem to work in these ‘government funded’ research organisations, even though they did not know much about the market related technologies which they were developing. Interviewees seemed to realise their ignorance about markets and the incompetence in business after start-up. According to them, such misguided overconfidence on their technologies may be conceived by their working experiences in the above mentioned environment far from the market in PRIs, and it

seemed to be exaggerated by technology-oriented policy support schemes in Korea. It indicated that they were gradually recognising their 'blind' technology orientation was becoming a risk factor threatening survival in the market. All interviewees responded that technology was surely the basis of start-up business, but they conceded that their technologies did not sufficiently reach to marketable levels in many cases, at least in the initial stage of start-up. This finding gives a meaningful clue to address the problematic concern why start-ups in Daedeok have not been as highly competitive in the market as generally expected in spite of their high technology levels.

7.3 Risk perception in occupational choice

7.3.1 Reason for new firm formation

In the meantime, the motivation of start-ups has been explored by several previous studies (Seol *et al*, 2002; Kim, 2004; Park *et al*, 2004; Kim and Jung, 2005). According to recent survey data, many start-up entrepreneurs who had worked in PRIs attributed their reason for start-up primarily to the desire for 'technology commercialisation'. In addition, a few other reasons such as the aspiration for making more money or running their own independent business were also identified. However the survey data does not provide enough understanding about more complex backgrounds or influences behind those reasons. In this study, the entrepreneurs were asked questions to capture more implicit contexts.

No notable differences between different groups of SVG, OVG, IVCs and FVCs were identified with regard to start-up reasons. Interview results showed individual and situational specific variations in start-up motivation, but it can be summarised into three categories: dissatisfaction, anxiety, and aspiration. In the first instance, '*dissatisfaction*' with a job in research institute as a researcher or engineer influenced the start-up decision. PRIs in Korea had a hierarchical and bureaucratic organizational culture. It was not easy for researchers with innovative ideas or special research interest to pursue

that in their labs. They had to conduct the research imposed by the institutes or the government, and they were evaluated according to the 'PBS'; an evaluation system based on the successful performance of project bids to the government ministries. As many entrepreneurship studies suggest, one of main features of start-up is self-employment (See Chapter 2). It means most of start-up founders have a strong achievement motivation to be independent. This general characteristic was also similarly found in this interview result. As an interviewee stated;

"I had worked for ADD. It has, as you may know, more closed atmosphere than other PRIs because most of defence technology is related to national secrets. I could not do what I really wanted to do in such rigid hierarchical organisation. I could not bear this." (CEO-1, OVG)

The above mentioned 'PBS' in R&D subsidising appeared to be one of main sources of PRI researchers' complaints. This system was originally prepared to improve the efficiency in government funded R&D activities in PRIs, but it had faced serious criticism from many researchers as a symbol of imposing superficial effectiveness. To undertake as many R&D projects as possible from the government ministries, PRI researchers had to make R&D plans for next year beforehand, and keep trying to persuade government officials to include their projects in the government budget of the next year. As an interviewee (CEO-9, SVG) said, *"this system may be necessary for boosting R&D productivity if it works well like its original aim intended"*, but as he added, *"it seems to be gradually operated in distorted ways to show just quantitative effectiveness of organisation which can be crucial for getting more R&D budget in forthcoming year."* It might be quite painful for active and dynamic people to prepare reports or proposals every day for just showing something to other people. Interview result reveals that most of complaints or dissatisfaction which led PRI researchers to start-up decision were closely related with structural problems of PRIs such as organisational rigidity in the light of their personal value or confidence.

'Anxiety' about the stability of a job was suggested by a few respondents. This reason looked to be the result of situational factors in that it was mainly expressed by the entrepreneurs who quit their PRIs around the time period of the IMF crisis in 1997. As

the Korean government pushed very strong and far-reaching reform policies after the crisis, the inefficiency of public sectors became a target of restructuring. PRIs were no exceptions. Most of the research institutes in DST tried to reduce their scale of budget, organisation, number of personnel, etc. However, it was very hard for PRIs to push coerced restructuring due to the existence of a strong labour union. PRIs encouraged researchers to accept voluntary or early retirements under the condition of paying a retirement lump-sum grant. It seemed to have contributed to triggering a start-up rush in PRIs like ETRI, but also created a concern for researchers that their jobs were not stable any more. Most of interviewees seemed to deny they were influenced by the pressure of PRI restructuring, instead they stressed the fact that they decided to quit PRIs voluntarily. As an interviewee (CEO-2, OVG) said, *“I obviously did not apply early retirement although ETRI suggested considerable amount of retirement allowance. It was because of the matter of my pride. I couldn't accept that I had to retire for just getting more money.”*

Another interviewee also well indicated researcher's anxiety about the future: *“I couldn't find the vision of my future any more in PRI. I tried to look back my career and look forth my future position in the organisation through my predecessors' case. And then, I came to realize it will take more than at least ten years for me to take the position that my predecessor could get there in 5 years considering the situation of downsizing at that time.”* (CEO-7, SVG). Regardless of these responses being based on frank speaking or just bragging, it looks clear that the situational factor of restructuring threw a shadow to some extent over their expectation about job stability.

'Aspiration' to be independent or richer was also seen as an important motivation of start-up. Entrepreneurs are self-employed people who decide something under their own responsibilities. Unlike the above two reasons, this could be a powerful driving force of risk-taking for start-up, even when researchers were satisfied with their job in the organisation. Desire to be independent was closely related to the desire to be richer in terms of economic wealth. Making more money not as a wage-earner but as an owner of business might be basically a common dream of almost all start-up entrepreneurs. It

becomes an impetus for willingly undertaking risks of novelty and uncertainty during start-up;

“I was quite satisfied with my job as a researcher in ETRI. I had no big complaints about it. If my son thinks about his future after the graduation from engineering department in university, I would like to recommend him to think about entering PRIs. However, in my case, doing my own business was more attractive than staying in ETRI. I really wanted to make more money through commercialisation of my technologies and I thought I could take risks for my dream.” (CEO-5, SVG)

Some interviewees had experience of technology transfer involving in PRIs. As one of them stated, *“I was very interested in technology commercialisation, but SMEs couldn't succeed in business with transferred good technologies from us. So, I and a few my colleagues decided to try it for ourselves.”* (CEO-8, SVG). He also added that *“in my case, more direct start-up motivation was the aspiration of doing really successful business with my own technologies rather than because of minor complaints about my organisation.”* Interview result revealed that start-up founders seemed to do ‘risk-reward calculation’ in their own ways, even though it might turn out to be incorrect later. It can be generally said that the bigger reward they expected or the stronger aspiration they had, the more risks they willingly bear.

As mentioned above, these three factors were seen as major start-up reasons of interviewed entrepreneurs. However, looking at the reason of start-up decision seems to be not so simple in that several influencing factors may have often combined in potential entrepreneur's mind rather just a certain single factor. Moreover, some people did not choose the way of being an entrepreneur, even if they had some of these factors in mind. During the period of start-up rush, in the case of ETRI for example, hundreds of researchers quitted their job to join this rush but many more researchers stayed in ETRI. It was not because they did not feel any of these factors, but rather because they did not dare to transform their mind into action. Therefore, these factors need to be regarded as some of the necessary conditions but not as sufficient conditions.

7.3.2 Risk perception in the process of start-up

The above mentioned three factors seemed to have some explanatory power in understanding entrepreneurship, but each of them seemed to be far from capturing the whole picture of entrepreneurship as a complicated and multi-dimensional phenomenon. Thus, a more comprehensive approach was necessary to examine the potential entrepreneur's occupational choice: how did researchers or engineers of PRIs in Daedeok decide to change their career as start-up entrepreneurs? As noted before, starting up a new firm looks like risk-taking behaviour. The concept of risks can be a useful starting point in approaching start-up entrepreneurship. There have been a number of empirical studies of risk taking behaviour, but the results of them have frequently produced contradictory findings. Some literature like Hull *et al.* (1980) showed more evidence of a higher propensity for risk-taking in entrepreneurs. Contrastingly, some researchers like Brockhaus (1980) cast doubt on the results of these studies with an empirical study which showed no significant differences in risk-taking characteristics between entrepreneurs and non-entrepreneurs, including managers or even the general public. This debate is related to the different point of view regarding whether the risk-taking propensity can be a discriminating factor to distinguish entrepreneurs from other people. This might be an important issue in many disciplines, but it is not the main interest in this study. Risk-taking can surely be seen as a critical and useful facet to understand entrepreneurship, regardless of its differentiated power.

Risk is a multi-dimensional concept, but this study particularly focused on understanding how entrepreneurs perceived and responded to risk. Accordingly, 'risk' needs to be accepted as a subjective concept, not an objective entity (Slovic, 1992; Renn and Rohrman, 2000). It includes psychological, organisational, social, cultural and institutional aspects. First of all, risk was perceived by individual entrepreneurs, so it was necessary to focus on the cognitive structure of entrepreneur's risk assessment, which was influenced by many socio-cultural, political and institutional factors (Gould *et al.*, 1988; Clarke, 1989; Shubik, 1991).

Subjective perceptions are influential in shaping entrepreneurial motivations and objectives. Several reasons for the start-up decision were explored in the above section, and these were commonly identified even in the cases of researchers who did not start their own business. Likewise, not all researchers in PRIs with dissatisfaction, anxieties, or desires made the same decision. This section focuses on exploring the changes in potential entrepreneurs' risk perception that makes them transform into an entrepreneur. Interview questions about risk perception in the process of start-up were designed to capture how respondents perceived risks in start-up decision making, how their risk perception changed over time, and how they judged themselves in terms of risk propensity.

People who are going to start a new business are likely to think about risks in many ways, either explicitly or implicitly. The start-up decision for researchers in uncertain situation can be very hard and risky, in that they invest 'all' in the new ventures. Thus, they no doubt try to reduce possible risks as far as they can. The results of interview showed that researchers made their start-up decision when they thought it seemed not so risky or the risk could be overcome within their capability to deal with risks. This risk evaluation might be the result of careful heuristics or abstract judgments;

"When I was going to start my business, I did not think this way would be so risky. ... I knew it must be not easy but I thought I could manage it. ... Now, I realised that I did not understand even what risk is on earth." (CEO-1, OVG)

"It seemed that I expected risky factors to some extent but I had a sort of over-confidence to overcome it considering our high technology level. ... I had witnessed a real case of bankruptcy from my brother-in-law, but I seemed to believe that I am different from him, so I can succeed even though everybody fails." (CEO-5, SVG)

Most of interviewed entrepreneurs had no business experience before they created their own business. Just two of them (one in SVG and the other in OVG) had a short period of business experience in other start-up companies beforehand. They said this was very helpful in enhancing their understanding of the market even though their experience was limited. The rest had limited and/or abstract knowledge about markets and customers before involvement in start-ups. The lack of business experience in market seemed to

cause their vague and even unrealistic recognitions about risks. Most interviewees replied that they took the probability of bankruptcy into account as the most serious risk, but they had no detailed analysis of this. Regarding the source of risk itself, they were concerned mainly about money. For example, many PRI researchers created their risky business even without having basic knowledge that ‘cash flow is very important’, or ‘borrowing money can be risky’. Bankruptcy or debt must surely be critical risk sources, but their perceptions about these risks seemed to have been considerably changed into more detailed and less abstract ones compared to the early stage of start-up;

“I knew money could be risky, and even I was afraid of borrowing other people’s money. ... But I did not know well why loan could be really risky. I never expected that I myself could be entangled with the debt problem of my company because I, as a CEO, guaranteed it jointly with the company.” (CEO-3, OVG)

“Before start-up, I seemed not to think of possible risk factors. ... When I looked back on the past, it was really reckless challenge to start my business with such an insufficient preparation.” (CEO-8, OVG)

Respondents were asked in this interview to reflect their start-up decision from the present point of view in terms of risk perception in particular. They commonly replied that to some extent they underestimated the level of business risks, and also overestimated their capabilities to deal with risks. It might suggest that risks did not exist out there as objective phenomena, independent of people’s minds and cultures (Slovic, 1999, p. 690). Consequently, it made entrepreneurs respond in various ways to the same risks. So many external factors were likely to impact on the individual’s risk processing. Risk perception, in this sense, can be regarded as a psychologically perceived and at the same time ‘socially constructed’ concept (Garvin, 2001, p. 450). This issue will be examined in more detail in the following section.

7.4 Factors influencing the change of risk perception

There have been numerous empirical studies that examine the way people understand, perceive and manage risks in their real business life (Cool and Dierickx, 1989; Tufano,

1996; Davis *et al*, 2000; Zwick, 2001). Most of them focus on quantitative analyses to measure probabilities or the consequences of risks, but a fundamental problem in this type of research is the qualitative nature of risk perception. As argued above, the interview result implicitly reveals that people have a level of risk with which they feel tolerable, and they tend to adjust their willingness to accept risks by considering the presence of safety measures (Botterill and Mazur, 2004, p. 3). This seems to be useful to explain a general phenomenon of why people tend to drive faster when they have airbags in their cars or they fastened their seat belts. It can be also connected to the fact that people feel more safety to do something when they carry insurances for driving or disease. According to Adams (1995), people have an individual's "*risk thermostat*". As mentioned before, interviewees commonly had a somewhat exaggerated confidence in their technology level which had formed in the process of government funded R&D activities in their mother PRIs. This overconfidence seems to have lowered their risk perception. However, the result of this interview shows that entrepreneur's risk perception was influenced by several factors besides this overconfidence in technology. The main factors revealed from the interviews can be summarised as personal experiences, social circumstances, institutions or policy support.

7.4.1 Previous experience

According to the results of the interviews, the influence of previous career or experience varies between individuals of how they thought about the start-up decision making or current business. Some replied it was not so helpful and even harmful in some cases, but some contrastingly said it was quite helpful. This gap seems to come from the difference of individual recognition. For example, knowledge of technology or good human networks in research institutes were differently recognised. An interviewee said that "*I have quite limited human network of mainly researchers or engineers, but it has not been very helpful to do my business*" (CEO-2, OVG). But another interviewee said: "*I think my previous career in DST is very helpful to develop new products or to sort out technological problems. I could easily get proper help from my human network in other*

research institutes.” (CEO-5, SVG). In this regard, how people recognise or perceive something is very meaningful to determine how people respond to it.

People tend to integrate new information collected from the outside - which always must be interpreted subjectively - into previously acquired experiences with as little contradiction as possible (Zwick, 2001, p. 51). Previous experiences were likely to influence people’s later perception. PRIs in Daedeok carried out R&D in the field of mainly basic technology and large-scale of government endowed projects. As the role of PRIs as innovative change-agents in the early stage of economic development was gradually decreased, the morale of researchers in DST began to wither. Interviewed entrepreneurs reflected that one of the most important jobs in PRIs was to report research results. Most of government R&D projects were evaluated by these reports. Evaluation of research report was very important for all PRIs because it became the criteria for R&D budget allocation for the coming year. Under the system like this, if a R&D project failed, it might result in the cutback of budget for that project. A few interviewees confessed they had to always succeed in every project in PRIs for the survival of their department and budget. Thus, in some cases, they had to take a probability of the project into consideration in advance before they applied for funding for a certain project to the government ministries. It made them more likely to stick to a project which had a high probability of success.

Previous experiences in carrying out R&D projects in PRIs could be very useful to have chances to undertake those projects from their mother PRIs even after start-up. They were quite familiar with making research proposals and giving presentations. Some of them had experience of proposal evaluation as members of examining panels. It means they would be more advantageous than other CEOs in advocating their proposals in front of panels. In this regard, it can be said that undertaking R&D projects can be at least a helpful strategy for survival on early stage of start-up. However, as a respondent described, *“relying on R&D projects must be a sweet temptation which is really hard to overcome for young high-tech firms, but it might be poisonous for business growth.”* (CEO-1, OVG). This notion suggests that entrepreneurs might have chosen a non-

business pathway, if they could finance 'easy money' (쉬운 돈) from their previous experiences.

Working experiences as researchers seemed to contribute to their holding a sort of narrow 'tunnel vision' of the world. As an interviewee said, engineer CEO tends to think about only his/her own field, so there is a tendency of continuously sticking to it, even though it goes wrong;

"...researcher or engineer like me is a person who has been familiar with the communication with machine for mostly over 10 years. ... Thus, we lack the relationship between people. ... we think we are the best in our field in terms of technology, but we don't know how to manage cash-flow, how to promote marketing, how to make customers happy, etc." (CEO-4, OVG).

This notion points to the narrow focus or limited scope of engineer CEOs' ability to look at business world. Entrepreneurs needed to overcome this force of inertia arising from their previous career or experiences. It, however, seemed not to be easy. A respondent confessed: *"my wife often teases me that you quitted your job in public research institute for doing business, but now you look running your own private institute again."* (CEO-2, OVG).

Researchers in PRIs do not usually care about the cost for their work in PRIs once they get involved with a project, due to the cost is managed by other department in charge of it. As interviewees stated, they did not have to negotiate financing matters for their project with other people. Even, they did not have to care about the possibility of commercialisation of their R&D results;

"I think that we, researchers of PRIs, have never been exposed to the risks in terms of business. We just asked money if necessary to research institutes or the government. ... We did not have to think about sales or marketing in our career. It seems like an experience in green house which is not helpful for business in real world." (CEO-9, SVG)

Once there was a fashion in using the expression of 'green house ventures' in Korea. This term was used to describe some start-up firms which were successful under the government protection or support, but vulnerable to severe market competition. Venture

capitalists pointed out that most of high-tech start-ups, particularly spin-offs from PRIs in Daedeok were recognised as typical ‘green house ventures’. As a CEO of venture capital company told, “*many start-up entrepreneurs in Daedeok tend to have a kind of exaggerated pride or confidence about their technology level and experiences as researchers. In my opinion, it made them underestimate the fact that business is much riskier than their previous R&D experiences*” (CEO of VC-4).

7.4.2 Social circumstances

As statistical data showed, the number of start-ups in Korea began to dramatically increase after IMF crisis in 1997. It reached a peak in 2000 and began to decrease from 2001. This fluctuation reflects the socio-economic situation of those days. One of the most spectacular phenomena in the end of 1990s was the ‘venture boom’. For only three year of this unprecedented booming period, over 10,000 small firms were newly created in Korea. KOSDAQ market played, without doubt, a critical role in this rapid growth of start-up sector. It made ‘equity investment’ possible by providing ‘exit’ opportunities for investors like venture capitalists or business angels. After the economic crisis, the flow of money in the market began to be converged into KOSDAQ. Many people could make huge money through start-up business and venture investment in a short period of time. Even a few start-ups surpassed existing large companies in terms of the value in stock market.

This phenomenon in Korea seemed to be encouraged by the global IT boom that originated in Silicon Valley. Many internet based companies, the so-called ‘dot com’ companies, grew surprisingly fast, and many CEOs of start-ups could become new millionaires. It was regarded as a myth of ‘*venture jackpot*’ (quoted frequently in news media in the name of ‘벤처 대박’ in Korean) for young potential entrepreneurs who were dreaming start-up. Many researchers and engineers were stimulated by this worldwide IT venture boom and a few successful stories, and joined to start-up rush like ‘gold-rush’. It, however, contributed to implant a sort of illusion in people’s mind about

the future of information technology and start-up. As an interviewed start-up CEO said, *“during venture booming period, huge money could be attracted by just showing a few advanced technologies in the field of internet or software”* (CEO-5, OVG). Most of start-ups established in booming period could successfully attract equity investment from the initial stage of starting-up;

“Every start-up founder seemed to dream big success. Most of them could raise enough seed money for starting business. In my case, I did not face with any serious problems or difficulties in at least initial fundraising, and I think it would be same to start-ups spin-offed from ETRI like us” (CEO-6, SVG).

As previous survey data indicates, seed money was mostly raised by founders themselves, family, friends or colleagues. Research institutes provided extra money besides their normal retirement grants for researchers who intended to start-up if they applied retirement earlier. After start-up, founders could receive investment from ‘start-up investment companies’ or individual angel investors with very favorable conditions. Even some firms could attract equity investment from the beginning of start-up. It was not rare cases in booming period that high-tech start-ups sold their stocks at dozens of times more expensive premium than the price of denomination;

“It became a strong motivation for me to see my colleagues who worked together for same research institutes just a few years ago created their own business and attracted huge money easily. I simply thought I also could do that in this social circumstance.” (CEO-8, SVG)

Some research institutes like ETRI had their own financial support programmes for start-up. ETRI used to invest or lend money from its specialised fund for start-ups established by its researchers before ‘venture boom’ period. Research institutes usually invested money at no premium, but often added a few options not favourable for entrepreneurs such as the condition for the investment at the nominal value of the shares. Ironically, however, in booming period in Daedeok, some researchers refused this money from research institutes due to better investment opportunities proposed by rapidly growing VCs. Several interviewees acknowledged that the abundance or even plethora of money in the initial stage of start-up seemed to function harmfully in the

process of their business growth. To start business with too much or excessive money might dull the importance of keeping cash flow.

Statistics after 2001 show the sensitivity of start-up entrepreneurship to the changes of socio-economic circumstances. As people became to recognise that there had been 'bubble' or 'illusion' in venture business sector, the scale of venture investment and number of new firm formation began to drop sharply. At the same time, several cases of fraud incidents in KOSDAQ market functioned as a coolant in lowering the fever of speculative venture investment. Empirical evidences are found in the interviews to support the above mentioned statistical data. Most of interviewed firms that started their business after 2001 were faced with a totally different set of circumstances, particularly in financing. They could rarely find opportunities to attract equity investments. Even the firms who already got investments experienced difficulties in attracting subsequent investments. Entrepreneur's risk perception was likely to have changed under a given set of social circumstances.

7.4.3 Supportive policies of the government

As emphasised earlier, entrepreneurship has drawn much attention from policy makers as a crucial source of innovation. It has been generally accepted that governments influence the level of entrepreneurship through supportive policies or legislation or other regulatory measures (Storey, 1999; Audretsch and Thurik, 2001). In Korea, policy support for start-ups needs to be seen through two different flows of policy aim: one is general start-up promotion policies before the IMF crisis in 1997, and the other is special 'venture firm' promotion policy after the crisis. The former focused on establishing institutional infrastructures, such as the legislation for preparing the basis of start-up investment companies, or the establishment of KOSDAQ market as their exit channel. The latter was strongly concentrated on providing more direct support for venture firms. To achieve this policy aim, special legislation was established and other supportive or protective measures were prepared. Among these policy measures, one of the most

significant approaches was ‘the system to support start-up for researchers or engineers’ (연구원 창업지원제도). This system seemed to contribute to the rapid growth of high-tech start-ups in Daedeok. Several exceptional benefits and preferential protections could be offered to researchers or engineers through PRIs by this frame;

“Institutional support from the government influenced on start-up founder’s thought and decision making in many ways. If not these exceptional supports, who could give up stable job in PRIs and adopt riskier pathway of start-up?”
(CEO-10, SVG)

PRI researchers could suspend their duties for maximum three years if they wanted to start their businesses. It means they could get back to their job as researchers when their businesses went wrong. At the same time, researcher could practice start-up within the labs. They could use expensive facilities of research institutes to make prototype products and test them. The necessary budget and space for this sort of business simulation were also provided. If the result of this practice was successful, they could start their own businesses with it, but if the result was not good, then they could safely return to their previous labs. This support offers great business opportunities and safety measures for the people who are going to start risky business. There are of course variations in receiving these measures by entrepreneurs. Some researchers quit their jobs to utilise ‘retirement grants’ for seed money, although they could leave their jobs just temporarily to make ‘occasional excursions’ into the realm of business. In this case, interviewees said that benefits from this system were not so helpful for their start-up decision making, but they still could take advantage of some other support measures. Contrastingly, some interviewees said that they enjoyed most of these supports and it was really helpful for starting their new businesses. These varied recognitions seem to be arising with differences in individual situations.

Some research institutes like ETRI allowed their researchers to buy some patents developed by them or their teams at a cheap price. The government has encouraged PRIs to commercialise their R&D results. In particular, PRIs needed to sort out impending pressures of restructuring after the crisis, through the cutbacks in budget and organisation. Start-up might look the best solution for the above-mentioned PRI’s

concerns: technology transfer and restructuring. Many start-up founders used this support in venture booming period. As some interviewees confessed, the fact that PRI like ETRI transferred its technology to a start-up could be quite attractive for investors to select a target in those days. According to interviewees, however, this policy became unpopular later due to the misguided implementation. Most of PRIs tried to seek the higher performance of it in short term point of view. As research institutes asked higher price for technologies for seeking their own interest, potential entrepreneurs became gradually indifferent to receive technology transfer from research institutes;

“I bought over 20 patents from ETRI when I quitted research institutes for start-up. All purchased patents were developed by me in ETRI. But now I realized that most of those technologies were far from making money.” (CEO-1, SVG)

“A few my colleagues did not get technology transfer from ETRI, but I did. ... Now I'm thinking they were much cleverer than me. They told me that core technology is already embedded in our brains, then why we have to pay royalty for using the patent for it which we developed. We can easily modify it if necessary for business with no legal problems.” (CEO-8, SVG)

There have been many policy measures to promote start-up in Korea. The government struggled to overcome impending economic crisis after 1997. To promote new high-tech firm formation was regarded as effective policy prescription to ‘chase two hares at once’. One was to create more jobs for unemployed people, and the other was to redeem lost economic vitality. Above all, policy makers focused on stimulating potential entrepreneur’s start-up motivation. Accordingly, the above-mentioned supportive measures were prepared. As many interviewees said, those supportive measures and institutions must be seen as reliable ‘insurance’ for start-up founders alleviating the level of possible risks they need to venture. Moreover, researchers or engineers could take this assistance more easily because high-technology was the most important criterion in order to select target firms worth supporting. Following mention seems to describe well how policy support functioned in people’s mind in terms of risk perception during start-up;

“I think that the government support played a role to make us not to realise the level of real risks exactly. ... In other words, even though real risk level was not changed, we could feel it less risky. ... It might be varied to what extent people

feel this, or to what extent this perception would last. I'm just saying such a tendency has been there in at least Daedeok.” (CEO-5, SVG)

7.4.4 Overarching influence of policy intervention

Among the above proposed three factors, the most notable influence seems to be policy initiatives by the government. Start-up entrepreneur's previous experience as a researcher or engineer was enabled by the PRI establishment of the government and accumulated through the R&D investment from the government. Continuous learning takes place through all working careers, in the process of applying, doing, presenting government R&D projects in PRIs. Technology gained from the experience in PRIs became the source of too much technology-orientation. It seemed to make these people overconfident about their capabilities to overcome possible risk factors in start-up. Experience of carrying out government R&D projects provided people with the recognition that they can depend on the government grant/subsidy for survival through undertaking R&D projects as they have done if they face financial difficulties after start-up.

Any social circumstances that motivated people to start their own businesses were largely induced by the government intervention through various policy measures. Opening the KOSDAQ market by the government in the mid of 90s played a vital role for the emergence of venture boom afterwards. It became a fundamental institution in Korea for the 'co-evolution' between venture capitals and start-up firms. After IMF crisis in particular, legislation of the special law by the government for promoting 'venture firms' and strong supportive policies triggered the rapid growth of start-up sector. Money converged on high-tech venture firms in the market. In this regard, it can be said that government initiatives were always in the middle of 'boom-bubble-bust' in start-up sector. It is not so strange that potential high-tech entrepreneurs perceived risks lower than reality under the favorable institutions and supportive policy measures. As many interviewees said, the influence of government support on their start-up decision making was really vital. It seemed to make people experience a great initial advantage

(whether it influence their later businesses positively or negatively) in the process of transformation from potential entrepreneurs to start-up entrepreneurs.

In summary, the risk perception of potential high-tech entrepreneurs was changed toward recognizing the risk factors of start-up business lower than real risks. In this risk perception change, policy support from the government played a central role. The government support for R&D activities of PRIs contributed to the reproduction of overconfidence on technology in entrepreneurs' mind. It also influenced their expectation about continuous exploitation of policy benefits even after start-up. In this respect, it can be said that a path of start-up firm's policy reliance emerged from the overconfidence of high-technology; the lack of business experience and knowledge about markets; and the expectation about continuous benefit exploitation from policy support. There can be, of course, another influence of the mode of intervention. In other words, how to support start-up business can influence the emergence of a path of policy reliance. This aspect seems to have an importance in terms of the causality between influencing factor and its consequence. However, the purpose of this chapter focuses on exploring the emergence of a path rather than identifying the cause of it. This issue will be discussed again in conclusion chapter.

8 PERSISTENCE OF THE PATH: BENEFIT-SEEKING FROM POLICY SUPPORT IN BUSINESS BEHAVIOUR

8.1 Introduction

This chapter explores the behavioural persistence of policy reliance in the business history of start-up firms. Even after the critical stage of start-up, entrepreneurs face continuously with a range of difficulties and risks in every corner of their entrepreneurial activities. On the extended line of policy reliance produced in the process of start-up, it can be assumed that they tend to keep seeking benefits from policy support when it is continuously provided for them. In this regard, the purpose of this chapter is to examine how start-up firms have responded to support measures of the government in getting on their business and why they come to respond in that way. According to the path dependency perspectives suggested in classical models like Arthur or David's works, it is significant to examine if the initial advantages were persistent in the future. As examined in above chapter, 'risk perception' can be regarded as a critical factor to generate entrepreneur's psychological reliance in starting up new risk business. Policy support in general, financial assistance in particular, plays a role in lowering the entrepreneur's perceived risk level compared to the real one. It is because the exploitation of policy benefit functions like insurance or a safety measure. As argued above, this beneficial effect can be a source of reliance. In addition, this reliance can also be a source of the persistence of benefit seeking behaviour. The concept of 'persistence' indicates that policy reliance can be reproduced in firm's business history through a self-reinforcing feedback mechanism. This chapter highlights four reactions of the interviewed start-up firms in response to the government support: response to the venture certification (Section 2); financing choice according to growth stages (Section 3); behaviour in seeking government grant (Section 4); and choice of business location (Section 5). These responses were examined in this chapter to unpack the 'persistence' of government dependent behaviour in terms of self-reinforcing expectation.

8.2 Response to the 'venture certification'

8.2.1 Motivation of initial certification

The venture certification system was first introduced by 'the special law for venture business promotion' in 1997. In the earlier stage of it, most start-up firms wanted to get venture certification which was regarded as a sort of "license" (CEO-2, OVG) or "qualification" (CEO-5, IVCs) for being an eligible 'venture firm' in Korea. The government needed a certain criterion to be met by firms for it to provide the exceptional benefits and protection to these 'start-up' firms, which were seen as a newly emerging growth engine replacing existing 'chaebols'. Under the IMF economic crisis, however, policy makers could not have sufficient time to prepare an appropriate policy scheme to support this new form of corporate entity. There have already been varied types of certification for firms provided by the government ministries such as 'certification for promising SMEs', 'certification for high-tech leading companies'. In this situation, as an interviewee stated, the Korean government seemed to introduce just a new version that looked quite similar to these previous certification schemes;

"The introduction of venture certification looked quite natural from the viewpoint of policy makers like me in that we adopted very familiar way of selecting target for policy support as we have done so far." (Director general, SMBA).

Newly established firms are likely to face with serious shortages and difficulties in every corner of initial business. Any benefits from the government must be very attractive for these 'new born babies'. The merits of venture certification expressed by interviewees are as varied as its kind of benefits. Certified venture firms could usually win 'added points (point-up)' in the screening of applications for government R&D projects or getting credit guarantees for bank loans. This merit was commonly suggested by many respondents as a biggest benefit of venture certification. Even though this premium was not big in itself, it could endow certified firms with big potential advantages in

competing with other firms under the same conditions. Some start-ups could be certified in the process of firm creation through the institution of ‘preliminary start-up’ (예비창업자 제도) even while they still stayed in their labs and did not quit their jobs. Then, they could enjoy all benefits provided for certified venture firms from the initial stage of start-up. Tax benefits were also big enough for entrepreneurs to motivate them to apply for venture certification. Some entrepreneurs recognised tax exemption or reduction (particularly corporate tax) could be a great merit, but they also realised it could only be beneficial when they made big money later because corporate tax depends on profit. However, it must have been a big motivation of certification at early stage start-ups.

When considering the scheme of venture certification and the social circumstances during venture booming period, most start-ups wanted to get a certification if they could meet one of four criteria for being a certified venture firms. As mentioned earlier (in Section 6.2), the criteria of certification were largely technology oriented, so most of high-tech start-ups could get venture certification with no difficulties. According to statistics from SMBA, the largest proportion of venture firms were certified by the criterion of ‘technology evaluation’ by 2001, when this scheme was transformed into more a business oriented one. It means that certification was not a difficult job for high-tech start-ups in Daedeok, particularly spin-offs from PRIs. As interviewees admitted, there was no reason why they would be refused venture certification;

“It is not hard to get a certification and we can expect many possible benefits. Then, who want to give it up? I thought venture certification would be definitely helpful later in some ways, and I could be confident that it would be at least never harmful for my business. Furthermore, I seemed to seek a certain psychological relief from the anxiety about strange business world through the certification.” (CEO-1, OVG)

Certification was also necessary for start-up founders to make their firms more attractive to potential investors. It was not easy for venture capitalists to select target companies worth investing among high-tech firms due to the relative lack of knowledge about the high-tech products compared to the knowledge of the entrepreneurs. Most VCs in Korea showed a lack of experience in equity investment due to their short history of growth. In

general, 'information asymmetry' between investors and start-up founders can be a cause of market failure in equity investment of high-tech start-ups. While start-up founders know their high technology well, investors are usually not so familiar with it. In this situation, venture certification might be regarded as a meaningful 'signalling' by the government of businesses deserving of investment. According to the interviews, most of VC respondents denied that their investment decision making was influenced by venture certification. However, they recognised that the meaning of venture certification by the government, particularly at the initial stage, was influential not only to the public, but also to the existing financial institutions like banks. Start-up founders seemed to be motivated by this circumstance. Even if they were not sure to attract investment with venture certification, they seemed to need it at least to appeal to investors;

"I thought the title of venture certification could be helpful to value-up my company at least externally by way of ornament. We needed to be seen more attractive to potential investors. ... Non certification might be a big excuse for them not to invest. I thought there was at least no reason to avoid certification intentionally." (CEO-9, SVG)

In the interviews, no particular differences were found in terms of the motivation of venture certification between 'still venture group' and 'once venture group', and also between IPO companies and failed companies.

8.2.2 Bifurcate responses to the certification over time

Certified venture firms showed two different ways of responding to the certification over time. According to statistics issued by SMBA every year, 322 firms among 503 certified ventures in 2001 were categorized as non-certified firms in 2005. The rest of the 181 firms kept maintaining certification up to 2005. The former case is referred to the 'once venture group' (hereafter referred to as OVG), and the latter case is referred to the 'still venture group' (hereafter referred to as SVG). What made start-up founders respond differently like this? What happened in their mind to alter their perception? Answers to these questions would be a starting point to understand how start-up founders have responded to supportive policies over time, in that venture certification played the role

of a selection mechanism in picking up target firms for support. On the other hand, an interesting assumption is also possible: the reason why firms in OVG did not extend their certification might have arisen from their recognition that they did not need the government certification any more. If this assumption is true, then 'once ventures' can be seen more market-oriented firms than 'still ventures'. Did they really become market-oriented?

There were varied reasons why start-up founders decided not to maintain their certification any more. Some could not meet the criteria for certification which became tougher from 2001. The level of technology had been the most decisive criterion until 2001, but some factors like financial or managerial conditions were added to the criteria from 2002. Some founders attributed the reason to the negligence of their attention for extension. After the valid period of venture certification was introduced in 2001, it had to be extended within one or two years. If certified venture firms did not apply again after the given expiration date, they lost the status of a certified venture firm. On the other hand, some firms gave up the extension of certification because they foresaw it would be replaced by another 'inno-biz' certification by the government. As a matter of fact, SMBA launched this similar scheme of certification under the cloak of supporting innovation-oriented firms in 2002. According to interviewees, however, it did not seem to be effective in transforming venture firms into more market oriented ones. Instead, it caused the unexpected behavioural responses that many certified venture firms were enforced to apply to the albeit similar 'inno-biz' certification separately;

"Many venture firms expected that venture certification would be disappeared in the near future. It was because the mother law of certification was scheduled to be expired in 2007. Moreover, because the government launched a new certification of 'inno-biz', we had to move on to it." (CEO-6, OVG)

Whatever they proposed as the reason of non-certification, interviewees in OVG seemed to have disappointing or even negative expectations of the real benefit of venture certification. However, it is interesting that this phenomenon was also found in the interview of SVG. Many firms extended their certification up to 2006, even though they were also skeptical about direct benefits of venture certification. Furthermore, even

interviewed CEOs of IPO firms maintained their certification up to the date of interview. According to some interviewees in SVG, venture certification had been extended naturally by a team of the firms, and as a consequence, even some of them became not aware whether it was already extended. This contrasts to an interview in OVG;

"I remembered that the first extension of venture certification was quite easy after the initial certification was expired. ... By the way, I missed the timing for the second extension because of my negligence. I could not afford to employ a staff in charge of it yet, and I myself could not pay attention to do it after the business became bad." (CEO-4, OVG)

Firms in SVG showed positive attitudes to venture certification. As an interviewee (CEO-10, SVG) said, any possible benefits might be available by the certification, as long as the government kept implementing supportive policies for venture firms.

Interestingly, most of 'once venture firms' had problems or poor business performances compared to 'still venture firms'. But did this poor performance provide a general explanation for non-reapplication? It seems to be an interesting issue, but it is not easy to simply answer in this section since other explanations were given. As an interviewee (CEO-9, OVG) said, he had not reapplied to venture certification, but at that time, he was unaware that interest rate for bank loan could be lowered in case of certified venture firms. This indicates that the lack of enough information on the certification can be connected to entrepreneur's perception that venture certification is not necessary any more. Another interviewee (CEO-4, OVG) said he failed to extend venture certification due to his negligence, but he applied for it again and was waiting for the result of his application. On the basis of these interview results, it is possible to say that non-certification of OVG does not directly mean any changes in their mind to more market-oriented direction.

A few interviewees in OVG, who already gave up the extension of venture certification, got 'inno-biz' certification. It points out that they did not think government certification is totally unnecessary. At the same time, it explains indirectly why above phenomenon can not be said as just coincidence. Interviews of IPO firms are also underpinning this argument;

“I think some of once venture firms ‘could not’ get certification rather than ‘did not’. ... As far as I know, these cases must be found largely among the firms which are currently in trouble.” (CEO-3, IVCs)

“Venture certification can give benefits for IPO firms like us. For example, we can be classified as ‘venture firms’ not as ‘general firms’ in KOSDAQ market, only when we keep maintaining the status of venture certification. ... Then we can be seen more attractive to investors.” (CEO-4, IVCs)

Interviewees in SVG and IVCs argued that their venture certification was maintained by a sort of ‘inertia’ from the initial certification. According to them, preparing documents for venture certification must be a tiresome job at first, but later it could be easy work to keep doing. For them, venture certification was still necessary in many cases, and it would be helpful in the future even though it seems to have no benefit now.

8.2.3 Recognition of certification effect

As mentioned already, venture certification by the government was a unique institution in Korea. However, it was not a totally new invention in terms of its basic institutional frame. An interviewed government official acknowledged: *“Frankly speaking, there were few experts who know well what is ‘venture’ exactly even in SMBA which was in charge of supporting it. So, in the case of venture certification, it was just a similar application of existing selection mechanism to filter target venture companies for support rather a really novel idea”* (Director general, SMBA). Certification is usually done by the market mechanism in a more market-oriented economy like US. A venture capital backed company was usually regarded as a certified one in the market. As discussed in earlier chapter (See Section 3.3.3), the ‘start-up ecosystem’ operated on the basis of co-evolution between start-up firms and venture capitals. It is often referred as providing vital impetus for a Silicon Valley-type success. VCs are willingly taking risks in investing money for new born small firms. Their high risk takings can be compensated with potential high returns. If market mechanism is well operationalized and market forces are sufficient, this co-evolution can take place spontaneously. However, in Korean start-up sector, there seemed to be the lack of a mature financial

market to facilitate this virtuous circle. In this vein, the market failure perspective can be applied to the case of the early start-up sector in Korea. The government tried to cultivate start-ups by means of a positive policy intervention. Venture capitals in Korea had a short history and weak experience of equity investment. They were also a target of policy support by the government. As interviewed venture capitalists confessed, VCs in Korea had too much dependency on funds from the government to have independent and self-sufficient capability.

Any 'certification effect' becomes different according to who evaluates start-up firms for certification. VCs usually undertake this role in a well-operating capital market. They provide start-ups with not only the source of finance but also other managerial assistance. In this respect, the title of 'VC-backed Company' can be regarded as a meaningful certification in the market. In other words, VCs can "*help start-ups to overcome the costly signalling through third party certification.*" (Avnimelech and Teubal, 2004, p. 37). Contrastingly, the government has undertaken this role in Korea. The institution undertaking this task was set up by the government through the legislation of special law, and evaluation for venture certification was also conducted by the government-established organisations. SMBA, which was in charge of SME policy, has operated this type of certification system. SMBA prepared lots of new assistance programmes for certified venture firms, and also transformed some of existing policy measures for SMEs into more favourable ones for certified venture firms. Exceptional benefits and advantages for certified firms were added to most SME support programmes. Venture certification was the most fundamental condition for start-ups to receive all the government support. In this unique mechanism, not surprisingly certification effect must be different from market-oriented one by VCs. With respect to such a government-led certification system, it can be assumed that most of actors, particularly financing actors like bankers or VCs, might be influenced to some extent by the government signalling of certification. However, interviewed venture capitalists did not agree with this assumption that they might be affected by the certification in selecting target companies for investment. Nevertheless, this result seems to be

contestable considering the interview results of start-up founders that they wanted to get venture certification for being eligible in financing from VCs or banks.

VC investment was one of four criteria of venture certification according to the original scheme. If a start-up attracted equity investment from VCs for over 10% of its share, then it could be easily certified by presenting evidences of VC investment. This criterion means 'market certification' that indicates the VC-backed companies. According to previous survey data referred in this study, however, the proportion of certified ventures by this VC-backed criterion was much smaller (just around between 12% and 13% as of 2004) than the one of technology evaluation criterion. Even in some cases, start-ups which could meet VC-backed criterion did not choose this way, and got certification by the criterion of technology evaluation. Interview data proposes very meaningful implications to understand this interesting phenomenon;

"In my opinion, certification by the technology evaluation criterion rather than VC-backed was preferred by many start-up entrepreneurs including me. It was because we thought evaluation as a high-tech company by the government could be more helpful for lifting the external reputation of the company. ... This seems to be linked to the 'government dominant system' deep-rooted in our culture."
(CEO-5, IVCs)

The recognition of a certification effect has changed over time. All interviewed start-ups expected at first and to some extent that the benefits of venture certification would be very big and helpful. However, this expectation has weakened by several factors. Accordingly, the overall scheme of certification was changed as time passed, and a new type of certification like 'inno-biz' was launched. As mentioned before, this changing environment around the government policy must have influenced their expectation. But the more influential factor seemed to be the change in their standpoints. As an interviewee (CEO-5, IVCs) said, people who already benefited from something at a certain point of time, even though they were much assisted by it, tend to feel it is not very helpful from the current point of view. In other words, certified firms could not feel any necessary for its extension, if they already enjoyed most of benefits offered by the certification, and if they thought potential benefits by extension would not so big. Interview results show that all interviewees were to some extent skeptical of the attitudes

about the effect of government-oriented venture certification. However, their decision makings whether they extend its expiration dates are not clearly linked to their skeptical expectation.

In case of SVG, a sort of inertia was found in maintaining venture certification. This inertia could be interpreted as a path dependent phenomenon. Then, can we say OVG firms adopted path breaking ways? It can be in some sense, but interview result show it was not true in terms of a 'government dependency' perspective. Some firms (CEO-1, CEO-3) in OVG suggested that the government should reinforce technology evaluation system of venture certification as a proper way of its improvement. An interviewee (CEO-6, OVG) said the scale of benefits, such as financial assistances for certified ventures, should be enlarged, if the government wants to make it more substantial support measure. Contrastingly, interviewed venture capitalists said the main function of venture certification should be gradually shifted from the government to the market actor like VCs. They, however, did not deny the importance of the government's role in start-up promotion. One of the most important roles of government was that it emphasised the need to make the flow of money in the market converge with that of the venture capital industry. Thus, it can be said that firm's responses to the venture certification depended on the situation they stood or the interest they had. Even in case of the firms in OVG, the fact that they did not extend their position as certified firms does not directly mean they became non-dependent on government policy supports. Although interviewees in OVG presented various reasons of their decision, they seemed to still show some extent of dependency on support. Moreover, most of them revealed more interest in any changes of government support policies such as the introduction of inno-biz certification.

8.3 Financing choice and capital structure

8.3.1 Risk perception in financing choice

Start-up firms are, generally speaking, typically characterised by high-risk and consequently exhibit high probability of failure. They require substantial capital to develop products and marketing activities, but the demand for fundraising used to exceed the internally generated cash flows or their own funds (Berger and Udell, 1998). Start-up entrepreneurs need to access external funding sources to pursue their opportunities, but they are usually faced with the lack of collateral and established reputation in their business. As a result, it is not easy for them not only to borrow money from banks but also to attract equity investment from venture capitals. These financial constraints may lead to a problem of underinvestment in start-up businesses.

The government tried to tackle this problem through positive policy intervention. To offer more opportunities for borrowing money to start-ups, policy loan programmes were developed on the basis of a credit guarantee scheme. Loans were offered on a lower interest rate and longer pay-back period than other general bank loan. However, the lack of collateral made it difficult for start-ups to receive debt financing. The credit guarantee scheme was introduced to sort out this constraint by the government. At the same time, the government made an effort to vitalize equity investment for start-ups through mainly fostering venture capital companies and establishing public funds. There was significant funding assistance for VCs from the government. This effort contributed to rapid growth of VCs within a short period time and more equity financing chances.

Start-ups were usually given the chance to make a choice between alternative financing sources. As mentioned above, financing can be broadly categorised into two ways: debt financing and risk financing. After start-up, or even during start-up, entrepreneurs are faced with crucial financing choices between bank loan and equity investment. In the real world of business, however, their choices are usually done in the form of mixed portfolio between two. Interview data shows that the pattern of financing choice shifted according to the changes in situations they stand. Before the venture booming period, equity investment was quite rare, even the government set up first four venture capital companies between 1974 and 1984 in an attempt to help commercialisation of technologies developed by state-financed research institutes (mainly PRIs). However, it

became easily accessible particularly between 1998 and 2001. Many high-tech based start-ups could receive risk financing from rapidly grown VCs. At the same time, start-ups could raise money through debt financing as well. Money in venture business sector seemed to be overflowing during venture boom period. As an interviewed CEO of IPO company illustrated, financing choices at that time was often cited as “*pleasant worries*” (행복한 고민) (CEO-1, IVCs). But, when venture boom phenomenon began to wither after 2001, venture capitalists sharply reduced their investment in start-up companies. Almost 50% of venture funding decreased during 2001, when compared with 2000.

As equity investment ran ‘dry’ in the market, bank loans became a very significant source of financing for start-ups. Equity investment is usually accepted as risk financing in terms of VC’s point of view. On the contrary, loan must be much riskier than equity from start-up entrepreneur’s view point. In the cases of start-ups which could not attract follow-on investment from VCs after the first-round of funding, the proportion of debt financing began to inevitably increased. The government offered several incentives to attract capital to VC industry. For example, the capital gains tax was lowered by the government in VC investment. At the same time, the government invested public money to VCs if they wanted to establish external investment funds for venture firms. The government also encouraged big potential investors like pension funds to join in establishing public venture funds. This government-leading system in VC sector caused strong dependency on government support. As a venture capitalist (CEO, VC-2) said, “*VCs in Korea had no self-sustaining basis as it would be collapsed if there was no government support.*” He added that “*public funds from the government were the only reliable source of venture capital funds because private sector or pension funds did not play active role to establish venture funds.*” In this situation, VCs could not help following the guidance or control of the government in their investment decision making. After consecutive moral hazard and fraud incidents in venture business sector took place in 2001, so-called ‘*sprinkling type of government support*’ (물 뿌리기식 정부지원) began to be faced by controversial criticism. Many supportive policy measures were re-screened and adjusted. In this process of policy adjustment, VC investment declined considerably, and as a consequence, start-ups had to experience significant changes in

their financing environment. Receiving equity investment became almost impossible like “*waiting for dead men’s shoes*” (하늘의 별따기) (CEO-9, SVG).

A sharp decline of equity investment enforced entrepreneurs into searching for a way of debt financing. As many interviewed CEOs said, policy loan and credit guarantee were really helpful for managing their business. An interesting phenomenon can be found from the interview data in association with entrepreneur’s risk perception about debt financing. Interviewed entrepreneurs tried to borrow money from banks through, first of all, applying to policy loan programmes represented as lower interest rate and longer pay-back period. As mentioned before, the lack of collateral could be sorted out by the ‘credit guarantee’ issued on the basis of technology evaluation by the government established ‘TCGF’. This perfect-looking support scheme for debt financing seemed to lower entrepreneur’s risk perception about bank loans;

“I used to borrow money from banks. But I did not know well how fearful bank debt could be in the future because of its favourable condition in particularly case of policy loan programmes. It was very helpful in bad financing situation. ... but its scale was getting bigger and consequently became really big burden threatening survival.” (CEO-3, OVG)

Above mention is telling that beneficial policy loan programme can influence the lowering of entrepreneur’s risk perception about debt financing. This phenomenon is quite often found in OVG, SVG, IVCs, and FVCs. It is also closely linked to business failure like bankruptcy. In Korean banking system, there is a uncommon institution in western countries which is called ‘*joint and several surety*’ (연대보증). Even if entrepreneurs can successfully get ‘credit guarantee’ through technology evaluation, they have to personally stand ‘surety’ for their bank loan. It is an additional and personal liability entrepreneur had to take besides the one as a CEO. As interviewees indicated, start-up CEOs had to take nearly ‘unlimited liability’ for their company unlike the countries like the US where they take just ‘limited liability’;

“I could really never expect that bank debts made me fall into the mire like this devastating ‘credit failure’ situation. ... Now I can not resume any business because of the stigmatic credit delinquent record in all banking system resulted from ‘joint and several surety’.” (CEO-2, FVCs)

Most of failed start-ups in Daedeok could not close down their businesses due to above mentioned problem. Interviewees in FVCs say that declaring bankruptcy is not easy unless their debt problems are sorted out clearly: *“it is not so easy to decide even going into bankruptcy in Korea because of institutional shackle put on my ankle, so I can neither go back to research institute again nor get another job.”* (CEO-3, FVCs).

At the same time, however, they say they could not aware of its devastating risks when they tried to borrow money from banks. In this situation, it would be not so strange for start-ups in trouble to struggle for survival even under the favor of policy support. According to them, many troubled start-up entrepreneurs had to keep going into foreseeable dead-end for just bare subsistence by relying on all available policy measures. In this process, some entrepreneurs made the scale of debt bigger through continuous challenges by borrowing policy loans, even though many people advised them to stop it up to there. As a failed entrepreneur stated, *“if the condition of policy loan programme was not so favourable and it was not so easy to borrow, then I might already give up my business long time ago.”* (CEO-1, FVCs).

A few CEOs of SVG and IVCs have quite sophisticated debt financing strategies;

“Banks always want to lend money. Then why it is hard for firms to borrow money from banks? I think it is because we, CEOs do not manage our credit properly. ... I regard my credit as a vital asset. ... I could borrow considerable amount of money on the basis of my credit.” (CEO-2, SVG)

“I think bank loan is not appropriate for launching uncertain projects. It is because company can be bankrupted if the project goes wrong. ... Enough money financed by equity investment can make risk-taking possible.” (CEO-3, IVCs)

However, even these start-up CEOs have often used policy loan programmes. They insist that it is important to choose proper financing ways according to the purpose and business situation. They also add there is no reason of refusing policy loans with low interest rate which are easily accessible.

Start-up entrepreneurs are usually seen as risk-takers but interview results show that they want to reduce risk levels as far as possible when they face with risky decision makings. An interviewee interestingly stated, *“nobody might willingly take high risks on purpose particularly in the case of critical decision like start-up which is usually done on ‘all-in’ basis, rather everybody might try to hedge or avoid possible risks as far as possible.”* (CEO-5, SVG). Start-up entrepreneurs want to get equity investment which is less risky than bank debt, but the accessibility of equity financing has been changed over time. In post-IMF crisis, venture booming situation induced mainly by the government intervention contributed to the enlargement of equity investment chances. However, venture capital investment began to rapidly wither after the bust of venture bubble. Bank debt could fill the gap of financing capabilities, but its risk has often been underestimated. The government intervention could make improvement in both availability and accessibility of debt financing through policy loan programmes and credit guarantee schemes. The government has undertaken the role of risk sharing considerably in start-up sector in particular. As an interviewed venture capitalist acknowledged, *“the government has willingly taken the large portion of risks in promoting start-ups and venture capital industry in Korea, but venture capitals couldn’t play the role sufficiently in risk taking due to our short history and weak financing capability.”* (Former Branch Chief, VC-1). The government tried to lower possible high risks in start-up sector through spending public money. In case of ‘Primary CBO’ for example, since 2001, over two trillion Korean won was poured into the policy attempts to revive moribund venture firms after the bust of venture bubble (SERI, 2004). However, a large proportion of the beneficiaries under the credit guarantee programmes like Primary-CBO went bankrupt in the end, ultimately just saddling the government with an even greater fiscal burden (Lee and Rhee, 2007). As a venture capitalist said, unlike the original policy aim, this type of intervention seemed to give actors a sort of ‘distorted recognition’ about the public money;

“At that time, many people used to call it as so-called ‘blind money’(눈먼 돈). It was often recognised as easily accessible money to be served on a ‘finders keepers’ basis (먼저 본 사람이 임자). ...It might be regarded as a fool from entrepreneur’s point of view if not received such ‘easy’ money.” (Branch Chief, VC-4).

Interview results show that this type of intervention is likely to make entrepreneurs perceive the risk of debt lower than reality. This lowered risk perception in debt financing can be linked to serious business failures later. But the result of this phenomenon is not same in every individual firm.

8.3.2 Change of capital structure according to growth stage

Start-ups grow in varied ways and their capital structures change over time. As discussed in earlier chapter, 'stage model' has been adopted in many literature to illustrate the growth of start-up firms although there has been criticism on it. Most of interviewees agree that there can be certain stages in growing process of start-up business, but they do not agree with clear distinction according to simple criterion like business career. An interviewee (CEO-6, SVG) argues that "*it is meaningless to say start-up's growth stages in Korea*", in that start-up's business fluctuation is too severe. However, it does not mean he deny stage model itself. In the present study, interviewed firms belong to OVG and SVG were selected among start-ups which can be once recognized as growing stage firms between 5 years and 10 years in terms of business career. Interviewed CEOs both in OVG and SVG recognised themselves as firms in 'expansion' or 'growing' stage. This result is fitting with the sampling criteria for interviewees. However, interviewees diagnosed their location on business stage in various ways: "*We are just about to enter into very critical 'market-penetration stage'.*" (CEO-1, OVG); "*I think we are in a sort of 'trap stage' or 'chasm stage' existing between each stage.*" (CEO-6, OVG); "*We are now entering 'early period of growing stage'.*" (CEO-9, SVG). Even IPO firms (IVCs) say that they are not on 'matured stage' but standing in front of a new 'starting point'.

Financing choices and capital structures look quite firm specific phenomena. Furthermore, it depends largely on situational factors particularly in rapidly changing business environment like in Korea. Institutional changes in policy regime, as mentioned above, directly affect entrepreneurial choices. Interview results showed that many firms

which already succeeded in securing equity financing in early stage of start-up, experienced difficulties in attracting second-round investment of all occasions after 2000, when most of venture support policies began to undergo large-scale adjustments. Thus, it is hard to find a certain typical financing route for start-ups. However, interviewees agree with the fact that more equity financing was normally requested as start-up grows. As cited above, it is because risk-taking for business expansion or challenging new business opportunities needs to be done preferably by equity financing rather than debt financing. In cases of well growing firms in SVG or IPO firms, most of respondents say the proportion of equity financing has been increased as a whole. But they are saying bank loan has also been very useful for survival or enduring the lack of funds while they could not access to equity financing. Coincidentally, most firms in OVG show relatively high proportion of debt financing. A few firms among OVG which have financed considerable funds in early stage of start-up from VCs failed to get consecutive rounds of investment and faced with financial difficulties recently. Even some firms have never attracted VC investment after start-up, and in these cases, their current business situation is sluggish or stagnant. This result itself may have no significant meaning considering this study is not employing quantitative approach. However, this phenomenon might be underpinning the above mentioned finding in the cases of SVG and IPO firms. In other words, the failure of continuous equity financing and the increase in debt financing (scale and frequency of it) seem to be at least associated with the downturn of start-up business.

Changes in capital structure of start-up can also be explained by changing purposes of domestic money according to business growth. Focusing on the 'purpose' of funding often provides more meaningful information than paying attention to the 'structure' of funding although these two facets are, of course, one side of same coin;

"In my opinion, the purpose of money changes in the process of business growth. In the early stage, money is used mainly for R&D or recruiting. As the company grows, the proportion of investment for facilities or marketing activities is likely to increase. ...The scale of money as a whole seems to be getting bigger and bigger." (CEO-5, SVG)

It indicates that more money is necessary when a firm is about to leap one stage further. This increasing need of fund may enforce start-up to enlarge the proportion of debt financing. Some interviews of firms both in SVG and OVG show that their financing risks have been increased by large scale of bank debts for facility investments such as factory building. In case of manufacturing based high-tech start-ups in Daedeok, this purpose of investment can be critical to make big profits through mass production. However, the problem is that most of equity investors are reluctant to put their money into this huge investment unless the prospect of capital gain looks quite certain. Then, entrepreneurs are likely to rely on alternative debt financing. The government offers a special support scheme with very favoured conditions for firms which want to build their own factories. It is provided firms through lowered interest rate and prolonged pay-back period like general policy loan programmes. Land and factory buildings are also offered to banks as collaterals for debt guarantee. The evaluation of this special scheme of debt financing varies in different interviewees. Some interviewed IPO firms have used it to build their factories and attributed one of their success factors to this policy support. However, on the contrary, some interviewees in OVG and failed companies said that it brought devastating damages to their businesses. Even this case is found in SVG firms, but the result looks less serious than the former cases. Common cause of these negative consequences seems to be big burden of huge debt financing and its bad effect in cash flows.

“It was really risk-taking for me to borrow such a big money for building a factory. It didn't look so dangerous because I thought if my factory was completed and began to manufacture products, then I surely could undertake such level of risks. ... But, its burden turned out to be beyond my imagination, once product sales didn't increase as fast as I expected. ... I finally had to suffer from serious crisis in cash flow, even after selling my factory to other company at quite low price.” (CEO-3, OVG)

When it comes to capital structure, it can not be fully illustrated by just two contrasting sources of financing such as VC investment and bank loan. Actually many start-ups can finance necessary money through various ways in general. For all types of firms, profit from product sales is generally regarded as a fundamental source of financing. However, in case of small and young start-up, it is not easy to produce profits from marketing

activities on a full scale. According to interviewed firms, it takes often a certain period of time in proceeding additional R&D to commercialize their technologies. It means any considerable profits can hardly be expected during this period and consequently, as many CEOs say, survival strategy becomes really important. From the entrepreneur's point of view, government grant for R&D projects might be very useful and significant way of financing. It would be examined more in next section in detail.

8.4 Grant-chasing behaviour

8.4.1 Inertia in seeking grant for government R&D project

Government R&D project has a great significance for start-up firms particularly in Daedeok. As suggested before, most of spin-offed CEOs from PRIs have experienced R&D activities funded by the government through their working career as researchers. Even after start-up, they have been interested in joining government R&D projects. Many start-up CEOs have tried to meet the needs for R&D expenditure required for their entrepreneurial activities through the grant for government R&D projects. In case they got involved with these projects, they could effectively finance necessary money for their domestic R&D needs. As interview results show, many entrepreneurs used to regard it as a significant source of financing. Start-up founders are, generally speaking, seen as people who successfully changed their previous paths into new ones in business world. There are many differences between wage employment and self employment. Start-up founders are usually expected to think and behave differently from their previous career. However, from path dependency perspective, it can also be assumed that a sort of 'inertia' may exist in their mind and behaviour even after their career transformation. 'Grant seeking' looks one of the typical cases representing this inertia.

There are different kinds of grant schemes for supporting R&D activities in Korea, but their delivering mechanisms in terms of policy implementation differ according to their aims and targets. Providing R&D grant has been basically concentrated on PRIs in DST

since early 70s in Korea. After mid 90s, however, spin-off firms emerged and could have a chance to join government R&D projects in mainly the form of sub-contractors, as PRIs were enforced to pursue restructuring. At the same time, start-ups could undertake R&D projects through participating cooperation programmes between university, industry, and PRI. The government has encouraged PRIs to strengthen cooperation with SMEs in general, certified venture firms in particular. In this case of cooperation programmes, start-ups apply for them directly to government ministries or associated organisations. As far as these government projects concerned, spin-off start-ups seem to have extraordinary advantages in that they are familiar with following necessary processes. Interviewed CEOs have experiences of getting involved with government R&D projects to some extent. Interview results show that they have a higher proportion of project undertaking particularly in early phase of start-up. Some firms are hardly involved with government programmes currently, and some said they gave up any grant seeking through these programmes. Most of them recognised that there has been a sort of inertia with regard to this issue in their business history. However, the purpose of doing it and its persistence turned out to be different according to individual firms.

First of all, main motivation of grant seeking seems to be aiming to meet domestic cash flows. More specifically, it can be helpful for entrepreneurs to finance R&D expenditures or running costs, even in some cases, it can be also used for just measure of survival. As many interviewed CEOs point out, grant-seeking through R&D projects might be natural and even necessary entrepreneurial activity, unless it lasts too long or its scale becomes too big. For start-up entrepreneurs, especially on the early phase of start-up business, government grant can be seen as a great initial advantage. In consequence, entrepreneurs are often likely to rely on it in later phase of business. This tendency includes two aspects: 'reliance' and 'persistence' which are closely fitted with main interest of this study. Here, reliance becomes the source of persistence. Once the path of grant-seeking shapes, it can gain 'momentum' to some extent in the process of its accumulation. Then, as interviewees admitted, breaking this path later seems not easy at all;

“When it comes to grant-seeking, once taste it, then hard to forget it because it is easier than increasing sales. ... That’s why spin-offs from PRIs like us are regarded as not easy to fail, but simultaneously hardly to bear big success.”
(CEO-1, SVG)

The origin of this inertia goes back to their previous working career in PRIs. They surely created a new path in terms of occupational choice, but they seem to be still staying on previous path in terms of behavioural pattern. As an interviewee (CEO-2, OVG) described well, some CEOs appear “*not to clearly understand their changed job*” as entrepreneurs.

This inertia is found in both SVG and OVG and it is no exception in cases of IVCs and FVCs. But as mentioned already, the extent of its ‘reliance’ and ‘persistence’ looks quite firm specific. Some firms which already quitted grant-seeking through government programmes are currently suffering from business difficulties. In contrast, some start-ups which are still involved with government projects are showing relatively good business performances. It provides meaningful implications. A path of grant-seeking is seen flexible in terms of its rigidity. It means this path can be developed into path dependency or lock-in, but simultaneously can be broken and replaced with another path by a certain ‘mindful deviation’ or exogenous factors. At the same time, it is hard to say that the consequence of this path dependency is inefficient in terms of business performance. With regard to this issue, it would be argued further in next section.

In the mean time, providing government R&D projects for start-ups has been criticized, in that it can just foster ‘*green house ventures*’ (온실형 벤처) which indicate the start-up firms which have never tasted the ‘bitter cup’ of business in harsh market under the glass of government protection and support. This type of firm represents the lack of self-reliance and the weakness in competitiveness in the market due to strong reliance on government support. Unlike this general perspective from the public, however, interviewed entrepreneurs show quite flexible point of view on this issue. Most of them insist that seeking government R&D project can not be harmful for business growth, if it does match up well with their business direction. But some argue that it can be negative

in business view points regardless its field fits well with business, because grant-seeking can not be basically seen as real profit-seeking behaviour.

8.4.2 Survival strategy or poisonous temptation

As argued above, 'inertia' can be found in start-up's 'grant-seeking' for government R&D projects. Grant-seeking may be, at a glance, seen as 'non-entrepreneurial' behaviour in terms of 'profit-seeking' entrepreneurship which represents firm's fundamental justification for existence. Interview results, however, reveal that this general assumption may not be always valid in Daedeok start-ups at least on the basis of their own perception. Some interviewees say that grant-seeking is necessary particularly on early phase of start-up or in the case of financial shortages in that it can be helpful to overcome these temporary difficulties. On the contrary, some respondents insist that grant-seeking can be harmful for business growth in long term based perspective in that it can make start-ups not to concentrate resources on main business domain. This bifurcating view indicates that grant-seeking has a 'Janus-faced' appearance. In this study, 'grant-chasing' is used as a distinguished notion from 'grant-seeking'. Some extent of grant-seeking might be natural and helpful if it is confined for the purpose of early stage survival or escaping from temporary difficulties. However, if this inertia lasts long or its portion gets bigger in later stage, then it can be described as 'grant-chasing'. Some interviewees admitted the impact of grant-chasing may be negative;

“If we become dependent on carrying out government projects, we may not have our own products, and more strictly saying we may manage to just live from hands to mouth.” (CEO-2, SVG)

“Actually winning government projects was never hard for me because I have been the best in my field. ... But as my firm grows, we can't afford to carry out government projects. ... and I came to know most of 'project-oriented start-ups' (정부 프로젝트 의존형 벤처기업) are finally facing with serious business stagnant or crisis. ... So, I thought this was really like 'sweets'(설탕). I should not do this any more, and quit it as soon as possible. After then, I intentionally didn't apply it.” (CEO-5, SVG)

Above notions point out implications, as an interviewee describes, that “*government grant can be ‘medicine’ as it originally aimed, but simultaneously be ‘poison’ which may cause devastating impact on business growth if it goes beyond a certain line*” (CEO-1, OVG). It means that ‘grant-seeking’ which can be possibly positive up to a certain extent might be transformed into ‘grant-chasing’ which can be negative if it exceeds that extent. However, it seems to be meaningless to detect the location of this critical extent because it looks quite firm and context specific.

In cases of IPO firms, they show relatively flexible attitude about grant-seeking, even in case they hardly carry out government projects at the moment. Some say it should be undertaken in selectively manner as follows;

“If a start-up wants to develop a new technology, and if I were the CEO, then I will finance the cost of this uncertain project through winning government R&D support programmes. ... I think this is a kind of business strategy rather than reliance or dependency. If government support is helpful for further growth, I believe we should take advantage of it.” (CEO-3, IVCs)

But, they are well aware of its potential problem as an interviewee said;

“In my case, R&D projects from ETRI were quite helpful for around three years after start-up. ... I could pay wages for two employees with grants from ETRI projects. But it seemed to make me unconcerned about risks of money in that I could make money quite easily.” (CEO-1, IVCs)

It implicitly means that they do not completely deny or refuse grant-seeking, and they have a certain selection criteria in screening projects worth carrying out. This tendency found in IVCs gave a significant implication in developing arguments with regard to the issue of ‘path inefficiency’. In other words, the consequence of ‘government dependency’ might be not always associated with inefficient outcome. As seen in the interviews of IV Cs, even IPO companies have exploited policy benefits and they suggested this utilisation of policy support as one of driving forces of IPOs.

The common reasoning why they became not interested in projects is linked to their business capacities to conduct those ‘time consuming’ and ‘non-profitable’ works. The environment of carrying out government R&D projects has been largely changed. For

example, government grants are often offered as a joint scheme with a form of loan rather than pure grants. Furthermore, firms should pay a certain percentages out of their own pocket in many cases. Thus start-ups which do not manage it well may have to pay grants back to the government, and consequently they may experience big damages due to its shockwave. This growing sense of concern makes some firms give up grant-chasing even they have a positive expectation about grant-seeking.

In cases of failed firms (FVCs), on the other hand, they also have similar but stricter perspectives about continuous grant-chasing;

“There are many start-ups in Daedeok which can manage somehow to survive indebted for government R&D projects. Those companies do not make money from sales profit. ... Strictly saying, they should not be regarded as real start-ups.” (CEO-2, FVCs)

According to them, most of failed start-ups need to be understood as ‘*failed challengers*’ (CEO-3, FVCs) in that they dared to quit grant-chasing for pursuing real entrepreneurship in spite of its ‘*sweet temptation*’ (달콤한 유혹). They also said that it was not easy to return to grant-seeking again, once the result of this challenging was becoming not as successful as they expected. It was because, as they acknowledge, whole organisational system of firms were already moved on to more market-oriented activities like production, sales, marketing, etc. This indicates a sort of ‘irreversibility’ in turning back to profit-seeking from grant-chasing may exist.

To sum up above arguments, grant-seeking by carrying out government R&D projects can be a reliable strategy for survival particularly on early phase of start-up. However, it can also be led to grant-chasing behaviour which might produce negative impact on entrepreneurship. It would be impossible in this study to say clearly that grant-seeking or grant-chasing should be regarded as a single aspect of the above mentioned two between necessary survival strategy and sweet (but maybe poisonous) temptation. This can also be extended to the argument that grant-seeking (or chasing) is to take advantage of government support, or otherwise to be accustomed to rely on it. In conclusion, it seems clear that inertia can be found in grant-seeking for government projects, but its impact or

development process in start-up's business history looks quite firm specific and context based.

8.5 Choice of business location

8.5.1 Spatial identity of 'Daedeok'

In this study, Daedeok is regarded as a regional innovation system rather than geographical territory. There is Daejeon metropolitan city as a local authority and a surrounding region of DST. Interviewed entrepreneurs were asked how they think about the meaning and the range of Daedeok. According to regional innovation systems approach, the regional dimension has been argued to have key importance in following several reasoning. Regions differ with respect to their industrial specialisation pattern and innovation performance. Knowledge spillover which plays a critical role in the process of innovation is often spatially bounded. The exchange of tacit knowledge, regarded as a crucial factor for successful innovation requires close personal contacts which can be facilitated by geographical proximity. Additionally, policy competences and institutions (formal or informal) are also bound to sub-national territories. Policy actors are seen to play a crucial role in shaping or facilitating regional innovation processes.

Daedeok in the present study, considering the above mentioned arguments from RISs, needs to be understood in both regional and systemic contexts on the basis of actor's conceived regional identity. As expected before the interview, most of respondents pointed to DST and its adjacent area as 'Daedeok'. Adjacent area here was a bit differently mentioned by interviewees: some said 'Daedeok Techno Valley' as an industrial complex for technology commercialisation should be included in the concept of Daedeok, but some insisted existing 3rd and 4th industrial complexes should be also regarded as the broader boundary of Daedeok. Even some interviewees argued Daedeok needs to be understood as a wider concept including some part of 'Yuseong-gu' district

and 'Dunsan-dong' area in which the 3rd government complex is located. They proposed 'functional links' of these areas to DST as the reasoning of conceptual expansion, but they opposed more expansion in a wider sense beyond the administrative boundary of Daejeon Metropolitan City. In other words, their regional identity of Daedeok does not extend to neighbouring regions such as 'Chung-nam' province or 'Chung-buk' province instead it is confined into Daejeon. This result seems to be partly because interviewed entrepreneurs have the same working experiences in PRIs of DST. As an interviewee stated, "*DST is the place like woman's womb for spin-offs from PRIs*" (CEO-3, IVCs). It seems that Daedeok is still being conceived for them as a technology or R&D intensive place rather than business oriented one. This interview result is quite contrasting to the broader concept of 'Daedeok Valley' illustrated in Daedeok Valley Master Plan (2001, Daejeon Metropolitan City). It was introduced to include neighbouring regions which can be functionally interrelated with DST beyond the administrative boundary of Daejeon. It implicitly points out perceptual difference about Daedeok between normative perspective of scholars or policy makers and realistic perspective of interviewed entrepreneurs.

An interesting finding with regard to regional identity of Daedeok is that most of interviewees are quite well aware of the limitation of Daedeok in terms of regional innovation system or industrial cluster. As a respondent stated, "*the most ideal place for running business in Korea is not surprisingly 'Kyung-gi' province (the Capital region encompassing Seoul) considering the effect of firm agglomeration*" (CEO-10, SVG). According to him, the fact that research institutes are simply agglomerated in a certain geographical area like Daedeok does not always mean it can automatically become an innovative place to run businesses. In systemic context, Daedeok may be characterised as 'the imperfect but potential RIS' which is on the way of transition from 'implanted R&D oriented NIS in a region' to 'well functioning and dynamic RIS'. When it comes to the imperfection of Daedeok on the basis of interview result, first of all, 'the lack of actor diversity' can be blamed in that there are just relatively thick R&D related organisations and several supportive formal institutions, but no large firms and other business related organisations such as VCs, law firms, marketing firms. This problem is

more related to the lack of actor diversity in the system than the matter of ‘organisational thinness’ (Nauwelaers and Wintjes, 2003). It is consequently connected to the problem of start-up’s limited networks confined into R&D related organisations. Another problem was ‘the lack of voluntary interaction’ among actors on the basis of self-interest. Although there have been many cases of cooperation between university, research institutes and industry, as an interviewee claimed, those can be described as a sort of “*coerced or manipulated cooperation*” (CEO-3, IVCs) by policy intervention. Furthermore, there was not enough motivation for close interaction or collaboration among PRIs because they have always looked at the government as if sunflower faces the sun. These problems or limitations look the phenomenon of system failure, but policy measures in the mean time seem to be focused on increasing inputs for innovation from market failure perspective rather than correcting the above mentioned system failures which block the functioning of the innovation system.

8.5.2 Tension between divergent and convergent forces

Daedeok can be seen as an innovative cluster in some sense in that R&D resources have been agglomerated and start-ups have steadily increased. There have been debates in regarding Daedeok as a cluster in that it has no strong industrial basis. To look at Daedeok as an industrial cluster might be of course not enough, but it looks gradually transforming into more innovative one as many spin-offs have been emerged. According to location theory, ‘agglomeration effect’ plays a critical role in the formation of a cluster. Initial location of some firms in a certain region is likely to work as catalyzer to induce other firm’s location decision in that region. This phenomenon is found in several cases of successful clusters in the world like Silicon Valley. Daedeok is not an exception of it in terms of agglomeration effect. The existence of DST made it possible to concentrate many R&D resources on Daedeok for last three decades. From mid-90s, many spin-offs from DST have been spawned around DST. As a result, some support institutions for start-ups were established, and some moved into Daedeok from Seoul. However, according to Daejeon Metropolitan City, about 60 start-ups left Daedeok to mainly Seoul for the period between 1998 and 2002. There are, of course, some start-ups

(around 40 firms) which moved into Daedeok from outside for the same period. It means that many start-ups established in Daedeok are leaving Daedeok.

Then why start-up firms go and come like this? How it can be translated in terms of agglomeration effect? To answer these questions, first of all, the matter of 'proximity' needs to be considered. 'Geographical proximity' has been usually regarded as an important factor to produce innovation through interactive learning among actors. However, the case of Daedeok shows that geographical proximity artificially formed by government planning does not always guarantee close interaction among actors. In this regard, Daedeok is seen to have weak 'relational proximity' due to its man-made and too much R&D oriented characteristics of agglomeration. The operating system of DST has been largely dependent on central government, and PRIs have had no strong motivation of cooperation with other organisations in private sector and even each other. This matter has caused the lack of business related interaction in Daedeok. Moreover, there are no 'large firms' which have strong influences on regional economy in Daedeok;

"As a matter of fact, there are only research institutes here. It is not enough for Daedeok to be good business destination. ... I think the attraction of leading companies like large firms would be one of possible solutions for making better business environment." (CEO-3, IVCs)

This notion points out the limitation of Daedeok in terms of 'actor diversity'. According to evolutionary perspective, diversity is really vital in dynamic process of innovation. Daejeon City has tried to vitalize DST through high-tech clustering for last couple of years on the basis of central government policy scheme. This policy was initiated by MOCIE (Ministry of Commerce Industry and Energy), but it has been combined with other policy measures from different ministries and implemented in the level of local authorities. Daedeok has drawn much attention from policy makers as the most potential region to be developed into successful innovative cluster. However, as an interviewee well illustrated below, this policy expectation seems to be still far from real self-sustaining cluster;

"Cluster can produce synergy effect and last long when the organic relationship should exist between people who can give money and who will take it in various fields, but there are only people in same field who want to take money in

Daedeok. ... it is like many gold fishes are gathering together to eat even a small piece first when people throw bread to them.” (CEO-3, SVG).

On the other hand, there seem existing two forces functioning around Daedeok which make firms move out or move in. These forces are associated with geographical location of Daedeok. One is ‘divergent’ force. This force works like ‘centrifugal force’ which enforces start-ups created in Daedeok leave their birth place to outside, mainly capital area. The other is ‘convergent’ force to make firms move into Daedeok from outside. It functions like ‘centripetal force’ to Daedeok. These two forces seem to operate counter to each other. Interview data shows that converging force is coming from advantageous factors of Daedeok, and diverging force is stemming from disadvantageous given conditions of it. Most interviewees were well aware of this phenomenon, but their interpretation about it varied according to their situation. Some say they are still doing their business in Daedeok because residential environment or living condition is better than capital area in terms of some advantageous factors such as lower house price or less traffic congestion. On the other hand, some respondents point out nice R&D environment as a significant merit of Daedeok. It seems plausible in that there are lots of high-qualified PRIs in various technological fields. As some interviewees emphasise, entrepreneurs in Daedeok can sort out their R&D related problems relatively easier than others by using well-connected human networks in the field of R&D that they already have through their working career in DST. They said this could be very helpful for their business in general, on the stage of product development in particular;

“I didn’t have to worry about freak demands from buyers on the specification of our products because I thought I could meet their needs at least technologically through my expert network. ... I could meet the very experts and solve my problems through one or two steps of contacting efforts even in case I didn’t know them directly.” (CEO-2, SVG)

Above mentioned merits of Daedeok are mostly related to R&D activities. Amenity in living condition is also seen as one of well-known necessary factors of R&D centre, and it looks quite natural considering the fact that DST was originally designed to have environmental amenity from the beginning.

However, many interviewees emphasised demerits of Daedeok as the business location of start-ups. These disadvantages or defects seem to stem mainly from geographical condition of Daedeok that it does not belong to capital area. Thus, most non-capital regions in Korea may have same problem to some extent considering uneven or unbalanced development process for last four decades. Seoul and neighbouring capital area has been a single growth pole in terms of both regional and industrial development. Even though Daedeok has the biggest R&D resources agglomeration, other vital resources and infrastructures, particularly business related ones, such as the existence of marketing or financing organisations are largely concentrated on Seoul. Interviewees point out several specific disadvantages of doing business in Daedeok including nearly whole business domain such as marketing, financing, recruiting, outsourcing, IR (investor relation). It means Daedeok is not seen as a good business destination from start-up entrepreneurs at least from the current point of view. Many firms already left Daedeok to Seoul, and many seem to be currently preparing to move due to these disadvantages. However, many firms are interestingly still staying and doing their business in Daedeok. Then what factors are holding them in Daedeok? Why they do not leave Daedeok in spite of several problems? Interview result exhibits a sort of inertia exists in start-up entrepreneur's decision making in business location choice. It is still unclear to conclude whether this inertia can be seen as path dependency phenomenon because the scale of interview data in this study is too small to explore this issue, and also the present interview was basically not designed to address this issue. This study, however, can suggest that a few factors like big transition costs indicating important sources of path dependency are found in interviewee's location decision.

“Daedeok has some merits in spite of many demerits, but it is clear that there are more disadvantageous factors than advantageous ones in Daedeok. ... By the way, we keep staying here for a while because those disadvantages are not yet too much fatal.” (CEO-2, SVG)

“The gap between Seoul and Daedeok is really big in terms of making money in particular. My company is located here in Daedeok, but I make money mainly in Seoul. ... I may leave Daedeok when I can afford to move sooner or later. In my opinion, it seems to be inevitable because there is no market here in Daedeok.” (CEO-3, SVG)

When it comes to business location in terms of land price, Daedeok has relative advantages compared to Seoul, but it becomes disadvantageous compared to neighbouring agricultural areas. Some firms argue that cheap land price for factory building is really significant factor for business location, as an interviewee says;

“The reason why I had to leave Daedeok and move into neighbouring town was because I couldn’t find any available space with reasonable price to build factory here. But I returned to Daedeok again because I could buy cheapest space in this industrial complex.” (CEO-3, IVCs)

To sum up this argument, location choice of start-up looks quite firm specific decision. Any notable differences are not found in each interview groups. Some firms can endure a certain extent of disadvantages of Daedeok, but some can not. At the same time, some companies may feel no disadvantages of doing business in Daedeok according to the characteristics of their business. In this regard, it can be said that a location decision depends on the entrepreneur’s value or other firm specific factors that regulate which one is bigger between convergent and divergent forces. Firms, in other words, may leave Daedeok when attraction power to pull them from outside becomes stronger than its ‘gravity’ which is gripping them in Daedeok.

8.5.3 Expectation of policy benefits and location choice

Regional attraction as a business location can be shaped to considerable extent by policy support and intervention. Except Seoul and capital area in Korea, Daedeok is seen it has received in the mean time relatively big support from central government. Daejeon Metropolitan City, the administrative region surrounding Daedeok, has been developed by some significant exogenous factors. DST was built in Daejeon, and international EXPO was held in Daejeon. A part of government ministries and other military institutions moved into Daejeon. A series of these historic events based on political decision makings contributed to considerable improvement of infrastructure in Daejeon. Furthermore, the government decided to designate Daedeok as ‘the specialized R&D zone’ (INNOPOLIS) recently in 2005. This ongoing huge project on national level is

expected to bring various additional policy supports to Daedeok particularly in the field of technology commercialisation and DST globalisation.

Considering the development process and recent policy direction, it is not so strange to assume that entrepreneurs in Daedeok must be influenced by the expectation of policy support. As mentioned in above sections, interviewed CEOs recognised their advantageous position as spin-offs from DST in several business areas such as seeking government R&D grants or utilizing expert network of PRIs. Business location in Daedeok endows entrepreneurs with these attractions, and it can be the source of gripping power to hold start-ups in Daedeok. On the other hand, according to interview result, entrepreneur's positive expectation on any benefits from policy support can also be very important reason of business location in Daedeok.

"In my opinion, if there are some firms moving into Daedeok recently, it may be because of growing expectation on benefits as Daedeok was designated as the special R&D zone." (CEO-1, SVG)

This can be similarly found in OVG firms;

"A government organisation which is in charge of operating and supporting the special R&D zone was established only in Daedeok. ... So, we may receive much more benefits faster than firms in other regions." (CEO-1, OVG)

This expectation on policy benefits can be connected to location decision not to leave Daedeok. Even in case entrepreneurs do not currently expect too much about benefits from the designation of special R&D zone, they seem to stay in Daedeok with the expectation that one day they will be able to receive any help from it (CEO-4, OVG).

A few interviewed firms have their offices or branches in Seoul for mainly marketing activities and some firms have their factories for mass production in other regions. They, however, do not move their main offices yet. Operating two business sites in different regions must be redundant and inconvenient in terms of management. The reason why they dare to choose this inefficient strategy seems to be their path dependent way of expectation. As mentioned before, start-up founders from PRIs in Daedeok are quite familiar with government support. They can win government R&D projects more easily

than others, if they want. Furthermore, additional policy benefits are continuously expected from ongoing government planning such as the designation of special R&D zone. They seem to have a certain vague expectation about policy benefits on the extended line of DST case in the past. This expectation is seen in both OVG and SVG, even in IVCs. In case of FVCs, however, interviewees show quite skeptical expectation about policy benefits from doing business in Daedeok. Even some failed CEOs have negative feelings on government support as follows;

“It is like ‘drugs’ to rely on government support. It seems to have a sort of ‘addiction’.” (CEO-2, FVCs)

“I don’t expect much about so-called ‘in-house company’ in PRIs which is one of support scheme by the policy of special R&D zone. ... Business is totally different from government supported R&D in PRI. ... If I can have a chance for start-up again, I will not start in Daedeok.” (CEO-4, FVCs)

Some extent of positive expectation on policy benefits in Daedeok looks quite common phenomenon, but it does not mean that this expectation always influence on entrepreneur’s decision making on business location. It seems to follow the above mentioned principle that business location is decided in the tension between converging and diverging forces existing around Daedeok. When the forces to attract firms from the outside of Daedeok become stronger than the forces to grasp them in Daedeok, firms are likely to deviate from their current trajectory in business location and eventually will leave Daedeok. From the path dependency perspective, it is indicating that path dependent inertia in location decision can be destroyed when ‘change-based momentum’ is bigger than ‘stasis-based momentum’ (Jansen, 2004). As Jansen argues, when *“change is going to occur, the energy directed at maintaining the current trajectory must be redirected, replaced, or overcome by the momentum in the new direction”* (ibid, p. 277). However, these two forces commonly exist together in entrepreneur’s mind, as Jansen claims that *“even if change-based momentum has been established, a tension between stasis- and change-based momentums may remain”* (ibid, p. 279). Thus, its direction can always be changed and also return to previous trajectory again according to his/her choices. Interview results, as mentioned above, show that Jansen’s argument can be applied to start-up’s location decision in Daedeok.

9 CONCLUSION

9.1 Summary of Research Findings

This study attempted to open the black box situated in the middle between input and output in the systemic model of innovation and look at what is going on inside. The purpose of this attempt was to explain the fundamental concern raised in research aim of this thesis: why government policy intervention does not necessarily result in an increase of regional innovation capacity. The government dependency of high-tech start-up firms, such as that found in Daedeok, can be understood as a sort of unexpected policy impact in that it is far from the policy objectives for facilitating innovation. Until recently, start-up firms have been accepted in much literature as a main actor in innovation systems (Feldman, 2001; Wagner and Sternberg, 2004; Koch and Stahlecker, 2006). In particular, the high-tech start-up firm has attracted attention from a high expectancy of rapid growth on the basis of technological innovation, and policy support to promote this promising actor can be found in many countries. Daedeok in Korea was such an area in that there was active policy concentration by the government and an accumulation of high-tech based start-ups. Analysis presented earlier has shown that start-ups in Daedeok had not produced 'very successful' business outputs compared to the relatively high technology levels. This phenomenon appears to be problematic considering the unique position of DST as a national R&D hub.

This thesis has addressed two primary research questions and four sub questions. This set of questions has a layering in analytical and methodological terms. Each primary question matches with its coupled sub questions. Firstly, this thesis examined the question of the production of policy reliance: How and why has the reliance of start-up firms been produced in the process of starting their business? From this question, two more specific sub questions were asked: What makes potential high-tech entrepreneurs become start-up founders? How has policy support influenced changes in the perception of risk during the process of start-up? Secondly, this thesis addressed the question about the persistence of this dependent path in business behaviour: how have start-up firms

responded to support measures of government in getting on their business and why they came to respond in that way? This question was addressed through two sub questions: What sort of entrepreneurial responses have been induced by this change in risk perception? How has these responses been reproduced as a form of behavioural persistence in their business history? The analysis of interview data has provided substantial evidence of government dependency on a micro level, and showed that the change in entrepreneur's risk perception in starting up process could be connected to a certain behavioural pattern of start-up firm in later business history in terms of reliance and persistence.

Chapter 7 revealed the emergence of a policy reliant path through changes in risk perception during start-up. Firstly, the ignorance or underestimation about market and business often caused many trial and errors in start-up businesses. Interview results showed that this phenomenon mainly came from their high-tech orientation and the belief in the power of technology in business. Start-ups in Daedeok were generally recognised as high-tech ventures in Korea due mainly to the influence of DST. The interviewed firms in this study were spin-offs from PRIs. They showed high technology-orientation in their overall start-up business. This was seen as being inherited from their long working experience of government funded R&D in PRIs. It played a significant positive role in their start-up decision making. Their belief that they have high level of technologies in their R&D fields seemed to be connected to a sort of overconfidence about their capabilities in business. However, as interview results showed, their high technology orientation was often connected to low market orientation because they had undertaken R&D under non-market environment in semi-hierarchical government funded research organisations. Secondly, interview results revealed that policy support furthered the underestimation of business risks and overestimation of their capability to bear these risks. This changed risk perception triggered self-reinforcing expectation of policy benefits. Policy support could provide considerable initial benefits and advantages for start-up firms. As argued already, the potential entrepreneurs in PRIs in particular could be seen as policy recipients who were relatively more familiar with policy support. For them, policy support was recognised as a sort of safety measure to

lower risks in start-up business. The analysis has therefore clearly shown that these two factors of high-tech orientation and policy assistance have functioned for start-up entrepreneurs to underestimate risks and to overestimate their capability in bearing risks.

In Chapter 8, start-up entrepreneur's benefit seeking behaviour from policy support was analysed. This showed that a path of policy reliance emerged in the process of start-up and settled into continuing business history as a sort of behavioural pattern. Government dependent business behaviour could be found in major entrepreneurial decision making in interviewee's business history. More specifically, it was described into four main types of dependencies:

- following government certifications
- financing through bank debt and credit guarantee by government support
- grant-seeking for winning government R&D projects
- making location decision according to the expectation of further support

Entrepreneurs sought venture certification to be eligible to receive policy benefits from the government. In the early stage of start-up, most entrepreneurs considered this government certification to be a 'license' or a 'qualification' as real venture firms. As the direction of policies changed, they responded to the certification in various ways. Some gave up the extension of it while others still maintained their certification. Among the former firms (once venture group), some could not meet changed criteria of certification, and some could not afford to think about its extension due to bad business situations. More often, however, extensions were not sought because of new types of government select and support initiatives like 'Inno-biz'. This showed that even the firms who gave up government certification can not be regarded as firms who became less dependent on the government support. Government dependent business behaviour was identified in each group of interviewed firms (OVG, SVG, IVCs, FVCs) in the form of benefit-seeking behaviour in their business history. However, it was also explored that the variation in extent or aspect of government dependency depends heavily on firm specific contexts rather than group differences. At the same time, it can be said that the

reproduction of government dependency was significantly influenced by regional and institutional factors in the Korean case.

9.2 Government Dependency and Policy Learning

This thesis sought to explain why government intervention for the promotion of high-tech start-ups did not necessarily result in an increase of regional innovation capacity. Korea has a long legacy of active state intervention, but it has gradually transformed from a Keynesian interventionism into a more market-mechanism oriented intervention. In the field of venture policy, the government realised the possibility that intervention may hinder the proper working of the market mechanisms and fail to facilitate the entrepreneurial activities of start-ups and VCs (Lee, 2000). However, the inertia in the mode of intervention, like 'selection and support mechanism', seemed to be long lasting in the Korean policy regime due to institutional path dependency. This study started with the implicit assumption that the reproduction of government dependency can hinder regional innovation. This section addresses this assumption through a discussion of the meaning of reliance and persistence in this reproduction. The circulating path dependency model (see Section 4.3) underpins this discussion and provides a means to expand the research findings in a wider context of path dependency theory and policy learning.

Policy change is seen as a critical concern raised in the research aim. As argued in Chapter 4, policy matters to both path dependency and new path creation. As reviewed in Section 6.3, the emergence of high-tech start-ups can be seen as a new path in terms of the career change at individual actor level and the structural change at a policy or systemic level. However, the promotion of start-up as a new path can also be seen in some sense just as the evolution of existing paths. Although new institutions for start-ups were newly introduced, many of the institutions of old paths continued as before, and some old institutions just transformed to new purposes. This does not mean it was not a new path. Instead, it was obviously considered to represent a new path in that start-ups emerged as a key actor in the market. It must be a really meaningful change in terms

of economic transformation. The logic of sub-systems of Korean economy has been significantly changed due to the rapid growth of start-up sector. Incentive structures and patterns of strategic interaction among actors also changed following this shift. The government initiative and policy intervention played a vital role in bringing about all this significant change.

Likewise, policy intervention can be regarded as a critical factor in institutional change, particularly in Korean context. As examined already, institutions are likely to be changed along path dependent ways. Even if policy makers conceive a radical and structural change through deliberate intervention, it is hard to produce expected consequences due to institutional inertia and many other unexpected factors. Moreover, their capabilities to intervene may often be limited by 'bounded rationality', and the timing and ways of intervention are more likely to be influenced by political factors which may be often non-rational. Institutions can influence political decision makings. In this regard, policy itself has also changed in path dependent manners. Policy influences diffusion processes of individual actor's cognitive or behavioural patterns at the micro level. At the same time, it influences institutional changes and it can be influenced by institutions at the macro-level.

The purpose of this study was to explore the reproduction of start-up firm's 'government dependency' induced by policy support in Daedeok. As far as government dependency was concerned, 'policy matters' a lot to start-up businesses, but it seemed not a single factor of it. The concept of path dependency helps to understand why policy intervention designed to bring about radical change often results in incremental change or produces unexpected outcome. As quoted in the example of QWERTY keyboard design, it has been introduced to explain why technological choices occasionally lead to sub-optimal solutions. To put it somewhat differently, it has been used to explain the rationality of behaviour that at first sight might appear irrational if one assumes utility maximizing behaviour. The construct of 'government dependency' in this study, however, stands on a somewhat different basis. Start-up firm's reliance on policy support is not seen as simply 'irrational' in terms of risk-reward calculations. These businesses are usually

regarded as facing more uncertainties and risks than other entrepreneurs. They are used to the lack of resources in every corner of their business. In this vein, it may be taken for granted in some sense for start-up entrepreneurs to seek policy benefits continuously, as far as they expect those benefits to be helpful for their business, and reduce the level of business risks. To keep seeking policy benefits may be a very rational choice for entrepreneurs under uncertain situations, unless the expected outcome of their risky challenges guarantees bringing certain and clear successes. They may be willing to pursue 'small but safe' improvements in business performance through benefit seeking rather than risky challenges for 'big but uncertain' successes. This path of policy reliance can often go unnoticed due to its own rationality and convenience. As shown in the interview results, even though they were aware of the fact that their choice was not the best one, there may be a certain rationality to keep adopting this dependent pathway. At the same time, start-up firm's behavioural pattern of policy reliance is not only influenced by institutions, but also linked to institutional stability and change. In summary, policy can really matter in shaping the path of 'government dependency' and its reproduction over time both in micro and macro levels.

For example, as mentioned in Chapter 8, start-up firms in Korea had to take big risks of business failure due to a few specific institutional settings associated with debt financing. Even though the government provided credit guarantee for bank loans for start-ups on the basis of technology evaluation, entrepreneurs had to bear a huge danger of credit failure because of 'joint and several surety' scheme imposed by banks on the entrepreneur personally as a CEO. It reflects why many dying start-ups could not relinquish their business and take another opportunity again. The analysis showed that entrepreneurs tend to adapt themselves to policy changes as a survival or business strategy. It can be seen as a sort of reflective learning process from policy intervention, where the individual firm's risk perception and the systemic risk sharing structures played critical roles in this learning process. In this regard, start-up firm's policy learning can be seen as a natural phenomenon like 'conditioned response' to policy benefits. It seems accumulated evolutionary adaptation for survival is likely to be embedded in business history. This policy learning process looks like a typical path

dependent process as the term of 'learning' itself is a path dependent phenomenon. Policy reliance gradually gains momentum through start-up entrepreneur's self-reinforcing expectations, and consequently produces behavioural persistence. Empirical analysis shows that benefit seeking behaviour from policy support emerged as policy reliance arose from risk perception changes. It can also be persistent over time through the process of mindful and institutional reproduction.

The outcome of policy intervention depends largely on the mode of intervention (see Section 3.4). There are two typical rationales for policy intervention in the process of innovation: market failure perspective and system failure perspective. According to these two different perspectives, policy prescription becomes different and consequently the outcome of intervention also occurs differently. As examined in Chapter 7, policy schemes and measures for start-up support in Korea have been initiated by the central government. During the presidential term between 1997 and 2002, start-up policy was focused on promoting the supply of entrepreneurship. Various supportive policy measures on the basis of venture certification were introduced to facilitate new firm creations. Most of them seemed to be prepared according to the logic of correcting market failure. Thus, provision of subsidy or grant for certified venture firms was the most representative and powerful schemes of intervention. The following presidential term from the end of 2002 saw the direction of policy intervention begin to change. Balanced regional development and regional innovation became the central themes of nearly all policies. The government emphasized the importance of cooperation or collaboration among actors, particularly between industry and universities (or research institutes). Establishing regional innovation systems on the basis of the enhancement of regional innovation capacities began to be highlighted as the way for accomplishing balanced regional development. As a result, innovation through cooperation has been more emphasised than before in the case of start-up policy. It seems to be a notable policy change from a market failure perspective to a system failure perspective. However, policy measures are still seen not deviating from subsidy or grant regime. Although a new certification called 'Inno-biz' was introduced, venture certification also existed. Even though cooperation between industry and universities was emphasized

rather than simple new firm creation, incentives for facilitating cooperation still focused on direct support such as subsidy or grant.

The provision of subsidy or grant can be quite efficient and rational in political terms. Politicians or policy makers are usually keen to display clear policy effects to the public (or voters) in short period of time. They are also interested in efficient distribution of scarce resources. As a result, policy making can be often changed by political or non-economic logic, and consequently certain inertia can be produced in policy changes. In other words, once adopted, policy measures are not easily changed even if policy makers or politicians come to recognise problems with existing measures. The policy changes in the mean time in venture support show that the government has recognised the necessity of policy correction. But interview results reveal it is not so simple. Due to the pressure of deregulation on the market, the direction of venture support policy such as venture certification was changed into a more market oriented and indirect one, at least explicitly. However, government-guided policy intervention, such as Primary CBO, was also implemented even amid such ongoing policy changes. It means that direct policy support was common in promoting start-up sector in Korea. In this regard, it can be said that the production and reproduction of 'government dependency' in Daedeok has been considerably influenced by this type of path dependent policy changes.

Policy is not prepared in a static and unchanging environment; instead it always changes through feedback processes. Learning effects can be produced not only on the demand side but also on the supply side. This study focused more on demand side policy learning ('learning from policy' as discussed above). Once the path of policy reliance was established, a cumulative process of policy learning started which brought big benefits to start-up firms, in that they could operate their business under less uncertainty (Meyer-Stamer, 1998). This notion points to why the path of policy reliance continues to be pursued by start-up entrepreneurs, despite the fact that there are obviously non-reliant paths which might produce better performances. This means that there is a positive and self-reinforcing feedback loop that brings a momentum and makes dependent behaviour persistent. However, interview results show that there may also be a negative feedback

loop as well. As seen in the case of continuous grant-seeking, entrepreneurs who feel the necessity for deviation from reliance do not always turn it into immediate action, due to many practical constraints and the lack of confirmation about the new path's outcome. This indicates that entrepreneur's policy reliance and behavioural patterns may have become embedded into organisational routines over time through the process of learning from policy.

On the other hand, supply side policy learning ('learning in policy') also needs to be taken into account in understanding government dependency. Unlike the illustration of learning mechanisms in demand side, self-reinforcing processes in the reproduction of 'government dependency' can be fostered by the feedback effects from unintended outcome of policy intervention. Policy makers used to pursue specific institutional changes through conscious policy intervention. It may not always result in intended outcomes as they expected, then they may try to intervene again with adjusted policy schemes. As a matter of fact, start-up policy changed a lot according to situational change in start-up sector. Many social and political factors seem to have had an influence on this change. For example, criteria of venture certification underwent a big change in 2001, and new type of certification for start-ups called 'Inno-biz' was introduced afterwards. As the analysis in Chapter 8 showed, start-up entrepreneurs have fitted themselves to this policy change. Reasons of their policy adaptation seem quite simple: they wanted to get more policy benefits continuously, or they did not want to lose any possible opportunities for sucking 'easy money' from policy support into their business. In Korea, policies for promoting start-up sector including venture firms, VCs, and the KOSDAQ market changed along the direction of more indirect and market-oriented support. As stated above, this does not mean the outcome of this policy change resulted in intended effects. Sometimes it contributed to the diffusion of dependent culture on policy benefits. In some cases, it influenced some start-ups to deviate from their dependent business pathways at a certain point of time. Thus, it can be said that start-up's 'government dependency' in Daedeok has been reproduced under the influence of policy changes induced in the process of policy feedback.

To sum-up, the dependency on policy support can be individually interpreted: some firms accepted it as policy reliance but others regarded it as policy utilization. In this regard, a critical juncture between reliance and utilization could not be clearly identified on actor's level. At the same time, it could be said that critical juncture of government dependency in terms of regional innovation was also not easily identified. Policy does not exist in vacuum. Rather it was continuously changing through the process of policy learning. Thus it can be said that policy support produced 'government dependency' both on actor and regional level, and it was reproduced variously depending on different institutional settings. However, it is hard to say clearly that government dependency hindered innovation more than non-intervention. Instead, it can be said that the expected policy effect in innovation might be reduced by a crowding-out effect due to the government dependency at an actor level, and this effect can be connected to a failure to increase regional innovation capacity.

9.3 Path Dependency and Regional Innovation Policy

The contribution of this thesis sought to build knowledge about regional development processes. More specifically, it expected to contribute to the knowledge about the role of high-tech start-ups, the rationale for policy intervention, the systemic understanding of regional innovation and, most significantly, the theoretical expansion of the path dependency approach. The earlier three contributions are intertwined with each other, in that the role of high-tech start-ups, policy support for them, and regional impacts in terms of innovation system have the relationship of biting at each other's tail. Path dependency theory was employed to address this interrelationship between business, policy and locality. Thus, the theoretical expansion of path dependency can be seen as a main contribution of this study. This study tried to modify traditional path dependency approach from a linear and non-flexible one to a non-linear (circulating type) and more flexible (less deterministic) one. This attempt provides an improved basis to analyse the process of innovation in any policy regime, since it delineates the repetitive relationship between new path creations from path dependency by policy intervention, and the

eventual recurrence to path dependency or lock-in from this deviation. In this regard, government dependency as an analytical construct can also be a useful criterion for the evaluation of the impact of innovation policy.

9.3.1 Government dependency trap

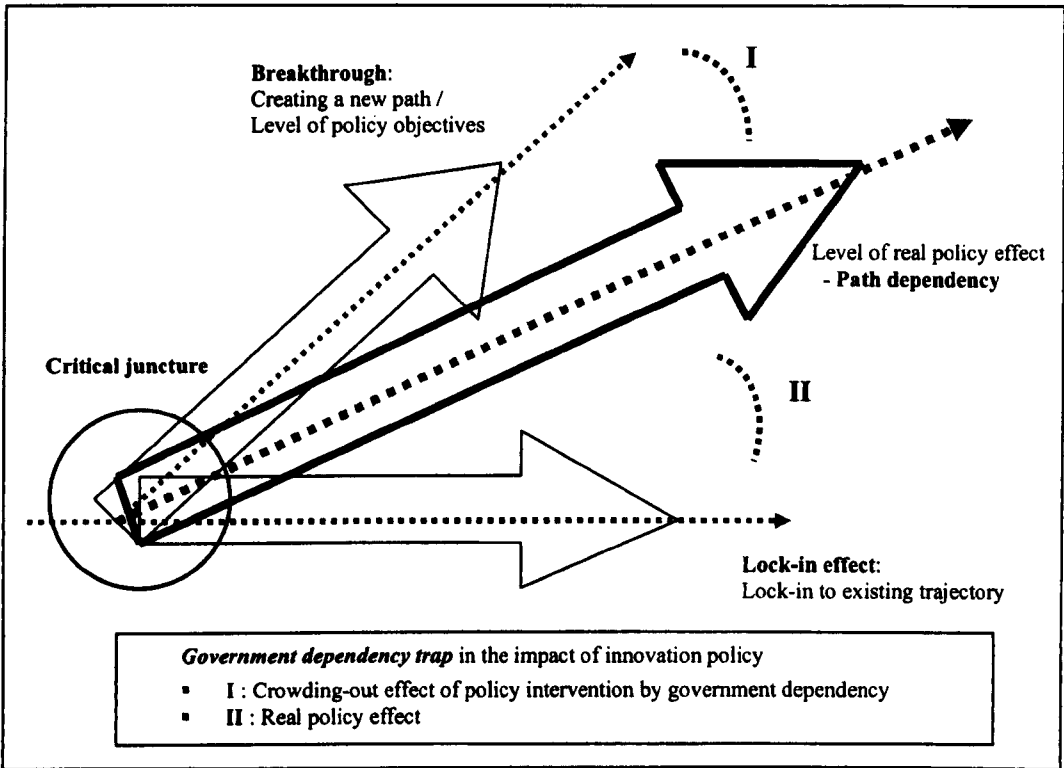
Path dependency in its classical version, as mentioned before, challenges the assumption of neo-classical economics where interactions between economically rational actors will always lead to efficient outcomes. Instead, it argues that the result of rational choices by rational actors can lead to inefficient equilibria, and this outcome may be stable. In such situations, inefficiency or sub-optimality can persist over time, even when actors are economically rational and they are aware of this problem. It means that a finally reached equilibrium may not be the most efficient one, and the taking of this sub-optimal path may be influenced by early moves. The matter of this path inefficiency is one of the most fundamental claims in path dependency theory. It is, however, difficult to be clearly stated in this study because the outcomes of 'government dependency' can not be simply regarded as an inefficient path. Generally speaking, grant-seeking or policy reliance may look far from an American style entrepreneurship. Start-ups are with no doubt required to be continuously competitive and innovative for their survival in harsh market. They are always struggling to maintain their competitive advantages. The notion of 'innovator's dilemma' well represents the climate of high competition in high-tech start-up sector. Many countries have struggled to foster start-up entrepreneurship through various policy interventions. Even in Silicon Valley, many policy measures focused on enforcing market forces, facilitating fair competition, eliminating unnecessary regulations, or providing soft infrastructure like managerial consulting services.

Contrastingly, the Korean government used resources to provide policy measures in the way of direct intervention. For implementing these supportive measures, a unique selection mechanism called 'venture certification' was prepared. This type of support, as mentioned in above chapters, has been often described as 'sprinkling' public money.

Serious waste and inefficiencies have happened, but these have often been recognised as an inevitable side-effect of the recovery from the IMF crisis (Crotty and Lee, 2002). Political factors and inertia in policy regimes seemed to bring about persistence of inefficient policy measures. Interestingly, their impact on individual firm's business growth has been positively evaluated in the mean time. This tendency is also identified in the interview results of this study. Most interviewees showed positive attitudes to the overall performance of policy support for start-up promotion over the decade since 1997. Although a few aspects were seen as negative impacts, such as grant-chasing behaviour, the outcome of 'government dependency' was not seen to be absolutely inefficient. According to interviewed CEOs of IPO firms, they have always tried to take advantage of government support properly at the required time. Moreover, they added it was a significant driving force in leading their business to the successful performance of IPO. Actually, IPO itself is not seen as the final destination of start-up business, but it can be seen as a great achievement in the market. If the business performance of start-ups could be observed over a longer term perspective beyond the stage of IPO, this judgement may be different.

This thesis suggests a possible consequence of policy induced government dependency on the basis of above discussion. Theoretically it can be expected that once actors experience some benefits from policy measures, they are faced with a critical juncture whether to follow a dependent way or breakthrough this dependency. As discussed above, actor's choice is influenced by various factors such as individual (organisational) innovative capacity, regional legacy conditioned by institutional settings, type of policy intervention, and others. If a path of start-up firms' policy reliance becomes persistent in their business history and the reproduction of this path dependent phenomenon has an inefficient impact on increasing regional innovation capacity, it can be said that the effect of policy intervention is likely to be eroded by the crowding-out effect of 'government dependency trap' as seen in Figure 11.

Figure 11. Possible 'government dependency trap'



Source: Author

Actor's risk-avoiding attitude was seen, in some sense, as a natural and rational business strategy in uncertain environmental changes. Policy support might be accepted in order for firms to reduce their risks or uncertainties in seeking entrepreneurial opportunities. This can induce more risk-taking by actors, for example even risk-averse actors can dare to start up their own risky business motivated by policy support. As empirical data shows, policy support can tempt a firm to move beyond its competences to bear risks in starting up business and, consequently, this excessive risk-taking influenced by policy support may be associated with an increased risk of business failure. Policy evaluators may think that excessive risk-taking has positive effects overall if the social benefit from the growth of start-ups exceeds the cost from business failure. However, evaluators also need to take the possible inefficiency into account due to an unexpected 'dependency' on government policy. When entrepreneurs gradually become beneficiaries, this dependency can undermine their self-reliance at micro level and also erode

entrepreneurship or enterprise culture at macro level. It may cause a sort of 'X-inefficiency' (Leibenstein, 1966) in overall entrepreneurial spheres, whereby the provision of assistance gives firms an incentive to rely on it and to seek a comfortable life under state protection.

This phenomenon can be understood as the result of reflective learning, and not surprisingly it may reduce the intended effect of policy intervention. Thus, the government dependency trap can be prevalent not exceptional, but its extent differs in each case. In general, government support is provided on the basis of non-market selection which can be distinguished from market selection. The process of market selection plays an important role in driving out inefficient or less progressive firms from markets. Contrastingly, the mechanism of non-market selection may work towards the direction of disturbing a natural 'eco-system' in markets. Thus, a policy implication is that the appropriate mode of intervention in this situation might be the 'stick' of competition rather than the 'carrot' of assistance. This study pays attention to the mode of policy intervention. The most common and powerful mode of intervention in S&T policy, industrial policy, regional policy, even recent innovation policy has been the combination of government selection and direct financial support for selected targets. This specific mode of intervention is pursued to some extent in many countries due to its effectiveness or efficacy. Nevertheless, this type of intervention may cause serious distortion in market mechanism due to its inevitable selectivity. Policy can affect the incentive structure in the actor's mind through its influence on institutional change, which also means change in the rules of the game. In this respect, government dependency can be seen to be the consequence of this specific mode of intervention.

In line with this discussion, a normative question may be asked: Is government supportive intervention fundamentally necessary for facilitating innovation? This issue is highly contestable. Even if policy support produces government dependency and its consequences can result in inefficient or negative effects, government intervention could be still justified in the name of its prescriptive potential in promoting innovation. In other words, if the result of intervention is not worse than the result of non-intervention,

government intervention may keep its footing. Furthermore, it can be also argued that government dependency could be avoided by applying a different mode of intervention or by fine-tuning policy implementation. Thus, government dependency needs to be interpreted by giving consideration to the specific regional, institutional, political, and socio-cultural contexts.

9.3.2 Criterion for policy impact evaluation

Policy occupies a critical position in the reproduction process of start-up firm's 'government dependency'. This phenomenon can be seen as a policy impact in that it is induced by policy intervention. This study, however, is not a policy impact evaluation study, although the concept of 'government dependency' might be a useful criterion in evaluating the impact of innovation policy. Policy impact evaluation is to estimate whether or not interventions produce their intended effects (Rossi and Freeman, 1993). In this regard, policy impact evaluation is usually undertaken in long term perspective and by experimental comparative analysis to estimate the net and gross effects of intervention. Comparing what happened with what might have happened without intervention, or comparing how different country or regional specific impacts arise from the same policy are very hard to accomplish (Parsons, 1995). In this respect, there has been an increased interest in many countries in the issue of evaluation of government policies in terms of the need to better allocate scarce public resources. This issue is, more fundamentally, associated with the appropriate role of government and market mechanisms across a number of policy areas (Papaconstantinou and Polt, 1997). Recently, the focus of innovation policies put an increased emphasis on knowledge diffusion, organizational changes and innovative behaviour. This has raised new methodological challenges for evaluating the impact of these policies.

Most of previous studies on innovation policy during 1970s and 1980s mainly focused on empirical analyses of policy effects through historical investigations or quantitative methods, such as multiple regression analysis and input-output models (Ashcroft, 1982;

Diamond *et al*, 1983; Folmer, 1986; Nicol, 1982). By the 1990s, some researchers tried to use more comprehensive evaluation methods such as cost-benefit analyses, survey-based approaches targeting companies which received political assistance (Bovaird *et al*, 1991; Foley, 1992; Anderson and Feller, 1994; Swales, 1997). However, this research has some basic problems: the lack of appropriate quantitative data sources and relevant analytical tools, the difficulties of quantifying some qualitative factors and comparing policy impact before and after. To estimate the net effects or the intangible benefits of the policies with sufficient accuracy are nearly impossible. The effects of policies can be revealed not only via economic impact on well-defined concepts such as competitiveness and/or other indicators connected with market exploitation, but also through non-economic effects on the behaviour of companies and institutional changes (Diez *et al*, 2000). The effects of the latter may be much more important than the direct economic effects in some sense. However, these effects are not easily transformed into measurable criteria of policy impact evaluation. Thus more qualitative and more political evaluations are emphasised in recent policy evaluation studies. Adopting the appropriate criteria to be used for judging policy programmes becomes a crucial issue in policy impact evaluation.

As stated already, this study did not attempt to evaluate policy impact directly. Rather it sought to develop an analytical construct for policy analysis that can be used to understand unintended policy impacts. Therefore, this study expected to contribute not only to the theoretical development of path dependency, but also to practical implications for policy makers, of why and how policy support produces unexpected and suboptimal impacts. Government dependency can be a useful criterion for policy impact evaluation in terms of 'additionality' in particular (Buiseret *et al*, 1995). This concept has been considered as a central factor that indicates the changes in behaviour and performance which would not have occurred without the policy intervention. The construct of government dependency in this study was investigated through the two concepts of policy reliance and behavioural persistence. Generally speaking, policy makers can expect that firm behaviour will be changed through policy programmes in a desirable direction. However, policy intervention can also induce unexpected perverse

effects as well, for example encouraging firms to take risks that they cannot afford (Georghiou and Clarysse, 2006). These unexpected effects on behavioural changes need to be included in consideration of 'behavioural additionality' that indicates the difference in firm behaviour resulting from a government intervention. Government policy support can encourage start-up firms to engage in more entrepreneurial and innovative activities. However, this study suggests that the effect of government policies can be eroded by the reproduction of government dependency. In this regard, the expansion of path dependency theory which combines with the construct of 'policy induced government dependency' can be a useful criterion to provide more persuasive insight in the evaluation of innovation policy.

The empirical study in Korea suggested a few implications that 'direct and continuous' financial supports for high-tech start-up firms have contributed to the reproduction of government dependency in Korea. In particular, this phenomenon has emerged and deepened notably in case of the start-ups in Daedeok due to not only their long term experience of R&D subsidization in PRIs from the government but also government dependent and R&D oriented regional legacies. Considering the case of successful policy intervention in the US, policy intervention in proper timing and appropriate ways can play a critical role in regional innovation and economic development. In the US, policy intervention to stimulate innovative activities on early stage in the market through multiple institutional interfaces could successfully function. However, this could be possible on the basis of specific conditions in the US such as sufficient market forces and enterprise friendly business climate. As many existing empirical studies revealed, this successful case has not been easily transplanted in elsewhere. In Korea, active role of the government in promoting high-tech start-ups using mainly public spending was once considered as a successful case of policy intervention on its early stage at least from 1997 to 2001. But this rule of financial support began to be reviewed critically from 2001. Since then, as seen in policy documents of that time, the government seemed to realize problems caused by 'direct' financial support for start-ups and attempt to address them by using more indirect and multiple support measures. Nevertheless, it seems to be still in big debates in Korea that start-up sector including venture capitals

could have grown in such a rapid pace if there were no active initiatives of the government. This phenomenon implies that the result of policy evaluation may also depend largely on when it is done. Thus it can be said that proper timing and mode of intervention according to specific environmental conditions or institutional settings in different countries and regions can be suggested as a successful policy initiative so as to ameliorate the risk of government dependency.

9.4 Critical reflections and Concluding remarks

One of the research objectives of this thesis was to construct the conceptual framework of government dependency and the other to apply it to the case of Daedeok in Korea. Although this study conceptualised government dependency in a generalised sense, its reproduction is likely to be largely based on regional and national specific contexts. High-tech start-ups and policy support for promoting regional innovation are commonly found in many countries, but the mode of policy intervention varies greatly in each region and country. In addition, the impact of policy intervention might be differently produced due to the difference of institutional settings even though same policies were implemented. This study reported on the case of Daedeok in Korean context and the ten-year period of economic readjustment since 1997. Thus, it can be said that the reproduction of government dependency must be variously presented in different contexts, although government dependency is expected to exist to some extent wherever policy support is provided.

At the same time, the competitiveness of government dependent start-ups can also be differently understood in terms of different time periods. Those firms which have been quite successful in the domestic market may not be continuously successful in global market because government protection and policy support may bring about vulnerability in limitless and borderless competition. Likewise, the label of currently successful business performance may not last long in a rapidly changing business environment. Considering the traditional concept of entrepreneurship, the outcomes of 'government

dependency' are much more likely to be inefficient, but as mentioned above, this study did not reach a clear judgement of this matter. As the interview results show, the firms that have utilised government support often demonstrate better business performances. In contrast, the firms that tried to quit grant-seeking behaviours or gave up policy benefits to exploit bigger business opportunities in the market, often record relatively poor business performances. Even in some cases, the firms that intentionally deviated from grant-seeking often fell into business failures. Thus, with regard to the consequence of 'government dependency', the result of empirical investigation might provide different interpretations if it was to be conducted over a longer study period.

This study suggests two meaningful directions of further research. One is to evaluate the impact of innovation policy through the construct of government dependency developed in this study. The other is to investigate the consequence of government dependency in terms of regional path dependency. As discussed earlier, the construct of government dependency can be used as a useful criterion for policy impact evaluation. To apply this construct to different contexts will also provide a wider lesson for policy makers who want to develop more desirable policy measures. On the other hand, the construct of government dependency can be applied to further studies to examine whether it has shaped a government dependent path in regional development process. Regional path dependency is likely to result in regional lock-in. To observe regional development trajectories needs a longer term perspective.

The role of institutions in shaping regional trajectory was also examined in this thesis. The importance of institutions is emphasised in most studies of RISs to determine contexts of innovation. Business start-up can also be considered a type of context-dependent social process. Their entrepreneurial behaviour and learning capacities are, on the one hand, heavily dependent on regional institutions and culture, but on the other hand, these factors are also shaping regional trajectories through institutional changes. 'Government dependency' is understood in this study to be mainly induced by policy support from governments. As mentioned before, most policy measures for supporting start-ups in Korea were prepared by the central government. There was, of course, a role

for local authorities in the implementing processes, but their roles were merely complementary in most cases. It means that national policy mattered a lot in the reproduction of 'government dependency' in Daedeok, but the influence of regional policy initiatives was quite limited. However, it does not mean that the influence of regional factors or ingredients can be neglected in shaping the path of 'government dependency' and its reproduction. If so, there would be no differences or variations in the aspect of 'government dependency' across the regions. However, this assumption looks quite unrealistic. This study did not attempt comparative work aiming to explore variations in government dependency between different regions. However, it seems likely that regional specific factors such as regional history, regional institutions, or regional business culture have influenced the reproduction of 'government dependency' over time. This issue can be an interesting source of further studies. At the same time, this argument can also be linked to the already mentioned matter of persistence of 'government dependency' as a regional path or trajectory.

As noted before, Daedeok has quite extraordinary characteristics in terms of national R&D resources, the agglomeration and continuous policy concentrations in this field. Its inheritance and endowments were also led by exogenous government initiatives. The results of institutional analysis and empirical investigation fit together quite well. It was argued in Chapter 6 that the institutional settings in Daedeok-RIS changed towards R&D oriented and government dependent ways. Interview results analysis (Chapter 7 and 8) revealed start-up firm's high-tech orientation and benefit-seeking behaviour in Daedeok. In this regard, it can be said that start-up's 'government dependency' was reproduced along the government dependent regional trajectory in Daedeok, and also this contributed to the formation of such a trajectory. The matter of this regional path dependency needs to be examined in further studies.

This study looked at start-up firm's entrepreneurial behaviours through the combined lens of path dependency and path creation under conditions of policy intervention to facilitate innovation. From this point of view, government dependency can be seen as the aggregate result of a series of start-up firm's individual and rational calculations.

Each assessed the incremental benefits of receiving policy support in an environment characterized by uncertainty and limited information. High-tech start-ups and their technological entrepreneurship are increasingly considered to play a crucial role in the generation of both regional innovation and economic development. As witnessed in the case of Silicon Valley, there has been significant interest in the agglomeration of 'technopreneurial' activities and their contribution to regional transformation and high economic growth. Governments in many countries have attempted to promote 'technopreneurship' by pursuing various policy initiatives. Policy intervention is expected to influence knowledge workers' start-up decision in that it affects the incentive structure of their career choices, whether they remain in incumbent research organizations or create their own new companies. Governments have various roles to play in encouraging start-up decision and supporting start-up firm's growth. Often they use regulative and protective measures. They sometimes provide direct assistances by public spending. By these attempts, innovative ideas or technologies can be moved into markets.

However, as many empirical studies demonstrate, the survival rate of such ventures is quite low. It means that the introduction of high technologies into markets does not always result in business success. Lots of business studies suggest there can be various pitfalls or traps in the pathway between laboratory invention and market innovation. In similar vein, it can be assumed that there is a black boxed section between technopreneurship and entrepreneurship. Considering the notion of 'grantpreneurship' induced by government supports, it can be illustrated there may be a critical juncture to be chosen for 'technopreneurs' between the two possible pathways of entrepreneurship and grantpreneurship. This illustration may be too simplified but it can provide a useful insight for understanding start-up firm's government dependency as a sort of unexpected policy outcome. As argued already, policy support can produce beneficial effects by filling a finance gap between social optimal levels and real investment level in the market. At the same time, however, it can erode the self-reliance of start-up firms and lead them to the way of dependency. In this case, an innovation system can fall into the government dependency trap at macro level. On the other hand, at micro level,

policy intervention might enable entrepreneurs to deviate from a path dependent business trajectory, but simultaneously to fall into the trap of benefit-seeking behaviour. Institutions play an influential role in entering one of these two possible ways at this branching juncture. Regional endowments and inheritance could make the institutional settings different in every region and it might have significant influences on the production and reproduction of government dependency.

In this regard, the construct of government dependency developed in this thesis is expected to provide a very useful insight in explaining the concern raised in the research aim: why government intervention does not necessarily result in increase of regional innovation capacity. It would also contribute to open up new horizons in studying multi-dimensional changes such as entrepreneurial, regional and policy changes on the basis of integration between self-reliance and dependency, market failure and system failure, path dependency and path creation.

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APPENDIXES

Appendix 1: The list of secondary sources

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'The Report of research in demand or trend of Daejeon R&D' (DSSC trusted by DHIPF, 2003)

'Report for the trends investigation of regional industry: A target for small and medium-sized venture business of Daedeok Valley', (DSSC trusted by DHIFE, 2004)

'Survey on the needs of marketing on demand in venture businesses' (DSSC, 2005)

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MOST (Ministry of Science and Technology) – <http://www.most.go.kr>

SMBA (Small and Medium Business Administration) – <http://www.smba.go.kr>

Venture net – <http://www.venturenet.or.kr/vnet/index.do>

NSO (National Statistical Office) – <http://www.nso.go.kr>

Daedeok Innopolis – <http://www.ddinnopolis.or.kr>

KVCA (Korean Venture Capital Association) – <http://www.kvca.or.kr>

KOVA (Korea Venture Business Association) – <http://www.kova.or.kr>

KOSDAQ market – <http://www.kosdaq.or.kr>

KRX (Korea Exchange) – <http://km.krx.co.kr>

KOSEF (Korea Science and Engineering Foundation) – <http://www.kosef.re.kr>

Appendix 2: Interview details

I. Interview Outline

1. Fieldwork period: 28/02/06~01/05/06 (63 days)
2. Total number of interviewees: 37
 - Still Venture group: 10 / Once Venture group: 9
 - IOP (KOSDAQ) companies: 5 / Failed companies: 5
 - Venture Capital: 5 / Government Officials: 3

II. Once venture group (OVG) – arranged by alphabetical order of company name

1. Founder and CEO of **OVG-1** / Spin-offed from ETRI
 - Date / Duration: 04/03/06, 11:00~12:10 (70 min.)
2. Founder and CEO of **OVG-2** / Spin-offed from ETRI
 - Date / Duration: 06/03/06, 10:00~11:35 (95 min.)
3. Founder and CEO of **OVG-3** / Spin-offed from ADD
 - Date / Duration: 07/03/06, 14:00~15:36 (96 min.)
4. Founder and CEO of **OVG-4** / Spin-offed from KAIST
 - Date / Duration: 06/03/06, 10:00~11:35 (95 min.)
5. Founder and CEO of **OVG-5** / Spin-offed from ADD
 - Date / Duration: 30/03/06, 16:40~18:00 (80 min.)
6. Founder and CEO of **OVG-6** / Spin-offed from ETRI
 - Date / Duration: 07/04/06, 13:00~14:28 (88 min.)
7. Co-founder and President of **OVG-7** / Spin-offed from ETRI
 - Date / Duration: 30/03/06, 15:00~16:05 (65 min.)
8. Founder and CEO of **OVG-8** / Spin-offed from KRISS
 - Date / Duration: 03/04/06, 09:30~10:43 (73 min.)
9. Founder and CEO of **OVG-9** / Spin-offed from ETRI
 - Date / Duration: 28/03/06, 14:00~15:56 (116 min.)

III. Still venture group (SVG) – arranged by alphabetical order of company name

1. Founder and CEO of **SVG-1** / Spin-offed from ETRI
 - Date / Duration: 14/03/06, 14:30~15:53 (83 min.)

2. Founder and CEO of SVG-2 / Spin-offed from ADD
- Date / Duration: 16/03/06, 16:00~17:30 (90 min.) *
3. Founder and CEO of SVG-3 / Spin-offed from ETRI
- Date / Duration: 16/03/06, 16:00~17:30 (90 min.) *
4. Founder and CEO of SVG-4 / Spin-offed from ETRI
- Date / Duration: 02/03/06, 14:20~15:54 (94 min.)
5. Founder and CEO of SVG-5 / Spin-offed from ETRI
- Date / Duration: 24/03/06, 14:00~15:27 (87 min.)
6. Founder and CEO of SVG-6 / Spin-offed from KAERI
- Date / Duration: 10/03/06, 16:00~16:57 (57 min.)
7. Founder and CEO of SVG-7 / Spin-offed from ETRI
- Date / Duration: 17/03/06, 10:00~11:40 (100 min.)
8. Founder and CEO of SVG-8 / Spin-offed from ETRI
- Date / Duration: 08/03/06, 15:00~16:42 (102 min.)
9. Founder and CEO of SVG-9 / Spin-offed from ETRI
- Date / Duration: 09/04/06, 14:00~15:33 (93 min.)
10. Founder and CEO of SVG-10 / Spin-offed from ETRI
- Date / Duration: 15/03/06, 14:00~15:21 (81 min.)

* 2 & 3 interviews were jointly conducted.

IV. IPO companies (IVCs) – arranged by alphabetical order of company name

1. Founder and CEO of IVCs-1 / Spin-offed from KRIBB
- Date / Duration: 16/04/06, 10:00~11:57 (117 min.)
2. Founder of IVCs-2 /
· Spin-offed from the Technical Research Institute, Shin-Sung E&G
- Date / Duration: 03/03/06, 14:00~15:20 (80 min.)
* *Didn't record but did note-taking*
3. Founder and CEO of IVCs-3 / Spin-offed from ETRI
- Date / Duration: 11/03/06, 15:00~16:22 (82 min.)
4. Founder and President of IVCs-4 / Spin-offed from KRIBB
- Date / Duration: 14/03/06, 10:30~11:40 (70 min.)

5. Founder and CEO of IVCs-5 / Spin-offed from KAERI

- Date / Duration: 09/03/06, 14:00~15:27 (87 min.)

V. Failed companies (FVCs) – arranged by alphabetical order of company name

1. Founder of FVCs-1 / Spin-offed from the Korean Machinery Lab (KIMM)

- Date / Duration: 20/03/06, 14:00~15:10 (70 min.)

2. Founder of FVCs-2 / Spin-offed from KRISS

- Date / Duration: 18/03/06, 14:00~15:20 (80 min.)

3. Founder of FVCs-3 / Spin-offed from ETRI

- Date / Duration: 10/03/06, 14:00~15:37 (97 min.) *

4. Founder of FVCs-4 / Spin-offed from ETRI

- Date / Duration: 10/03/06, 14:00~15:37 (97 min.) *

* 3 & 4 interviews were jointly conducted

5. Founder of FVCs-5

- Date / Duration: 27/03/06, 16:00~17:00 (60 min.)

VI. Venture Capital

1. General Manager of VC-1

· Former chief of Daejeon Branch, Muhan Investment Co., Ltd.

- Date / Duration: 09/04/06, 14:00~15:30 (90 min.)

2. CEO of VC-2

- Date / Duration: 05/04/06, 13:30~14:50 (80 min.)

3. Chief of Daejeon Branch, VC-3

· Former founder of Telephus, Inc.

- Date / Duration: 27/03/06, 15:00~15:52 (52 min.)

4. Chief of Daejeon Branch, VC-4

- Date / Duration: 04/04/06, 10:00~11:30 (90 min.)

5. Former CEO of VC-5 (KTB: Korea Technology Bank)

· Executive Director of Technology Commercialization Center, DAEDEOK
INNOPOLIS

- Date / Duration: 28/03/06, 11:00~12:15 (75 min.)

VI. Government Officials

1. Director General of Technology Assistant Bureau, SMBA

· Former Director of Venture Policy Division, SMBA

- Date / Duration: 29/04/06, 16:00~17:10 (70 min.)

2. Director of Business Partnership Division, SMBA

· Former Assistant Director of Venture Promotion Division, SMBA

- Date / Duration: 20/04/06, 16:00~17:00 (60 min.)

* *Didn't record but did note-taking*

3. Director of Management Evaluation Office, Daejeon Metropolitan City

· Former Director of Science and Technology Division, Daejeon Metropolitan City

· Former Assistant Director of Business Support Division, Daejeon Metropolitan City

- Date / Duration: 28/04/06, 14:00~14:40 (40 min.)

* *Didn't record but did note-taking*

Appendix 3: Interview guide with set of questions

After brief introductory remarks,

I'm interested in the perception of entrepreneurial risks in start-up's business history. As far as I know, you had worked for a public research institute (PRI) and started your own business in the mid 1990s. I would like to know your experiences associated with decision making or challenges in risky and harsh venture business markets.

Let's begin with the process of firm formation.

- *Could you tell me when and how you started your venture business?*

I'm wondering why you gave up your previous job as a researcher of PRIs and created risky business.

- *How long have you worked there?*
 - *What was your main responsibility (or role) in there?*
 - *What were you satisfied with in your previous job? (Or complain?)*
 - *(If necessary, ask this), Could you tell me your previous job before PRI?*
- *What was your motivation of start-up?*

It's been said that people usually face many uncertainties when they make a decision of start-up, and making a decision in uncertain situation could be very risky. I'd like to listen to your experiences in this process.

- *Did you experience any trouble?*
- *What kinds of risks you recognised at that time, and..*
 - *What was a serious risk(s) you faced in your firm formation process?*
- *Do you think how the risk you had experienced as a start-up entrepreneur is different from the one other existing firm's entrepreneur experienced?*
- *How did you deal with those risks?*
 - *Particularly, how did you finance the seed money for start-up?*
- *Did those experiences change you? And how?*

You were a researcher (or an engineer), so I think you are fully aware of the importance of technology in venture business.

- *How did you deal with necessary technology developments for initial business setup?*
- *Were there any supports from a research institute for which you worked?*
 - *For example, were there any support schemes from your PRI to encourage starting-up or technology transfer like ETRI's patent allocating system?*
- *Do you think it was helpful to lower the level of risks you perceived?*
 - *Do you think you could behave differently if there were no such support scheme from your PRI?*

There was the government policy support to encourage start-up particularly from 1997. The government provided varied policy measures for start-up entrepreneurs. I think this

strong policy support influenced on potential entrepreneur's risk perception and decision making in any way.

- *What did you think of the government policy support for start-up?*
- *Could you tell me how it influenced on your risk perception and decision making?*

You have ___ year of working experience in ___ (the name of PRI) as a (senior) researcher (or engineer). So people can think you have high technologies for your own business and it might be a good advantage for starting up.

- *Do you think your previous career in DST was helpful for your start-up?*
- *(If so, could you tell me about it?)*

Now, I would like to ask some questions relating to a venture certification system. As you may know, it began in 1997 when a special legislation for supporting venture firms was enacted. It has been changed a little in the meantime and is now likely to be transformed into more market oriented one before its expiration at the end of 2007. There have been big debates about the contribution and the problems of this government-oriented certification.

- *Could you briefly tell me when was your company certified and what was the type of certification?*
 - *Why did you want a venture certification at that time?*
 - *Why did you choose that type of certification?*
- *Is your company still a certified venture firm?*

If yes (still ventures group),

- *I'm wondering why you have maintained the status of a certified venture firm. Would you tell me about that?*
- *Do you think why some of once certified venture companies gave up the extension?*

If no (once ventures group),

- *When and why did you give up for the extension of venture certification?*
- *Do you think why other companies are still maintaining their certification?*

As far as I know, there was a big change in the criteria and the way of venture certification in 2001.

- *Could you tell me what you experienced after this change?*
 - *Were there any changes in your strategy to keep venture certification?*

Venture certification particularly by the government has been seen as a very unique institution in Korea. I'd like to suggest that it is nearly impossible to review the history of venture business in Korea without mentioning this policy.

- *What do you think of current venture certification system?*
- *Do you think venture certification affected on your perception of business risks?*
 - *If yes or no, could you tell me why do you think so?*

- *How would you like to assess it in terms of business support?*
- *Could you tell me about any changes caused by it in your firm's businesses?*

There recently have been big debates whether its expiration date needs to be extended, and more recently the government is trying to transform it into more market oriented one.

- *What do you think of this?*
- *Do you think its expiration needs to be extended further?*
- *Could you tell me your idea who is more appropriate for venture certification between the government and the market?*
(Why do you think so?)

Now, I'd like to move on to some questions about the survival and growth process of your business.

You told me you started your own business in _____.

- *What is the criterion at that time to say it as the beginning of your business start-up?*

There of course might be different points of view, but some literature says that the stage of start-up's growth can be divided into three phases such as start-up phase – growing phase – mature phase. This point of view is mainly based on the business career of firms.

- *What do you think of this idea?*
- *Do you think you can position your firm among these three stages?*
- *If yes, then where?*
- *Could you tell me your opinion about how to describe the growing stage start-ups in terms of business career?*
- *Or, do you agree with this idea that firm's growth stage can be divided by the single criterion of business career? Why you don't agree with it?*

I think there were many difficulties in your business history up to now, particularly in growing stage considering the statistics of start-up's survival rate in Silicon Valley. The probability of its survival for initial 3 or 5 years after start-up is reported to be very low. We can imagine varied risk factors in business growth: financing, R&D, production, marketing, recruiting, management, etc. But, first of all, 'financing' might be very closely related with business risks because it is the matter of money. Thus I'd like to start from the different financing structure.

- *Could you tell what your capital structure is as of now in 2006?*
- *What about your portfolio between equity investment and loan?*
- *Are those equity investments from venture capital or public venture funds?*
- *How about loans? (General bank loan or policy loan program?)*
- *What about the capital structure in the initial stage of start-up? Are there any changes compared to now?*
- *What different risks do you think are associated with those changes?*

I can assume that your company will move on to mature stage in the (near) future like IPO stage.

- *What do you aim to matured company in capital structure?*
- *What different risks are associated with these changes?*

Generally in United States, 'venture business' is regarded as 'high-risk / high return'. In UK, 'high-growth / high-job creation' is being accepted as the most important factor. But, considering the criteria of venture certification and other government supports, 'high-tech' has been more emphasised in Korea than 'high-risk' in US or 'high-growth' in UK.

- *Do you think how technology is important in start-up business?*
- *How have you procured necessary technologies for your business?*
- *Do you think your previous career in DST was helpful to source technologies and do continuous R&D?*
- *What about getting a venture certification and government supports? (If so, could you tell me about it?)*
- *Do you think the high level of technology can lower business risks?*

According to varied statistics, Daedeok is well known for the region of knowledge agglomeration. But some people say that start-ups in Daedeok have been too technology-oriented rather than market-oriented.

- *What do you think of this saying?*
 - *Do you think high technology can guarantee the successful business in markets?*
 - *Even though not guarantee, but can be very helpful?*
- *What do you think of the start-up's level of technology in Daedeok compared to the global level?*
 - *What about other levels such as sales and marketing, management, etc.?*
- *Do you think the start-ups in Daedeok have been too reluctant to be challenging risks in their business?*

As you may know, according to the statistics from Daejeon city, many companies moved into Daedeok for a last decade, but also many start-ups in Daedeok, even spin-offs from DST, moved out to mainly Seoul.

- *Do you think why some companies moved in and some moved out?*
 - *Advantages from proximity, any social networks in Daedeok?*
- *Do you think this is associated with entrepreneur's risk perception?*
 - *Which one seems to be riskier between staying in Daedeok and moving out Daedeok? (Why do you think so?)*
- *Do you think 'staying in Daedeok' can be advantageous for your company to get government supports?*
 - *Do you think 'moving out Daedeok to Seoul' can be advantageous for doing sales and marketing?*
- *If we describe Daedeok as a regional innovation system, how do you think the meaning or boundary of 'region' can be defined in the Daedeok innovation system?*

Finally, I'd like to ask some very basic questions about you and your business.

It might be not easy to answer clearly, but,

- *Do you think you are a risk-taker or risk avoider?*
 - *Do you think such a position of your risk perception was influenced by your career in PRIs?*
- *What do you think of the competence (merit or demerit) of yourself as a start-up entrepreneur who has the background of research or engineering?*
 - *What do you think of a few recent cases of other firms in Daedeok that they attracted the experts of management as CEOs?*

Thank you very much for your time and kind acceptance of my interview.