Vietnam as a Counter-Developmental State

The Paradox of the Development of Information Technology

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The candidate confirms that the work submitted is his/her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

In the course of the global transformation from industrial to post-industrial economies during the twentieth century, the roles of computer technologies have changed. Whereas these technologies began as tools for industrial engineering, as enabling mechanisms to redefine industrial production processes, they eventually became a significant industry in themselves: hence the post-industrial economy has also become known as the information economy. Concurrently, the roles of the state in relation to economic development have been challenged by new conditions shaped by the continuously evolving characteristics of information technology.

Against this backdrop, the thesis explores some different technologies in the IT industry to examine how the post-industrial characteristics of these technologies interplay with technology-upgrading approaches conducted by various actors in Vietnam. The thesis also examines how these technology-upgrading approaches relate to the Vietnamese state's economic developmentalism. The thesis examines four sectors of Vietnam's IT industry: outsourcing, cloud computing, the app economy and online games. The thesis finds that technology-upgrading approaches for each of these four sectors were conducted in different ways. Moreover, the roles of the Vietnamese state also differed in relation to each of these four technology-upgrading approaches. Based on these findings, the thesis presents three arguments. Firstly, the relationships between technology-upgrading approaches and the state in Vietnam are different from what the literature suggests. Secondly, technology is not simply an instrument of the state to be used for economic development; technology is also a structure shaping the role of the state in economic development. Finally there can be more than one role for the state in the IT industry, and these competing multiple roles can actually jeopardise state economic developmentalism. The thesis characterises this phenomenon as the 'counter-developmental state'.

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Chapter 1

Introduction

1.1 Introduction

The research intends to answer two main questions: (1) How should we characterise the nature of the technology-upgrading approaches that are employed domestically in Vietnam, and how are these approaches processed within the context of Vietnam's IT industry? and (2) How should we characterise the state's roles regarding technological upgrade in Vietnam's IT industry, and to what extent and in which ways do these different state roles affect domestic technology-upgrading approaches? Focusing on these two questions enables the research to analyse the impact of being a state with a highly controlled political-economic regime on the technology-upgrading approach of a late-industrialising country. Vietnam is a case study representing the state with a distinctive mixed economy known as the socialist-market economy; its information technology (IT) industry is selected as a unit of analysis representing a high technology-based industry. The original contribution of this research is that it examines the extent to which the findings of the literature on the development of the IT industry in technologically 'backward', market-oriented states also apply to states where the government plays a more dominant role in the economy, such as Vietnam.

The research questions arose from the existing literature on the state model in technological development and especially in latecomer nations, which mostly have the characteristic of being technologically backward societies. This literature notes that such technologically backward nations have upgraded their technology and integrated with international technology production by changing their state model in regard to economic development from a dominant and ruling role to a consultative role. The consultative role is claimed to be the most effective state role in dealing with the logic of technological development at the present time, when technology generation and assimilation are taking place outside formal settings and market transactions, and changing at a rapid pace. Because of these changes, states are no longer able to direct national technological development. However, the existing literature does not provide an explanation for the case of a technologically backward nation with a socialist regime, in which the idea of taking a consultative role is against the logic of its political ideology.

There are five remaining socialist countries, only three of which have been integrated into the global IT market: China, Vietnam, and most recently, Cuba. Of these, China is far larger than the other two. Its size has provided it with a different level of economic resource, a huge domestic market and an international economic integration trajectory in which China is aiming at global economic hegemony rather than just being another highly competitive economy in global production, like many smaller states. If we compare the regional and economic performance of Vietnam and Cuba, we see that Vietnam, situated in the Southeast Asian region commonly described as a development success story (McGregor 2008: 1), has been one of the world's fastest growing economies in the 2000s and is an attractive newly emerging site for both U.S. firms and Asian nations with strong IT sectors, like Japan and China. Since the proposed research aimed to study the impact of a socialist regime on the technology-upgrading process of industrialisation, Vietnam seems to be able to offer more than Cuba, especially given Vietnam's complicated relationship with another powerful socialist regime, China.

Vietnam is often compared with China as a result of their close cultural socialist alliance within the region; more importantly, since the collapse of the USSR, Vietnam has learned much from China's experience of adjusting to the outside world. The collapse of the USSR, which had a closer mentor relationship with the Vietnamese Communist Party than China, served to warn Vietnam of the danger of applying shock therapy; while China's open door policy and reform strategy has been viewed by Vietnam's economic development elites as a good model to follow (Evans and Bui Duc Hai 2005: 219).

However, when it comes to industrialisation, especially in technology production, the huge size of China has permitted a different economic development trajectory from that possible in Vietnam. With its great natural and human resources, China contains a large and diversified supply of and demand for manpower and industrial capacity. This is consistent with the country's great historical hegemonic status, leading to China's path of avoiding international economic dependency during its early industrialisation process (White 1988: 159). Even though China has successfully integrated with the so-called fragmented global production since the 1990s, such integration does not follow the post-Fordist economic development blueprint. Lall and Albaladejo (2004: 1441-1442, 1457) analyse the logic underlying China's international economic integration, which as can be seen from its allowing FDI in domestic markets since 1992 and joining the WTO in 2001, is to obtain technology and resources for its export activities rather than to form international alliances and connections to international technology markets as a main consumer. In more detail, Lall and Albaladejo argue that China is aiming to be a hegemonic engine of growth for technology production, starting in Asia and the Pacific region (2004: 1457). It uses its market size with lower wages and greater industrial depth to negotiate with MNCs in the areas of technology transfer and the local linkages that the MNCs have been establishing with other nations (2004: 1442). On the basis of this agreement, MNCs can use China as their manufacturing base of technology production to export to other Southeast Asian developing countries, while China benefits by learning new technology from the MNCs through a short-cut and the rapid rise in connections with production in the rest of the world. All of this ultimately serves China's exporting goal: to upgrade its technological capacities through the MNCs to advance its export industrial structure to supply a resource-based technology for other countries' technology-based production (2004: 1457).

Since China's international production collaboration is for the purpose of promoting its status as an engine for processing and manufacturing in global production rather than integrating directly in specific technology production chains in the fragmented global alliances of technology production, Vietnam was chosen as a potentially rewarding case study for this research.

1.2 Background and Academic Originality

Since the end of World War II, the pace of technological production has increased at a phenomenal rate in western countries, at first due to military concerns fuelled by the Cold War. Then civilian technology took over from military technology starting in the 1980s. However, in terms of economic performance, those who make and implement policy later realised that radical innovative technology determines national competency in economic development and international economic competitiveness (Archibugi 1997: 121). Nonetheless, utilising the benefits of technology in economic activities is not something that can be done easily in a short period of time. As the most crucial factor generating technological development is innovative capacity, a long time is needed to accumulate knowledge as a strong foundation for the creation of innovations.

Economists and policy makers, who are interested in employing innovative capacity for economic development, have paid particular attention to the approaches that many countries have adopted to cultivate that capacity. In the early years of the use of high technology in commercial activities, radical technology production was something that only occurred in technologically advanced societies, most notably OECD members and countries in the G7 group. Because these countries invested in human resources and R&D infrastructures earlier and had the advantage of early industrialisation, they had a more robust technological base than developing countries.

Nowadays, however high-technology based production is not the preserve of only technologically advanced and wealthy nations. Computerisation along with globalisation makes it easier for technologically backward societies to access new and more advanced technologies at minimal cost. This also has implications for the conventional approach to technological know-how and technology assimilation. Individuals are much more independently able to learn new technologies without being embedded in the R&D system. Furthermore, after and even during the process of learning, the acquired technologies are diffused across the society by informal or non-market channels, and even through intangible assets (1997: 122). These have made innovation affordable and unrestrained within the science and manufacturing sectors.

It is undeniable that IT is one of the most important technologies ever invented, as it is not only a production technology, but also an enabling technology, which allows and makes possible other technological productions. Hence, an investment in IT production also indirectly establishes firm foundations for other innovation-led industries. For these reasons, the IT sector has become a notable strategic sector for industrialising an economy that is industrialising late, and for maintaining the international competitiveness of advanced economies.

In terms of the study of political economy, the significance of IT is more than simply its role in cutting-edge and enabling technologies. Recent and unprecedented developments of the IT industry in many technologically backward societies have epitomised the modern technology-upgrading approach that determines the success of economic transformation from a resource-based to a knowledge-based order. This approach signifies a new structure of the high-technology professional network community that restructures the conventional production processes as well as redefines the roles of the state in technology-learning for economic development.

American computer companies have dominated the computer industry from the very early commercialisation of viable computers (1945) to the birth of personal computing with Microsoft (1975), then Apple (1976) and IBM’s first personal computer: model 5150 (1981). Other industrialised countries saw that the computer industry would be a ‘trigger atom’ causing a chain reaction leading to the technological hegemony and economic superiority of the U.S.; hence, since the 1950s there has been a plethora of new names and nationalities in this industry, which made their reputations not only on technical grounds but also through their impact on economic development and the technological development regimes that made them fiercely competitive.

While the U.S. and its computer companies competed on a global scale through trade liberalisation and free market mechanisms combined with radical innovative capacities, the second wave players in this industry from Japan, like Toshiba (1950), Fujitsu (1952), NEC (1955) and Hitachi (1956) (Yonekura 2004:

125) competed against each other under the roof of trade protectionism adopted by their state, using incremental innovation as a method of technology production. The atmosphere of this industry from the 1950s until the 1970s, started with a major emphasis on hardware production followed by the rise of software production, was well portrayed as a catch-up game, in which one particular computer industry would succeed only if it came up with a new model of a complete computer before its competitors.

The rise and fall of these leaders and followers was made more complicated by the entrance of a few more players into this international dynamic during the 1990s. As the computer industry progressed over time to become an Information Technology industry instead, it also became more and more cosmopolitan in its international alliances. Nowadays, many well-known cutting-edge IT technologies are not invented and implemented by Americans or advanced countries like Japan and Germany: for instance, Israeli network security system technology, Indian enabling services and software-outsourcing hubs, and Taiwanese memory chip design.

The newly prominent nations in this area are Ireland, Israel, and India, who have advanced one of their innovation-driven industries, the IT industry, based on the aforementioned emerging concepts of technology generation and diffusion through a professional network community. Academic studies link the economic phenomena in these countries together, studying them as nations formerly characterised as technologically backward, that nevertheless were successfully transformed to compete at the global IT frontiers within a generation (Breznitz 2007: 2). For convenience, they have been dubbed the ‘three I’s’ (Carmel 2003: 1). Since this impressive technology-led economic transformation was recognised, there has been an emergence of research trying to examine what actually lies behind the three I's' success, and their experience, which has not been replicated elsewhere so far, has been examined to see whether other developing countries could nurture IT sectors. Although the research findings uncover various causes, these countries' cultural-professional networks constitute the most common explanation for the three I's' success. They effectively utilise the informal IT professional networks of knowledge linkages as a technology-upgrading approach by providing a sustainable economic habitat for the intangible communications between such networks, and link them flexibly with economic mechanisms at the national level. For example, in the case of Israel, the Israeli IT industry is succeeding at the global level by specialising in network security. The prototypical Israeli company in the network security field is Checkpoint, which established and produced its software before the government realised that such technology would become an internationally competitive strategic technology in the future. The three founders of Checkpoint also took part in other IT projects outside Checkpoint, which spontaneously spread and developed further technical knowledge about network security among local Israeli IT firms. Checkpoint and other local IT firms started to connect to each other through an informal IT professional network beyond the Israeli state's institutions. Eventually, led by Checkpoint, these communities have provided Israel with a network security market niche and the dynamics of its own endogenous technology-learning capacity (Breznitz 2007: 8-9).

If the success of the three I's has been based on each country building a distinctive national technological specialisation in certain innovative products and technology-learning in the form of professional proxies, especially from the same culture, then it is worth monitoring how a new wave of countries that wish to follow the three I's and differ in political and economic contexts, national identity, culture, and history that construct their national innovative capacity. as well as their potential success with technology-learning for industrialisation. Additionally, to provide a clearer picture of these countries, Carmel's taxonomy of global software exporting is referred to here.

According to Carmel (2003), the three I's have joined the global IT frontier , which consists mostly of nations that are OECD members and were already at the top of the global software hierarchy during the late 1990s and early 2000s, followed by Russia and China, which were thought to be highly capable of joining the tier 1 nations by 2010. The tier 3 nations were emerging software exporting nations, including a few such as Brazil, Korea and Mexico, that had the potential to move up the hierarchy. The tier 4 nations were those who had just entered the global software market, such as Vietnam, Cuba, Indonesia and Iran. Lastly, the tier 5 nations were those with almost no impact on the global software market, such as most African nations (2003: 3-4).

Of course, Carmel's 5-tier taxonomy is now somewhat out of date, especially considering that the software sector is rapidly shifting despite the existing hierarchy. However, it still provides a clear picture of global competition stages and potential IT industries around the globe. Out of the tier 4 countries, Vietnam was chosen to be the research's case study for the reasons stated earlier in the introduction. To date, work on the impact of the socialist state on development has focussed on China, but China does not fit into the three I's concept in that it already has a large domestic market for high-technology goods and is also connected with the global market through the mass manufacture of IT goods (OECD 2004), particularly hardware and computer peripherals rather than software.

Vietnam's IT sector is still young, yet it is striking that the country was in the world's top ten in terms of spending on the development of the IT industry during 2004-2008 (U.S. Department of Commerce 2007). IT has only recently been recognised by the government as a strategic sector for industrialising the country, but the sector has already drawn a great amount of attention from major IT companies, which see Vietnam as an attractive business partner. Vietnam is now being labelled as a new destination for software outsourcing (2007).[1]

Vietnam is one of those countries that have long struggled politically both internally and externally. Not long ago Vietnam began to catch up with the world economy, and not much earlier that that it was able to shift further from the shadow of a socialist economic regime; however, Vietnam is now facing another challenge from the new form of economy that is knowledge based and intensive in high technology. In this kind of economy, the nation's capacities come from individuals rather than state institutions. This thesis argues that this new economy relies less on the state and more on international networks and the community of IT professionals; it demands a profound decentralisation of state authority that threatens the survival of the state's communist ideology.

The emergence of skilled and talented IT workers, the IT industry, and IT alliances with its old enemy, the U.S., are challenging Vietnam to prove its socialist market economy competent to cope with a modern form of economy. In this economy, the state's roles as well as other critical success factors are redefined by a dynamic of technological learning that is removing national technological and economic borders. How Vietnam will respond to this challenge within its political context is a question yet to be answered.

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[1] For Revenues of Vietnam's IT Industry by sector (2008-2011) see Appendix A

1.3 Research Terminology

The terms employed in this research are multidisciplinary, being drawn from the fields of computer science, politics, economics and business. Although most of them will be clarified as they occur in the research, a few will need to be defined at the outset to establish the primary scope of the research. .

As for the connections between the three fundamental terms central to this research: information and communications technology (ICT), information technology (IT), and innovation, all of them are related to information and knowledge production.[2]

The IT industry is defined in this research as an industry that consists of three sub-sectors: hardware; software; and digital content. This definition is consistent with the breakdown of the domestic IT industry according to the published documents from the Ministry of Information and Communication, which supervises the development of Vietnam's IT industry (MIC 2010).

However, such breakdowns (hardware, software, and digital content sectors) are tentative when it comes to considering guidance for conducting the research's fieldwork, which required more detailed guidance about what type of IT activities the three sub-sectors involve. For this reason, I define what types of IT activities are included in the three sub-sectors.

I define what types of IT activities are included in the three sub-sectors. In the case of this research, it focuses on IT production, IT spending, IT service and any IT production-related fields such as industrial automation, telecommunications,

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[2] The term 'IT' and 'ICT' are seem synonymous; however, the term 'IT' is preferred to be used here in this research.

software and microelectronics (Duysters and Hagedoorn 2000: 212), but will not include uses of IT such as E-Government or PC usage in education. As Okada (2005: 274) suggests, ‘the ICT industry should be distinguished from the sectors that use ICT’. I apply the same principle to the definition of the IT industry in this research.

With regard to the term ‘innovation’, the research defines the term based on the definition provided by Gobeli and Brown (1988, cited in Huizenga 2004: 15). For Gobeli and Brown, there are four classifications for the term ‘innovation’: application (high innovative level with low benefits); radical (high innovative level with high benefits); incremental (low innovative level with low benefits); and technological (low innovative level with high benefits).

To apply Gobeli and Brown’s definition to the IT industry, I connect their four classifications with Okada’s ranking of skill level in the Indian IT industry. Okada (2005: 257) breaks down this sector by ranking it from semi-skilled (a) to high-end skilled activities (d): (a) includes IT-enabled services (call centres, finance and accounts), and data processing (medical, insurance, banking); (b) includes software services (programming/application development, network solution and management, system development and consulting); (c) includes software product development, network solutions and management, systems development and consulting and finally, (d) includes R&D and computer hardware engineering, chip design and embedded software.

Okada’s skill ranking is linked to innovative levels in Gobeli and Brown’s four types of innovation (with level (a) being the lowest innovative level and level (d) is the highest innovative level), but not linked to Gobeli and Brown’s benefit levels. The capability to produce high-end skilled IT activities from category (d) does not always mean that producers have entered an innovative production level or are themselves being innovative, since these tasks can be designed, implemented and integrated by different producers. For instance, a firm might implement a very innovative software program, but if such a program was designed by another firm, then the production by the implementing firm is certainly not an innovation. On the other hand, producers can enter an innovative production level even though their products are located in lower skilled IT areas ((a) – (c)). This leaves the gap for the research to ascertain the benefit level of technology examined in the case studies from the fieldwork.

Furthermore, another issue related to the term ‘innovation’, is the context of intellectual property rights (IPRs), which differ from country to country. At the early stage of technological development, incremental innovations were protected by IPRs; however, as time progressed, only radical innovations remained protected in most technologically advanced societies. The generally accepted definition of innovation among developmental statists covers innovations that might have already been created somewhere else but are newly introduced to firms mainly though the ‘innovation by learning’ approach; in other words ‘imitation’ is a major technology-learning strategy for the developmental school at this early stage. However, IT, as conceived by this research, requires radical innovations rather than incremental innovations if entrepreneurs are to survive.

Thus, against this backdrop, the term ‘innovation’ in this research is defined in the manner provided by Gobeli and Brown, with the addition of Okada’s ranking, and the concern over IPRs issue, as newly created IT ideas, which can be implemented in the form of products, processes or services (Dodgson 2000: 231), and has constituted radical innovation even when the owners of such ideas pay another firm to implement the end technology (Breznitz 2007: 211). Moreover, the use of technologies is location specific (Mani 2002: 3). Thus any technologies that are merely adapted to match local demands will not be counted as innovations in this research.

In this section, the basic terms central to the thesis research are defined. However, in the following chapters, a few chapter-specific terms will be introduced and defined in their contexts.

1.4 Research Questions and Objectives

The research aims to examine the Vietnamese state relations with the IT industry during the industrialisation process, which occurred with the challendge of knowledge-based economy. Vietnam's domestic IT industry is the case study this thesis researched to examine the state's role in industrial development. The specific focus was the technology-upgrading process employed by the local IT industry, both in the public and private sectors. A close and systematic examination of this process provides a broader picture of a hi-tech industrial path for catching up with other innovation-driven economies around the globe.

Unquestionably, the industrialisation process is not merely a passive object of the polity, as the emergence of high-technology based industries in technologically backward societies creates unfamiliar circumstances that challenge the political dynamics of those countries. It is a two-way interaction: as Doner (1991: 819) writes in delimiting the political economy it is, '[…] the ways in which politics influences aspects of economic policymaking, and economic interests and outcomes influence political processes and outcomes'. This addresses the research fields that should be included when elaborating the core research questions, which are as follows:

Question I: How should we characterise the nature of the technology-upgrading approaches that are employed domestically in Vietnam, and how are these approaches processed within the context of Vietnam's IT industry?

The research examines the Vietnamese approaches to technology catch-up at the national level in the age of post-Fordist production. In this age, the product life cycle has fragmented from mass production into a production-specific network from the perspective of the technology-upgrading approach. Therefore the research began its investigation at the firm level, which is the smallest sub-cluster in the organisation of technological change.

There are a few terminologies related to the concept of the technology-upgrading approach. To begin with there is a difference between an approach and a process of technological upgrading. In this field of research, a process of technological upgrading is employed within a technological realm, where it is exploited by the research to examine a technological advancement or change free from the context of the state's roles. While an approach of technological upgrade is employed here to examine the broader context in which the interplay between the state's roles and the process of technological upgrade occurs, making a distinction between these two terms in the way this research does is not a heuristic device. I am fully aware that the process of technological upgrading in Vietnam is in no way totally free from the state's interventions, as the process is embedded within an economy in which the main governance is still from the state. Nonetheless, I propose ways to look at the two phenomena separately to capture the differences in how political factors affect the nature and true dynamic of technological development.

The first research question can be unpacked into sub-questions as follows:

(1) What are the best ways to describe Vietnam's domestic technological-upgrade approaches and their processes, and the nature of the accumulation of technological capacities to conduct such processes? Addressing both the process and the capacity will enable the bigger and more complex ecosystem, the system of the technological upgrading approach, to be placed in the context of Vietnam's national industrial development.

(2) What are the factors that shape the development of such approaches and processes?

Question II: How can the state's roles regarding technological upgrading in Vietnam's IT industry be characterised, and to what extent and in which way do these different state roles affect the domestic technology-upgrading approaches?

It is important to note that the technology-upgrading process of industrialisation involves both policies that directly deal with industrial technological activities and those that have less to do with such activities.[3] Therefore, to examine the channels through which the state exercises its political power upon the technology-upgrading process, numerous institutions and development agencies that play an important part in drafting and implementing policies in the fields of education and finance, as well as those in the industrial field of science and technology, are the fields of this research's investigations.

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[3] There are three main related policies that are analysed in this research, namely science, technology and innovation policy. These three policies are distinct from each other in theory, but this is not always the case in practice (Dodgson 2000: 231). Science policy aims to promote new scientific knowledge breakthroughs in the national R&D units, whereas technology policy aims to develop specific technologies and related infrastructure (Dodgson 2000: 230-231). Innovation policy aims to use science and technology policies to create new products, processes and services of domestic firms, combining science/technology policy with industrial policy (Dodgson 2000: 231; Rothwell 1982: 3).

The list below consists of a few particular points, which are the focus of this research, drawn from the analysis of such policies.

- The allocations of industrial resources, especially to high-technology and software agglomerations
- The conditions of domestic market competition
- The performance of national research and development institutions (R&D) with regard to both civil and military technology
- The relations with foreign firms and MNCs, and international industrial financiers.
- The relations with small IT firms in various IT sectors.
- The perceptions toward unconventional practices of newly emerged technological production and consumption.

Investigating these policy-related areas will provide the researcher with empirical evidence on how the socialist regime affects the state’s role in industrial development in a post-Fordist production context, and will enable an understanding of the constraints high-technology industries are facing under economic development directed by a socialist regime.

1.5 Theoretical Framework

The thesis research aims to analyse the impact on the technology-upgrading process of being a technologically backward country governed by a highly centralised regime. This research objective is developed based on an argument about the process of technology production and dissemination that is intensive at the micro level beyond the institutional setting. Therefore, the nature of the research touches upon many disciplines to construct the theoretical framework for this argument: starting with the theoretical literature on IT development, then moving to the broader theme of technological upgrading in late industrialising countries; next, discovering what can be understood about the technology-learning process from economic and business theories; and finishing with the political economic theory of industrial policy and state roles in high-technology development.

These theories will not be considered separately in the thesis research framework, as such a separation can never lead to an understanding of their interactions or the impacts they have on each other. The key phenomenon that prompts this research is the evident increase in the IT professional network community around the world, along with many states' attempts to connect economically with such networks. Therefore, building this research's framework will focus on the interactions between theories surrounding this phenomenon.

With this in mind, I have divided the theories under discussion into three scenarios in accordance with different industrial development regimes which make different choices concerning the technology-upgrading approaches that can be adopted by late industrialising countries. The first two scenarios illustrate conventional analytical accounts of technology-learning approaches that are employed by two conventional industrial development regimes: neo-liberalism and the developmental state. The third scenario illustrates the challenges posed by the phenomenon of the IT network community's conflict with the conventional wisdom of industrial development regimes. There is to date no panacea for states to handle the rise of the IT network community, which limits the power of the state in the national technology upgrading process. The incomplete character of the theory concerning the relationship between the state's role and the technology-upgrading approach leaves a gap to be filled, and the recognition of this gap was the thesis research's starting point.

There are three main models of technology learning in the literature. The first scenario of technology-learning is what I call a market-led model. The neo-liberal economic school focuses on this model, recommending that latecomers allow FDI and encourage MNCs to invest and have local affiliates to promote technology transfer and knowledge spillovers. Inevitably, the technical approaches advocated by neo-liberals are full of biases. Because the technological giants have codified all the technical knowledge in a form that can be traded with IPR protection, it is questionable whether the neo-liberals' recommendations are remedies for technologically backward societies or a tool for advanced economies to exploit a new market in developing countries, which normally have weak IPR protection and high barriers for FDI. However, the rich literature provided by economic and business theorists seems to demonstrate that late industrialising nations benefit by allowing FDI and encouraging MNCs to have a local presence (Fosfuri et al. 2001; Görg and Strobl 2004; Korgaonker 2004; Møen 2005; Zhou 2008; Buston 2008).

Theories associated with the market-led model provide a framework dealing with the process of technological change from an external perspective only. They do not consider internal accounts of technological change that occur under local conditions. This shortcoming leads the research to examine the second scenario, concerning accounts of the domestic technological change process led by the state: the state-led model.

As suggested by its name, the state-led model of the technology-upgrading process focuses on the national scope of technological change driven by domestic dynamics along with a statist economic policy designed to protect infant high-tech industries. The relevant technological change theory associated with this model is the National Innovation System (NIS) theory (Nelson 1992; Niosi et al. 1993; Freeman 1995; Archibugi and Michie 1997; Rooji et al. 2005). The theory offers a structure of innovation systems based on the capacity of various state institutional arrangements to create productive interactions between science and technology, educational, financial, civil, military, economic, entrepreneurial, legislative and political units within national borders. However, recent work on the NIS tradition is increasingly concerned with how globalisation is breaking down the foundation of NIS's technology-learning capacity. Its failure to offer satisfactorily an explicit technology-learning format in the era of technological globalisation drives this thesis research to develop theories on industrial policy that are capable of coping with the contemporary setting, where technological change, particularly in IT sector, is generated on the ground.

The third and most recent model, the network knowledge-led model, attempts to examine the dominant accounts explaining the success of high-technology-based economies. Work in this tradition comes closest to the needs of the thesis research, in the sense that it investigates the factors that particularly underlay the emergence of IT clusters in new and less advanced economies around the world during the 1990s. The IT clusters in Taiwan, Ireland, India, and Israel are the prototypical examples of a notable success story, while Malaysia's Multimedia Super Corridor is often described as a case of failure.

Unlike the previous two models, which debate whether neo-liberal or statist economic regimes provide the high-tech industrial policy that best fosters the technology-upgrading environment in latecomer nations, this latest model is well aware of the emergence of IT professional network communities in particular regions and concludes that these communities are the key device facilitating the technology-learning environment in technologically backward economies (Breschi and Malerba 2001; Brehahan et al. 2001; Saxenian and Hsu 2001). Moreover, recent innovation theory on the rise of tacit knowledge as an ideal type of knowledge for international competition (see e.g. Ernst and Lundvall 1997) strengthens the significance of technology-learning in such network communities.

There are important analyses of the changing industrial development role of the state in accordance with the rise of technology-learning through network communities (Ansell 2000; Cooke 2001; O'Riain 2004; Ohmae 1993; Breznitz 2007). Most of them are developed from developmental state accounts, but advocate a flexibly structured development regime rather than a rigid bureaucratic structure, as presented in classical theory. This school of thought provides the last theory to be deployed in constructing a conceptual approach for the thesis research.

Chapter 2

Research Methods

The research methods were designed prior to the fieldwork phase in a very detailed manner, as can be seen throughout this chapter. However, not all of them worked out in the way originally planned originally regarding both the methods to collect data and the research participants during the fieldwork phase. In this chapter I will outline both the original and revised research designs and methods instead of omitting the original research designs and methods that did not work during the fieldwork, for two main reasons. Firstly, doing so will highlight the pitfalls of researching the dynamics of Vietnam's IT industry. This may act as a reference for others who plan their research in a similar context as mine, whether in Vietnam or in any other newcomer country to the global IT industry. Secondly, I believe that the failed methods did not work for a reason – they did not fit the context of Vietnam's IT industry at the time when they were conducted. Thus outlining them in comparison with what-worked-well will provide more understanding of the circumstances and dynamics between different agencies and the circumstances of Vietnam's IT industry.

2.1 Research Design Prior to Fieldwork

In order to answer the research questions, practical and effective research strategies are required before planning fieldwork. The researcher needs, firstly, to determine the key concepts that should be used to answer each research question rationally according to the defined theoretical framework, and secondly, design appropriate procedures to enable the questions to be answered by employing suitable strategies and methods within financial and time constraints (Burnham et al. 2008: 42-43).

To conceive appropriate research strategies and methods before the actual fieldwork was conducted, I followed Pierce (2008), who recommends aspects that political researchers should consider to narrow down the choices of method, notably: academic requirements that regulate the researcher, recommended methods for each sub-discipline of politics, resources available for the researcher to conduct fieldwork, and the accessibility and types of data (Pierce 2008: 51-53). The selected research methods and samples are presented according to Pierce's suggestions, and are outlined for each research question, as presented in Table 2.1.

The research fieldwork had three phases: preliminary work, data collection and data analysis. The fieldwork took place over a course of ten months (from April 2010 to January 2011). Table 2.1 below presents the three phases of the fieldwork in greater detail.

Table 2.1 Distributions of Research Questions, Form of Answers Needed, Methods, and Techniques by Phases of Fieldwork

Fieldwork Phase	**Research questions***	**Form of Answers needed**	**Methods**	**Techniques**
Preliminary	Question I , II	Exploratory	Survey within a case study (planned, but did not work)	Online survey (originally planned, but did not work)
			Observation, Content analysis (Solutions to unworkable	Local tech-conference/workshop. Archival document analysis (news,

Fieldwork Phase	Research questions*	Form of Answers needed	Methods	Techniques
			plans)	business analyses, IT industrial policies, and academic work on related topics) (Solutions to unworkable plans)
Data Collection	Questions I, II	Explanatory	Case study, Content analysis	Interviews, participant observation, document collection
Data Analysis	Questions I, II	Exploratory and Explanatory	Content analysis, Non-parametric statistical analysis	Archival documentary analysis, conversation analysis, and field notes analysis, policy analysis

**Question I: How should we characterise the nature of the technology-upgrading approaches that are employed domestically in Vietnam, and how are these approaches processed within the context of Vietnam's IT industry?*

Question II: How should we characterise the state's roles regarding technological upgrade in Vietnam's IT industry, and to what extent and in which way do these different state roles affect the domestic technology-upgrading approaches?

2.2 Preliminary Phase

There were a few pieces of information on the composition of Vietnam's IT industry that this research required before the data collection process in the actual fieldwork setting was conducted. Yin (2009: 8-9) suggests the use of the survey method to answer quantitative enquiries involving *what* and *how much/many* questions. Thus, in the preliminary phase of the field research, I selected a case study and conducted a background analysis using an exploratory survey method. Although Vietnam's IT industry is still young and small, collecting data from the entire industry would create pitfalls rather than benefit the research due to the limited time and financial resources available to the researcher and the diversity of conditions among the sub-units within the industry, which might lead to misrepresentation of the actual situation. Therefore, a structured single case study which would identify the geographic scope and a list of prospective participants was the first step taken to answer the research questions.

2.2.1 Case Study

A single case study for explanatory purposes was employed as a research method to find the answers to the two research questions. Since the units of the case study came in different forms, such as events, phenomena and individuals, choosing the most suitable unit that could be generalised to the entire context was an essential step for ensuring the valid interpretation of the findings (Yin 2009: 29, 33-34). In the case of this research, the sub sectors of Vietnam's IT industry were taken as a unit of analysis. There are four case studies employed in this research that were selected out of a total of seven case studies from which data was gathered during the fieldwork phase. In more detail, the selected four case studies were Cloud Computing, software outsourcing, App economy, and online games sectors. The three case studies that were not used as in the research were embedded system, online survey software, and databases. There were several justifications explaining the selection of these four case studies out of the seven cases.

Firstly, the selected four case studies provide sufficient data for the research to insightfully use for answering research questions. This was a crucial justification for a selection of research case studies as sufficient data enables the research to have a concrete ground for data analysis. Nonetheless, the non-selected three cases were not wasted, as they as well provided the research with an insightful overview on the dynamics of Vietnam's IT industry, which was also important for the research data analysis phases.

Secondly, the selected four cases also represent a fair share of cities that have significant roles in Vietnam's IT industrial development, namely, Ho Chi Minh City and Hanoi. Ho Chi Minh City is the site where the most active and intensive agglomeration of IT firms takes place, while Hanoi is a capital city where the central government is located. To date Ho Chi Minh City has developed more intensive IT and other high-technology industrial agglomerations than anywhere else in the country. According to Vu Xuan Nguyet Hong (2007), there are four high-tech and software parks under the authority of the Ho Chi Minh City municipality, compared to six high-technology clusters under the authority of Hanoi, Hoa Lac, Danang, Haipong, Cantho and Hue municipalities. This data suggests that selecting a case study from Ho Chi Minh City had the potential to yield findings that well represented the dynamics of technological development through networks. However, Vietnam is governed by a one-party state firmly based in the capital city of Hanoi – home of the central government and of many local pioneering IT companies – hence the research also collected data from the government bodies, IT pioneers and industrial consortium that are located in Hanoi. The selected four cases were from these two cities. While data on the cases of Cloud Computing and software outsourcing were gathered from Hanoi, data on the cases of App economy and online gaming were gathered from Ho Chi Minh City.

Thirdly, the four case studies provide the research a variety in research findings regarding the state's industrial developmental roles and technology-upgrading approaches. This led the research findings to be comprehensive and well representative of the state roles and technological drivers of Vietnam's IT industry.

2.2.2 Survey

In the primary stage of the fieldwork, an exploratory survey was employed as part of the original methodology. This technique can aid researchers when they have very little information about their topic, for example when the research is about a phenomenon that has not yet been studied previously (Manheim et al. 2001: 122).

In my case, an exploratory survey was intended to make it easier for me to obtain the most up-to-date details about local IT enterprises, MNCs, their relationship with other firms (locally and internationally) in the demand-supply line, types of IT product speciality, approaches to technological change, membership of IT consortiums and venture capitalists. Besides the above information, O'Riain (2004: 245), from his research on Ireland's software industry, suggests the types of primary data on the software industry that he thinks are useful for breaking down the industry in greater detail. These include alliances with other firms or sectors, sources of innovation or technological learning that firms obtain for their production and worker training, and details of a company's workforce such as the qualifications of employees and the specifications of technical positions. In the case of Vietnam, besides these types of primary information, information on the composition of shareholding in domestic IT companies is essential. This would permit the public and private ownerships to be distinguished before further analysis. It is often the case that private firms that have shares in companies have connections with state or public agencies; moreover, state-owned enterprises in the economic sector are often characterised as being established for purposes other than economic ones (Ning 2007: 583).

In the exploratory survey, the required information was collected by means of a list of questions. Different survey instruments can be used, depending on their suitability to the context, sample convenience and the opportunities available to the researcher. Manheim et al. (2001: 123) suggest several types of survey instruments. The researcher can choose to conduct the survey using questionnaires (by mail or self-administered) or interviews (by telephone or in person); however, a common problem found in using a survey method is a low rate of response. To address this problem and limitation, the original plan was to use an online poll sent to the respondents, since most IT professionals are available online, and it should in theory be easier to obtain their co-operation by asking them to fill in an online poll. In the case of the respondents who did not reply, they would be followed up by telephone interviews. This aimed to ensure a high response rate and optimise data collection.

In selecting the survey's respondents, a list of firms was to be obtained from the membership lists of high-technology clusters and other IT consortiums – VINASA, Quang Trung Software Park, and a directory of IT companies from a local computer magazine. This would allow IT firms located outside industrial clusters to be included in the sample.

Data obtained from the initial survey was to provide information on all current IT firms (whose number is constantly increasing) and their ownership in Vietnam. These selected companies would then be approached. A number of interviewees would be identified after acquiring the information from the initial survey in the first phase of the fieldwork. Furthermore, the data obtained from the survey would be presented in the form of descriptive statistics, rather than being statistically analysed, due to the aim of the preliminary survey being to obtain primary information rather than to test research hypotheses statistically.

The rationale of using a survey was promising; however, when implemented it proved too limited to generate the primary information required. The survey was available online on my postgraduate research profile on the university website from 10 September until 31 December 2010,[4] however only a very small number of firms responded to this. Later, I managed to meet up with many firms that received the invitation to participate in this survey. They said that they could not afford to spend their time on an academic-related survey due to the lack of incentives.

Following this setback, I opted for an alternative, which I had considered previously: archival documents and observation. The information listed above to be retrieved from the survey might be available in the form of archival documents. However this method had some limitations, as the volatile nature of the IT industry creates difficulties for the researcher who wishes to follow the most recent trends, as such documents rapidly become outdated. Additionally observation could not be done on a large scale within the time, human resource, and financial constraints which I was facing during the research fieldwork phase.

As I was fully aware of the downfalls of both methods, I conducted them in a selective way, only filtering data and information from active sources to avoid out of date material. For archival documents, I selected the most up to date lists containing IT firms, their business type, their industrial alliances, and workforce from two main sources: the Vietnam Outsourcing Portal and VINASA. However, as both sources contain lists of domestic IT firms, clustering heavily on outsourcing businesses (especially with the Vietnam Outsourcing Portal), I also employed an observation method to help me consider a wide variety of businesses. I selected two IT related venues, observing two technology conferences: the Fourth Annual Technology

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4 http://www.polis.leeds.ac.uk/research/students/phothiyarom-uer-aree.php

Business Conference, 11-14 October 2010, Ho Chi Min City, held by Strategic Alliance Vietnamese Ventures International (SAVVI); and the Workshop on the Promotion of Open Source Software Applications and Development, on 14 December 2010, Hanoi, held by Ministry of Information and Communications. I also made regular visits to software and hi-tech parks in Ho Chi Minh City where there is a high density of IT firms.

2.3 Data Collection Phase

Table 2.2 Distribution of Key Information, Key Informants, and Data Collection Methods for Answering Each Research Question

Research Question	**Key Information**	**Key Informants**	**Research Techniques**
Question I	1. Technology-upgrading process 2. Source of technology-change process 3. Retrospect of key IT professional networks	A. Vietnamese IT forums B. IT consortium, associations C.IT diaspora network D. Local enterprises E. FDI	- Participant observation - Interviews - Archival documentary analysis
Question II	1. Related policy drafting processes 2. Related policy implementation processes 3. IT's standardisation process 4. Physical infrastructure	A. Experts from related ministries B. HCMC authorities C. FDI D. Private enterprises E. Public	- Participant observation - Interviews - Archival documentary analysis

Research Question	Key Information	Key Informants	Research Techniques
	development 5. International political and economic relations 6. The connection between the state and the IT industry (government actions)	enterprises F. R&D units G. Universities H.IT consortium, IT associations, and industrial associations I. Other industrial participants such as business consultants and financiers	

2.3.1 Participant observation

Due to the nature of technological learning, which is a source of the capacity to upgrade particular technologies, technical knowledge accumulation processes do not occur only in the formal settings of R&D, educational and training units, or market transactions (Archibugi 1997: 122). Hence, encapsulating the patterns of such processes, including the interactions between each actor within the network, between the network and other regional networks and between the network and the state, should be conducted in informal settings.

The participant observation technique has principles that are suitable for the study of the Vietnamese IT informal knowledge network as it is a data-gathering technique designed to obtain information on a set of behaviours with a view to understanding the context explored by the research that might be distorted if the questions are answered verbally or by written accounts, especially those concerning on-going behaviours (Manheim et al. 2001: 330-331). This technique identifies patterns of behaviours from particular events, as well as the factors in the natural context that influence such behaviour, and operates by the researcher being part of such a context (2001: 332).

The natural context of the Vietnamese IT professional network appears both in the physical world and the online world. Undoubtedly, the latter has become a norm of the technological learning approach through online spaces offering information sharing and technical problem solving on IT material, especially now that most technical input is becoming available through open source material rather than proprietary material. As a consequence, participant observation techniques enable the researcher to collect field-data from online settings by means of observation, interactions between the researcher and informants via online space, and even through the researcher's perception from the viewpoint of being a member of the group (2001: 345-348). Several Vietnamese IT forums are already well known among IT professionals as rich sources of technical learning and also problem-solving communities covering broad disciplines of computer science. Specifically in Chapter 7: The App Economy and the Irrelevant State, the main discussion is set around open source software as a case study. In this chapter I observed the dynamics of how members of this network obtain and exchange ideas, knowledge, and hints relating to an Android operating system on a specific IT community network called 'The Open Embedded Software Foundation' (http://www.oesf.biz). Participant observation was also conducted at several local Internet rooms, in order to gain information on Vietnam's gold farming activities.

In terms of the approaches within the scope of the participant observation technique that will be employed, Manheim et al. (2001: 332-334) advise the use of a mixed approach consisting of obtrusive and unobtrusive approaches,[5] and structured and unstructured approaches[6] rather than employing a single approach. These mixed approaches usually provide considerable benefits at each stage of the research. This research followed this advice and employed a mixed approach where appropriate.

A main concern of using this method is how the researcher was to communicate with the studied group. Fielding (2004: 148) points out that communication with respondents in the natural setting requires some knowledge of not only the study group's native language, but also the special meanings of words likely to occur in the conversations. In the case of this research, Vietnamese and a technical knowledge of the terms used in IT industry are the native language and the special meanings respectively. To overcome the language barrier, the researcher had studied basic Vietnamese, and Vietnamese research assistants were hired when needed. Regarding the IT technical knowledge barrier, basic IT knowledge has been obtained through the researcher's academic IT background.

2.3.2 Elite Interviewing

Elite interviews have been chosen as the interview methodology in this research. The term 'elite interviewees' refers to people who politically influence the outcomes of the research foci, in both direct and indirect ways (Pierce 2008:119).

The research in practice utilised the information collected by this method in two main ways. Firstly, to quote Burnham et al., the elite interview '[…] is often the most effective way to obtain information about decision makers and decision-

5 Obtrusive observation occurs when people are informed that they will be observed, whereas unobtrusive observation occurs when people are not informed, thus are unaware that they are observed (Manheim et al. 2001: 332).

6 Structured observation occurs when a researcher observes events by following guidance which indicates what that researcher should look for (in this case it refers to theoretical framework). Unstructured observation occurs when a researcher observes the events without a framework as to discover a pattern of phenomena (Manheim et al. 2001: 333-334).

making processes' (Burnham et al. 2008: 231). One of the research's objectives is to explore the implications that the growth of the IT industry has for Vietnam's policy in its industrialisation period; thus the examination of the political issues behind the making of IT policy is well suited to this method as IT is one of the strategic sectors in the industrialisation of the country.

Secondly, elite interviews are an excellent aid when the interviewees appear to hold expert knowledge on the topic that is greater than that of the interviewer (2008: 231). Central to the proposed research is inevitably the pool of technical knowledge and terminologies; hence, the elite interview appears to be a sound interview technique, bridging the gaps in technical knowledge between the researcher and the sample.

In terms of sampling technique, snowball sampling is a recommended method for conducting elite interviews (Burnham et al. 2008: 233). Snowball or network sampling is a method where a sampling frame is not available; thus the initial interviewees will be indicated by the literature or an Internet search. The sample can be extended by consulting the initial set, who can identify the related population that they know in the same network or area of interest (Arber 2001: 63; Burnham et al. 2008: 233).

In addition, non-elites were also included in the proposed research. These people are impacted directly or indirectly by the outcomes of the events or policies that are the foci of the research (Pierce 2008: 127); for instance, the people or organisations that are responsible for the implementation of IT policy, and the local IT firms that are affected by IT policies.

The proposed research's population of interest, which can be identified as the initial sample, could not be reached during the fieldwork phase. Therefore, leading on from the snowball sampling, the actual research participants are different from those who were initially targeted; the differences between the two groups are presented in Table 2.3 below.

Table 2.3 A comparison between the research's original population of interest prior to the fieldwork phase and actual research participants during the fieldwork phase

Information Groups	Population of Interest	Research Participants
Line of related ministries and local authorities	- MIC: Department of Information Technology: Director, Mr. Nguyen Anh Tuan - MOST: Information Communication Technology Centre: Director, Mr.Phung Bao Thach - MOIT: Science and Technology Department: Deputy Director General, Nguyen Phu Cuong; and Vietnam E-Commerce and Information Technology Agency: Director General, Nguyen Thanh Hung - MPIP: Department for Economic Zones Management: Director, Mr. Le Tan Cuong - HCMC's Department of Information and Communications: Director, Mr. Le Manh Ha	- Department of Information Technology, Ministry of information and Communication: Nguyen Thanh Tuyen, Deputy Director General - People's Committee of Ho Chi Minh City Department of Information and Communications: Nuyen Anh Tuan, Deputy Director -Quang Trung Software Park: Lam Nquyen Hai Long, Director of the Cloud Service Project
R&D agencies	- The Software Technology and Digital Content Institute: Director, Dr. Le Hoang Minh	-Vietnam Academy of Science and Technology: RD1, Senior position

Information Groups	Population of Interest	Research Participants
	- The Information Technology Agency: CEO, Dr. Nguyen Anh Tuan	-FPT Technologies Research Institute: RD2, Senior position -iDragon BCC: RD3; RD4; RD5, Senior positions - TMAs R&D Centre: Bui RD6, senior position
IT consortium	- Ho Chi Minh City Computer Association (the first IT association in Vietnam, established1988): Chairman, Mr. Chu Tien Dung - Overseas Vietnamese Club for Science and Technology - Vietnam Software Association (VINASA) - The Software Engineering Institute: Professor, Dr. John Vu – a member, and also Chief Engineer of the Boeing Group's IT Centre	- ITCon: IC1, senior position -VINASA (Ho ChiMinh City): Tran Cong Tuong, Director -VINASA (Hanoi): Nguyen Thi Thu Giang, Director - Ho Chi Minh City Computer Association (HCA): Tuan Phi Anh, Director
MNCs	- Intel Corporation - International Data Group (IDG) - Global Equipment Company Services (GES)	- Intel Corporation Vietnam: Than Trong Phuc, Ex-General Director
Indigenous local firms	- Corporation for Financing and Promoting Technology (FPT) - Computer Communication Company (CCC) - Business Information Technology Co., Ltd (BITCO) - Harmony Co., Ltd	- Sirvina: ILF1, Founder - VNG:, Le Hong Minh, CEO - TMA Solutions: Nguyen Huu Le, Chairman -TMA Solutions: Hong Tran, Director Assistant of

Information Groups	Population of Interest	Research Participants
	- High Performance Technology JSC (HPT) - Vietnam Data Communication Company (VDC) - Enterprise Software Development and Trading Co., Ltd - Hong Nam Computer Communication JSC	CEO - ISB Vietnam: ILF2, Senior position -3D Network: ILF3, Country Sale Director, -Lacviet: ILF4, Director
Journalists and academics	- Ho Chi Minh City University of Technology (Faculty of Information Technology) Dr Tran Anh Vu - Runckel and Associates - Chris Runckel and Ly Tran - Professor, Academician Dang Huu - Nguyen Tu Quang	- Posts and Telecommunications Institute of Technology : Dang Thi Viet Duc, Lecturer - Faculty of Computer Science and Engineering, Ho Chi City University of Technology: Tran Vu Pham, Head of Systems and Networking Department , - Ho Chi Minh City University of Technology: JAA1, Lecturer, - Ho Chi Minh National Academy of Politics and Public Administration: JAA2, Deputy Director Centre of Information Technology
Financers	- none	-DFJ Vinacapital: Than Trong Phuc, Managing Director

Information Groups	Population of Interest	Research Participants
		-DFJ : FN1, senior position

2.3.3 Archival Documentary Analysis

Several sorts of archival documents were examined for this research, especially those that analyse similar patterns of impacts to the research. First of all, archival research was conducted in disciplines related to the conceptual framework. This was not limited to academic research, but also included research conducted for business purposes. As the latter tends to be published more often than the former, it provided more up-to-date information for the needs of this research. Secondly, official reports, policy statements and relevant publications on sciences, technology, innovation and industrial development were consulted. Thirdly, voluminous publications such as newspapers, journals, magazines and conference papers were included as sources of documentary evidence. Lastly, published statistical data were obtained from reliable sources such as the Vietnamese General Statistics Office, Vietnam's National Organisation of Intellectual Property Agency (providing statistics on granted licences of intellectual properties) and the U.S. Census Bureau for statistics on trade in advanced technology products.

2.4 Data Analysis Phase

The data analysis phase in this research has two purposes. First of all to assess whether there was enough data collected from the data collection phase to frame issues for addressing the research questions. Following this, the data analysis phase was to analyse the obtained data to answer the research questions and the research's contribution to the theories on state developmentalism in high technology industry.

Research's data analysis phase was processed in the following stages;

1. Case study selection: four case studies were selected out of a total of seven case studies by using sub-sectors of Vietnam's IT industry as a unit of measure (Section 2.2.2 Case Study). As the research employed snow ball sampling as a sampling method, this enabled the research to obtain multiple samples that were clustered in the same sector segments providing sufficient data for each case study.

2. Quantitative data analysis: the data obtained were analysed based on the type of data. Firstly, the quantitative data from archival documents and the survey were statistically analysed on a nominal scale, using descriptive statistics in the form of percentages and means where applicable. The obtained quantitative data were used for comparative and illustrative purposes rather than for testing hypotheses or finding correlations between variables.

3. Qualitative data analysis: regarding the qualitative data, content analysis was employed as an analytical method. Pierce (2008: 263) defines content analysis as the textual analysis of the message communicated via various sources notably readable, audio and visual sources. He also notes the comparative capacity of this method to evaluate the similarity and dissimilarity or agreement and disagreement between informants on the same topic (2008: 264). Politics is generally a sensitive topic, especially in socialist nations. Research regarding Vietnam, especially during the transitional economic stage, can cause difficulties as informants may not necessarily want to provide what they think could be socially unacceptable answers. Thus, using content analysis allowed the researcher to obtain sensitive information from messages that are communicated through non-spoken sources such as

advertisements and photographs, and also from indirect spoken sources such as speeches, without placing the key informants in difficulties.

The research followed Pierce's guideline to analyse the content data with two more specific techniques of content analysis: non-frequent technique; and successive approximation technique.

3.1 Non-frequent: the first step in content analysis is to use a non-frequent technique, identifying content evidence from obtained field data. George (2009: 144-145) posits that the non-frequent technique is conducted by observing the consistency of the presence or absence of content features in the context, without a concern over the features frequency values. The content features can be anything that the research defines as research variables such as content characteristics, dichotomous attributes or coding judgements (2009: 144-145). In the case of this research, the content evidence was loosely classified into three groups: the state's industrial roles; technological upgrading; and other attributes that connect the first two groups together.

3.2 Successive Approximation: after obtaining content evidence using the non-frequent technique, the successive approximation technique of qualitative data analysis was conducted in order to relate the content evidence with research questions and research frameworks (Neuman 2003: 451). The research looked into the content evidence and located them within the research frameworks of three models examining state roles with technology-upgrading process (Chapter 3: Literature Review). This technique helped the research to evaluate whether the identified content evidence fit well with the theories or act beyond what the related theories suggest. Neuman (2003) suggests the key strategy for this method as '[…] repeatedly move back and forth between data and theory, until the gap between them shrinks or disappears' (2003: 458), as by doing so the evidence and theory will structurally shape each other (2003: 451).

2.4.1 Research Constraints and Ethical Considerations

Being a researcher with no direct connection to the country where fieldwork takes place imposes certain limitations. First of all, I was not familiar with the field area, which made the fieldwork more time consuming than originally planned. I paid the price for this when the original research design was not successful, as a great delay occurred in the fieldwork. Secondly, there were language constraints, which were overcome by hiring research assistants when needed and taking a Vietnamese language course. Because of the nature of the research, the key informants use English as the main technical language in their professional lives, and thus most of the interviews were conducted in English. The Vietnamese language ability gained from the three-month-language course came in handy when attending technological conferences or workshops, and when observing local Internet rooms. Thirdly, being an outsider means I had no connections with the informants at all, and there were a number of rejections and a high probability that the informants would not participate if they had no interest in my research or did not benefit from it. To overcome this barrier, I made use of a personal network which I have been developing since the beginning of this research, which brought me in to the proximity of local IT engineers as well as IT firms. Moreover, I established a local affiliation with Dr. Cao Hao Thi, from the School of Industrial Management, Ho Chi Minh City University of Technology who provided me with local connections as well as credentials when contacting the informants during the period of July 2010 to January 2011.[7] Being an outsider also has its advantages, such as seeing things from a

7 For an original copy refer to Appendix B

different perspective from individuals who are entrenched in the Vietnamese system and the ability to be more objective in my analysis.

Lastly, as a Thai citizen, I am permitted to travel ASEAN member countries such as Vietnam without obtaining a visa for any single three-month period. This saved me time as I did not have to deal with visa procedures. However, owing to the limitations of the three-month visiting period, I had no choice but to enter Vietnam more than once in order to complete my fieldwork, going back to Thailand then returning to Vietnam again.

Regarding ethical considerations, I provided the participants with the details of my research before the data collection took place in order to enable them to make an informed decision about whether or not to participate in my research. During data collection, research participants were all informed and asked for consent when recording devices were operated. Following the guidelines agreed to for ethics purposes, informants in this thesis have been anonymised using pseudonyms, except where they gave explicit permission for their real identities to be specified. The research obtained retrospective ethical approval from the university research ethics community (reference number AREA 11-041).

In conducting participant observation, a mixture of obtrusive and unobtrusive techniques was used based on ethical considerations. Whenever, an event was open to public participants, for example in the case of this research when I accessed the sites or events where non-members had access to information, participants were not informed about my observation (except when this was required). On the other hand, if any forms of communication took place between informants and me they were informed about the research and asked verbally if they agreed to the use of the information for research purposes.

Chapter 3

Literature Review

Technological-learning Approaches for Late Industrialised Economies

This section is organised in three parts, in accordance with the needs of this research. Aiming to examine the relationship between politics and technological-learning capacity under a highly centralised political regime in the state like Vietnam, the research requires as its foundation a focus on explaining how technological-learning capacities are generated for economic purposes.

In general, the literature touches upon multi-disciplinary issues around technological-learning for industrial catch-up in late industrialised economies. However, in this chapter, such literatures are reviewed from the point of view of innovation and technological-learning theories, in association with different industrialisation strategies, which can be presented in three ways: as market-led, state-led, and network knowledge-led models. The purpose of categorising the relationship between technological-learning approaches and industrialising regimes is not to justify which model is best but rather to illustrate the diversity of the impact the latter has on the former.

The three models are not of equivalent value. As the first two models, the market-led and state-led ones, seem to receive more criticism of how ineffective their related industrial regimes are in relation to technological upgrading, the last model seems to be a more effective approach to deal with the emergence of technology network communities outside formal industrial and R&D settings. These communities are widely accepted to be the actual source of technological-learning nowadays (early works on this are: Breschi and Malerba, 2001; and Saxenian and Hsu, 2001). However, in reality the conditions facing the late industrialised economies are more complicated than the theories suggest. The work on the network knowledge-led model emerges largely from a new model of technology production that relies largely on less-institutionalised knowledge which is out of state's techno-economic apparatuses, leaving a big gap regarding the applicability of this model to a state with a highly centralised regime, such as the Socialist Republic of Vietnam. Therefore this research aims to provide an analysis beyond the scope of the existing theories of the network knowledge-led model.

The second condition arises from the fact that the first two models are still active in most of the late industrialised nations; this includes Vietnam, despite the empirical evidence illustrating their ineffectiveness on technology-upgrading capacity. Thus reviewing the first two models not only provides the background on conventional approaches for technology upgrading, but also identifies the area that the research needed to investigate and on which it needed to gather data for answering the research questions.

3.1. The Market-Led Model

The market-led model of technological learning suggests that developing economies will be able to upgrade their technological capacities mainly through neo-liberal industrial policy prescriptions, such as liberalised trade and market conditions. The focus point of this contention is that less technologically advanced economies will upgrade their technological capacity by borrowing new or more advanced technologies from more technologically advanced countries, rather than attempting to generate an indigenous technology in the infant phase of industrialisation.

Liberalising trade and market conditions will favour the inflow of FDI and encourage MNCs to manufacture in developing countries. Consequently, technologically-backward developing countries can acquire the already produced technologies though various technical channels of technology transfer and knowledge spillovers. This will enable them to catch up with technologically advanced countries and connect them better with technology consumers on a larger scale as exporters to the international market.

With regard to technology consumption, developing countries will benefit from economic liberalisation mainly in terms of technology standardisation. Historically, at the beginning of the rise of the computer industry IBM was a pioneer in standardising the industry (Coopey 2004: 4). The United States, as both the home of IBM, and a major advocate of the free market, from the late 1950s onwards became hegemonic in the computer industry as any product, service, or marketing that involved computers had to be compatible and upgradeable with IBM machines (2004: 3-4).

As such, neo-liberal proponents contend that trade liberalisation will foster technological upgrade for catching-up nations via their connection to the global IT industry, which is a source of learning about the latest technology abroad, including principles of technological production and means of technological standardisation, as well as being an actual market for technology consumption. Using India’s IT industry as an example here, a few scholars point out that economic liberalisation was a turning point in the remarkable growth of India’s IT industry during the 1990s. According to Saxenian (2001), India was once given an opportunity to catch up with global IT production through the presence of IBM manufacturing during the late 1970s. Nevertheless, the economic environment at the time was characterised as being unfriendly to FDI, for instance in Foreign Exchange Regulation Act areas, which caused IBM’s departure in 1978 (2001: 5). Following the nationalist economic trajectory of the Indian government during the 1980s, India’s IT industry was isolated from global production (2001: 4).

The Computer Policy (1984) and the Computer Software Export, Development and Training Policy (1986) followed with the economic liberalisation process (1991) and have brought India back into the technological market. In contrast with the import substitution industrial policy that regulated imported technology and made national technology capacity obsolete, the new liberalised and exported oriented industrial policy put India back in touch with cutting-edge technology through foreign investment. Moreover, the technical capacity of local firms has been modified in accordance with competition and international standards both in technological production (through the International Organisation for Standardisation: ISO) and technical management (through Total Quality Management: TQM) (Korgaonker 2004:110 - 114).

In addition to the neo-liberal mechanism at the international level, there is a well-known regional Asia-specific model that advocates the benefits of the neo-liberal market mechanism. This model is known as the flying geese model. The model praises neo-liberalism by advocating that pro-trade economic policies will allow FDI to act as a transmitter for moving countries up the hierarchy of an Asian production chain; this mechanism is referred to as ‘pro-trade-oriented FDI’ (Kojima 2000: 376). The flying geese model is a regional hierarchy in two dimensions: the first dimension is a hierarchy of countries in which Japan is the lead goose; and the second dimension is a hierarchy of production in which the higher stage of the hierarchy, the more capital intensive and sophisticated are the products (2000: 376).

The flying geese model connects neo-liberalism to technology upgrading by suggesting that superior technologies from more developed countries will be transferred to less developed countries when the economic conditions of the destination countries are liberalised enough to allow FDI from the more developed countries to flow in (2000: 383). However, the flying geese model has been criticised over its claimed advantages for technology transfer. We shall examine this critique in the remainder of the chapter along with other criticisms of neo-liberal economic policy's effects on technological learning in less technologically advanced countries.

The critics of this tradition argue that neo-liberal economic policy benefits the technologically advanced nations rather than backward ones (Ning 2008; Zhou 2008). For example, technology transfer in the flying geese model is critiqued for not encouraging indigenous innovation in the following geese, since they are dependent on foreign technology rather than creating their own (Kojima 2000: 393).

In another example, bilateral or multilateral trade agreements are a means for wealthy nations to remove any trade tariff that is a disadvantage for them when they trade with or want to exploit productive resources from developing countries (Ning 2008: 265-268, 288). Wade (2003) and Weiss (2005) suggest two angles to view how neo-liberal economic policy benefits developed countries rather than developing countries. Wade points out how the WTO (led by developed countries) passively obstructs developing countries from moving up the global developmental hierarchy through strategies that Wade refers to as 'a modern version of Friedrich List's "kicking away the ladder"' (2003: 1). In more detail, Wade argues that the Uruguay Round's agreement on investment measure (TRIMS), trade in services (GATS), and intellectual property right (TRIPS) make illegal many industrial measures that benefit domestic technological upgrading in developing countries (2003: 9). These agreements thus act as global rules to diminish the measures for developing countries to move up the global developmental hierarchy. Furthermore, Weiss's critique of neo-liberalism comes from the opposite angle of Wade's by focusing on direct strategies of how the leading developed countries create opportunities through the WTO's rules to favour themselves in a zero-sum manner (2005: 723). For Weiss, the post-GATT WTO appears to be strategically influenced by developed countries to give themselves more space in global industrial governance to increase their global economic prosperity (2005: 744-745). Apart from Wade (2003) and Weiss (2005), there is a great deal of literature on the issues surrounding the impact of international trade agreements and disputes on economic development for developing countries, however, it is out of the scope of this research to review them.

In terms of technological production, some research has investigated the technology transfer and knowledge spillover effects from FDI and MNCs in the host economie. However, the results of such research do not always evidentially support neo-liberal arguments on technological learning (Archibugi and Michie 1997: 132; Fosfuri et al. 2001: 207; Zhou 2008: 2368). When examined further, the evidence suggests that transfers and spillovers rarely took place straightforwardly in the host countries, contrary to the predictions of neo-liberal economic theorists.

Technology transfer is an arranged process of technical training and/or supports through the client-supplier role between the host countries and the MNCs. When enterprises from the host country are local suppliers for the MNCs, 'backward-linkage technology transfer' occurs as local firms receive offers to improve their technological capacity as suppliers. By contrast, 'forward-linkage technology transfer' occurs when local enterprises are the clients and receive technical support from the MNCs through FDI (Nguyen Ngoc Anh et al. 2008: 8-9). Knowledge spillovers are an involuntary process of knowledge transmission caused by the presence and economic integration of the MNCs with domestic firms through FDI in the local market (Görg and Strobl 2004: 2). For technologically backward host countries, the benefits from permitting MNCs to have their affiliates and engage in FDI in their countries come through three fundamental channels: namely demonstration effects, increased competition, and labour mobility (2004: 2).

Many scholars, mainly from business schools and economics departments, find mixed evidence to support the argument that economic liberalisation advances the technological upgrade capacity of developing countries, and argue further that some types of technology transfer and knowledge spillover rarely occur in the contemporary setting of the high-technology based economy. In comparison with knowledge spillover effects, technology transfer is a more deliberate process as it arranged between the MNCs and the local government. However, the host government cannot build economic competitiveness simply by relying on such a process, due to many conditions in the host economy. For instance, the technology gap between the original source of technology and the host reduces the likelihood of local firms absorbing new technologies (Fosfuri et al. 2001: 207). What is more, even if the transfer takes place, the host will hardly obtain cutting-edge or core technologies (Archibugi and Michie 1997: 132; Zhou 2008: 2368), as the MNCs protect their patented technology, especially in developing countries with weak intellectual property right protection frameworks (Zhou 2008: 2368).

In terms of knowledge spillovers, the most out-of-date channel is the 'demonstration effect': in other words, technological learning by reverse engineering or imitating an already existing technology. Undeniably, imitating technology crucially accounted for the phenomenal rapid industrialisation of the East Asian NICs in the 1970s. At that time the product life cycle was still characterised by scale economies. However, in the 1990s, the pace and level of advancement in key internationally competitive technologies, such as IT and ICT, have 'de-verticalised' the production processes (Korgaonker 2004: 108); this means that the competitive capacities in global high-tech production do not require firms to enter into an entire vertical production chain. On the other hand, production processes are driven by specialised innovation and become increasingly fragmented (O'Riain 2004: 5). Anecdotal evidence from successful emerging IT frontrunners illustrates that their IT industries only connect to the market in some parts of the production lines in which they specialise, notably Taiwan's emerging devices' hardware; India's technical problem solving for Y2K and European integration; and Israel's and Ireland's Internet- and network-security. Even the centre of global IT alliances, the Silicon Valley, once made its entry by specialising in integrated circuit production (Bresnahan et al. 2001: 842). Therefore, the technology imitation approach, which is time consuming, non-innovative, and lacking long term potential to develop a speciality in an unexploited market opportunity, is no longer sufficient for current global high-technology based development.

The evidence, provided by empirical research in the economics and business disciplines, might provide a more comprehensible picture of how technological-learning from MNCs through FDI is actually taking place. However, as mentioned previously, the evidence is mixed in different countries, despite their experiencing the same macro-economic trajectory towards trade and market liberalisation. Regarding the two other channels of knowledge spillovers – competition and labour mobility effects – these two seem to be evidentially more closely associated with neo-liberal mechanisms rather than the FDI channel covered in the discussion above.

Trade liberalisation generates a competitive effect as it offers local exporters an exposure to more advanced technologies outside their home country, as well as pressuring local exporters to improve their technological-based production to be able to compete with other foreign traders (Bustos 2008: 35). Along with market liberalisation, the degree of competition is improved among local firms, although the overall infrastructure and educational sector affect the potential of all economic mechanisms. Apart from the benefits for their technological competitiveness, the host countries also improve their human resources by allowing MNCs to have a local presence through FDI. This type of local human resource technical training without an explicit investment from the local host is one form of technology spillover known as labour/worker mobility.

Labour mobility is thought to occur whenever MNCs fail to keep the local technical workers, such as those who are scientists and engineers, from leaving the MNCs after they have received training, accessed the research results, or accumulated knowledge through on-the-job learning (Møen 2005: 83). The spillovers will only take place when the workers use such knowledge for a local firm or set up new spin-off firms on their own after leaving the MNCs (Görg and Strobl 2004: 4). Furthermore, worker mobility is not only a source of technological-learning, but is also considered to be a source of technology diffusion that benefits the host countries (Møen 2005: 82).

At first glance, knowledge spillovers via labour mobility might appear to be a great advantage that neo-liberal industrial policy can offer to developing countries. However, the increment in technical knowledge of local workers from MNCs does not support the idea that the host can exploit such knowledge as a significant resource for mastering the technology-upgrading process. There are several reasons supporting this point of view.

First of all, the MNCs are well aware of the spillovers from labour mobility even before they employ local workers. A main reason that MNCs choose to hire local workers rather than expatriates is the cheaper labour cost offered by local workers (Fosfuri et al. 2001: 206). Consequently the MNCs tend to offer only general technical training to local workers and preserve the core knowledge for their home countries (2001: 207). They also under-invest in local R&D activities (Møen 2005: 83).

Secondly, labour mobility is not always a form of spillover as it can be characterised as a fair exchange between easy access to new technology and cheap labour. Møen (2005: 106-107) argues that technological workers, with cheaper wages at the beginning of their employment, expect an increase in wages after they have worked for MNCs for a certain period of time. This means that even though such local workers do leave the MNCs and exploit with local firms the technological knowledge they have gained at the MNCs, these local workers actually pay for this knowledge through the lower wages they received earlier. Furthermore, although this labour mobility might still result in technology transfer; it is not a short term strategy for developing economies to build transfer capacities.

The more specific literature on socialist market economies, such as China and Vietnam, notes that they are increasing their degree of economic liberalisation due to various trade agreements and joint membership in international organisations. Vietnam joined the WTO in 2007. The effect of economic liberalisation on technological-learning might have started to show with regards to technological-learning. There is empirical evidence from Nquyen Ngoc Anh et al. (2008: 24-25) who conducted research on statistical data from the Enterprise Census of 2000-2005. They suggest that Vietnam's local enterprises in the manufacturing sector benefit from the technological spillovers through backward linkages and labour mobility rather than from demonstration or competition effects. However, such research offers only preliminary data and still lacks empirical evidence to address whether the increase in technological capacity is sufficient to catch up and compete with other global high-technology frontrunners.

Although the evidence used for the discussion of the relationship between macroeconomic policy and technological change for catching-up might be less well established in firmly linking liberal economic policy and technology-upgrading processes together, it is based on too much solid scholarship to dismiss the idea that liberal economic policy supports technology upgrading processes. As mentioned before, global IT production has increasingly fragmented into specialised production. This means that the more the degree of technological specialisation progresses, the more economies need to be oriented toward international trade: the domestic market is simply too small for specialised suppliers, and domestic technological production must obtain more diverse fragmented pieces of technology from international suppliers rather than develop its own (Rooji et al. 2008: 164-165).

Therefore, and to sum up, the market-led model, which mainly represents a technological-learning approach in association with export-oriented trade policy and economic liberalisation with a minimum of state intervention in the market, has a crucial implications for technological change. Market-led policies are not a direct scheme for technological learning, but rather fulfil the needs of contemporary innovation-driven industry with respect to the consumption of technology by connecting nations to the global market, since technology-based industries are the backbone of economic performance. This benefit occurs whether the limitation of domestic revenues is due to the country's being small in size or being large but with a technologically backward national economy, such as in the case of India.

3.2. The State-Led Model

The counterbalance to neo-liberal theory is statist economic theory, which advocates nationalistic economic development. This is based on the ideas that nations whose economies are at the infant stage of industrialisation should be protected by their own governments from exposure to international economic competition. Furthermore, states should master their economy by themselves rather than leaving this task to market mechanisms, which will never be in the ideal condition advocated by the neo-liberals.

Historically state interventions have often taken the form of import-substitution trade policy, which aims to protect the domestic market from fierce competition, and arranges various economic institutions to allocate economic resources and administer the intervening economic regime. Technological capacity building through the import-substitution measures was notably used earlier among East Asian countries; however, as we discussed in criticism of the market-led model, technology upgrading though an import-substitution trade policy is very difficult to carry out under the WTO agreements after the Uruguay Round wiped away these industrial measures that had been used by the earlier wave of East Asian countries (Wade 2003: 1).

Against this backdrop, scholars in this tradition support the role of the state in controlling the trajectory of the technological innovation process; beginning with the process of selecting the strategic technology, through to developing the chosen technology, diffusing it across society, and obtaining feedback from users to improve such technology. The literature on technology and innovation policy puts forward the state as a dominant actor in the technological-learning process through the notion of National Innovation Systems (NIS). The NIS theory advocates nation-specific accounts that specify the actual determinants behind the diversity of types of selective technology, stage of innovative development, and innovative processes belonging to each nation, and as a result lead to the difference and unique outcomes of a nation's industrial innovative productivity.

The notion of NIS comes from Friedrich List's (1984 [1841]) concept in 'The National System of Political Economy' (cited in Freeman 1995: 5). The pioneers in the NIS literature have developed List's ideas to explain the association between industrial technology and economic performance. These pioneers include Lundvall (1992), who originally coined the term National Innovation Systems; Nelson (1992) who adopted List's idea to explain how Japan competed with the United States to be a global technology hegemony during the 1970s and the rise of East Asian NICs like Korea and Taiwan; and Freeman (1995) who has applied List's argument to explain from an historical perspective the development and utilisation of technology from the first World War until the fast growth of the East Asian NICs.

Like-minded NIS theorists agree with classical economic theorists that firms are the actual source of innovation. Nevertheless, the classical theorists do not see positive effects from a government role in the economy, while NIS theorists suggest the opposite, arguing that the innovations generated at the firm level will never be integrated into the economy at the national level without an active state. The NIS theorists posit two fundamental suppositions, the first about the factors that underlie the difference in the ability to produce innovation, and the second with regards to the system that processes such factors to produce innovations and utilise them.

With regards to the factors that determine national innovative capacity, nation-specific factors are positioned at the core of this tradition's analytical accounts. Such factors arose and were formed by the historical circumstances forging nation-states, such as political norms, social behaviour, economic customs, and even geographic characteristics. Despite the diversity in each national combination, proponents of this approach find a few common analytical factors that can be used to rationalise the profitable factors that have nurtured the economic and technological power of many advanced economies such as Japan, the United States, European nations, and the Latin American and East Asian nations that became NICs in the 1980s.

Several writers in this tradition suggest that while the innovative capacity of each country lies in specific factors that are unique and national in scope, there are a few analytical factors that lie behind the success and failure of innovative technological capacity among countries. Nelson (1992: 353-354) acknowledges that geographical conditions, such as country size, and having rich or scarce national resources, exert different influences at the foundational stage of technological development. Large countries have more market demand, and also engage in a wider range of manufacturing than smaller countries. Countries with resource scarcity problems also have to develop their national economic competitiveness through export-oriented manufacturing and thus are forced to develop a strong innovation system to support this. Moreover, Nelson (1992) suggests that the degree of affluence also makes a difference to the innovation system. This is due to countries with wealthier populations being able to afford to engage in economic activities that are technologically advanced, while countries with poor populations cannot.

Another crucial factor to which the NIS theorists pay attention is the concern over national security. Countries with higher security concerns will commit more to military R&D than those who do not. However, this only produces economic benefits when there are linkages for military technology spin offs to the civil economy (Freeman 1995: 12). A good example of IT generated from military technology is the early-development of computer languages such as COBOL from the U.S. defence R&D sector (Richard 2004: 3). These factors are embedded fundamentally in a variety of political, social, technological, and economic institutions that co-ordinate to created linkages of interactions among all the actors (both from users' and producers' sides) across sectors in a national fabric (Nelson 1992: 351-352; Freeman 1995: 10, 12, 14; Niosi et al. 1993: 208–211; Archibugi and Michie 1997: 122).

In terms of the system of innovative production, the mainstream researchers argue that the most powerful actor who determines technological change cannot be anyone else but the state, as technological change is a series of occurrences, which involve the stages of innovation generation, finding uses for the technology, technology marketing, receiving feedback, technological improvement and the assimilation of technology. Such processes cannot be taken away from the social structure in which these innovations are grown and exploited (Freeman 1995: 11; Archibugi and Michie 1997: 122). Therefore, national innovative capacities have to be created through national action (Nelson 1992: 348). Niosi et al (1993: 212) explains that the state is a main financier for national R&D activities, a view also confirmed by Rothwell (1982: 4) who emphasises the need for government R&D

investment. Rothwell argues that R&D is an area where the private sector rarely spends enough: it requires huge investments but is prone to failure, thus it is hard for private firms to justify their investment in conducting R&D activities. However, this argument is now rather outdated: the willingness of the private sector to invest despite the high level of risk is a key factor in cutting edge technology. However, to nurture technological upgrading processes requires not just financial policies, but also a variety of organised technological policies affecting the national level, such as procurement policies and intellectual property laws, which are exercised on the political impetus of the state (Niosi et al. 1993: 211-212).

Although the NIS concept offers an explicit account of how different countries with different nation-specific factors experience different innovation outcomes, it has a poorly established foundation. Firstly, the NIS literature is ambiguous on the scope of its concept. The NIS theorists strongly believe that every country has an NIS, as for them even a country with just a system for using technology but without system of technological production counts as a national innovation system (Sharif 2006: 760). Due to this ambiguous structure, employing the NIS concept to analyse a technological upgrade approach, can be difficult. Secondly, the term 'innovation' for the NIS theorists encompasses every technology that is newly introduced at the firm-level, rather than at the national or global level (Nelson 1992: 349), because this type of 'innovation' already produces economic growth (Hobday 2000: 131). This means that innovations that already exist anywhere else in the world, but are introduced to firms for the first time can be called 'innovations'. The reason for assuming that this type of activity is an innovation is understandable, at the literal level, as NIS views innovation as a series of processes in which technology assimilation is as vital as technology generation (Freeman 1995:10); however, there is not strong empirical support that such ‘innovations’ can provide nations with technological competitiveness in the present global technology market. As noted above, the fragmentation of technological production has been increasing rapidly. Technology entrepreneurs around the globe have adjusted to the new environment of production by turning themselves into technology specialists. This specialisation means that market competitiveness relies on an ability to create technology that has never existed before, which could either be a brand new type of innovation, or new technology on the top of skills in which firms already specialise. Thus, defining innovation as NIS theorists do is inconsistent with the condition of current global production.

Moreover, the fragmentation in technological production also diminishes some of the nation-specific factors. Large countries are no longer in a more advantageous position than smaller ones, as even the more recent works on the NIS note. Rooij et al. (2008: 164-165) found during research on NIS theory in the Netherlands that there could be more than one innovation system in a country as a result of technological specialisation. This means that each country needs to be connected to a larger market at the international level to export its speciality and import other technological specialisms from abroad. Hence, market variety should be viewed from an international perspective rather than one based on a nation’s size, as the aforementioned NIS theorists suggest.

What is more, Rooij et al.’s analytical account questions further whether firms are still the smallest unit of knowledge flow in an innovation system at the national level. Globalisation makes national borders become increasingly unimportant, thus, human migration happens regularly on an international scale. This portrays the flow of technical knowledge as geographically footloose due to individual mobility (2008: 165).

While the escalation of economic and technological globalisation is a focal point for the critiques of NIS, a common argument given by scholars on this practice is that globalisation does not diminish the role of the nation state in cultivating the national innovation system, but rather the role of nation state is altered in accordance with the degree of globalisation. As mentioned earlier, the state is the most dominant actor in the innovation system, especially as a major financier and possessor of the sovereignty and political supremacy needed to create R&D policies and link them across sectors (Archibugi and Michie 1997: 133). Globalisation might have lessened the incentives for the state's financial role, as the profits might not be returned to the local level but remain within MNCs to establish their foreign hosts. However, this change cannot eliminate the prevailing role of the state in the national R&D unit, in such areas as educational policies and other R&D resource allocation, which are embedded at the national level (Nelson 1992: 369; Archibugi and Michie 1997: 133-134).

Even though the nation state is still in a leading position to determine national R&D activities and resource allocations, the NIS school of thought still has not yet satisfactorily explained whether the state is still capable of commanding the dynamics of all the actors in the innovation system. This is the case particularly in the IT industry; for example, Silicon Valley is increasingly independent from other national institutions in the system (Bresnahan et al. 2001: 836).

Despite all the aforementioned arguments against the concept of the NIS, this notion still provides invaluable perspectives for the research. The recent development of NIS theory has shifted from its fundamental concept, in which the state holds a role dominant to that of other actors in the innovation system, to new concepts such as the so-called 'university-led model', in which the university directly plays a significant role in the system through the production and assimilation of technology. The entrepreneurial role within academic institutions has created activities concerning dynamic innovation that lie beyond the institutional capacity of a state. Nowadays, a number of universities run their own business organisations; academics not only have teaching and researching roles in the universities, but also analyse the technological demands of the market and provide services and products in accordance with such demands. The university-led model demonstrates a robust interaction which occurs outside the rigid institutional arrangements of the state.

In practice, the premise of an entrepreneurial university is not a new concept, but can be traced back to the 1930s (Etzkowitz and Dzisah 2008: 654), when MIT first introduced it as a solution to solve a classic problem of technology diffusion: the ivory tower. In the ivory tower, newly developed technology did not diffuse to the market. However, this idea has been notably connected to the notion of the NIS. Etzkowitz and Leydesdorff (1995) theoretically combined the entrepreneurial university with the traditional NIS format and introduced it as the 'triple helix model', which is a model concerning the relations between three major actors namely the university, the industry, and the government. [8]

The triple helix model shares similar components to the original model of the NIS. Nevertheless, a major difference between the triple helix model and the original NIS model appears in the flow of the interaction between the components within the system. In the latter, the state acts as a broker who has a dominant role

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[8] Etzkowitz and Leysdorff introduced the model in their first paper (1995), *The Triple Helix: University Industry-Government Relations: A Laboratory for Knowledge-Based Economic Development.* However, the idea of triple helix was also initiated in Etzkowitz 1993 paper, *Enterprise from Science: The Origins of Science-Based Regional Economic Development and the Venture Capital Firm*.

including controlling, initiating and directing the communication between the system's components in order to enable newly created technology to diffuse from the R&D units to the industrial sector. On the other hand, the state no longer has a domineering role in the triple helix model. In this model, the flow of interaction in the system is not directed by the state but is rather initiated at the micro level of the system, for instance, through the merger between a R&D unit and an industrial unit in the university-led model.

More precisely, the triple helix model highlights the flow between the components in the innovation system at both the macro and the micro level (Etzkowitz and Dzisah 2008: 662). Under the triple helix model, there are three major fields in the innovation system: (1) the economic field comprised of market mechanisms, firms and consumers; (2) the science and technology field comprised of academia and R&D units and; (3) the state institutional apparatus purporting to control the first two fields (Leydesdorff and Meyer 2007: 210). According to the traditional NIS format, the economic field and the science and technology field create the innovation process, while the institutional apparatus brings about the system of production (2007: 210).

However, the traditional NIS format faces certain difficulties. Although the outcome of the innovation system is believed to be entirely evaluated through institutional parameters, such as national labour and production statistics, according to the traditional NIS format (2007: 210, 216), the triple helix model offers a different approach. The triple helix model suggests that the increasing advancement of small-scale high technology and polyvalent knowledge, as well as the Internet, brings about a network between scientists and engineers beyond the state's institutional control. These are the key factors to produce a system of production with less assistance from the state. Accordingly, the assessment of the innovation system does not rely merely on the institutional parameters but also on econometrics and sciencetometrics, such as patent statistics and number of technology publications (Etzkowitz and Dzisah 2008: 661; Leydesdorff and Meyer 2007: 210, 213, 216).

For these reasons, the structure of the triple helix model seems to be more suitable for the purposes of the research than the traditional NIS model. Moreover, it should be recalled that the traditional NIS model originally aimed at counterbalancing the neoclassical economic treatment of technological production at the macro level, not the micro level (Sharif 2006: 753-754). The triple helix model's fundamental concept remains based on the traditional NIS model at the macro level: even though it acknowledges the university-led model at a micro level, it merely focuses on the academic arena. In other words, it does not extend it to other micro areas of the system. Overall, both the traditional NIS and triple helix models do not entirely serve the purposes of this research. Consequently, it is necessary to review the next relevant model, 'the network knowledge-led model'.

3.3. The Network Knowledge-Led Model

The third model in this chapter is an alternative model examining the relationship between the state's industrial roles and technological-learning capacity. The state's industrial roles in this model is referred to as 'a network state', which is presented here as the third way, coming in between the state roles from the above two models (the market-led model and the state-led model). The network state emerged in line with a shift from Fordist technological production towards a post-Fordist one. Along the line of this shift, technological productions become increasingly to rely on knowledge that localises in a form of networks. What is more, these networks of knowledge come in unconventional characteristics that challenge the state's industrial roles from the first two models, as they (the networks) locate outside the sphere of state's industrial apparatus, for example in the form of regional networks (either bigger or smaller than a nation), or an amateur IT network.

To start the discussion of this model will be an examination of literature in relation to the notion of the network state. Generally speaking, work on the roles of the state in the development of IT industries advocates that technology or innovation policies and institutional arrangements are designed uniquely to fit the nature of technological learning and production of each technical speciality (Breschi and Malerba 2001; 831) This crucially highlights how technological production in the post-Fordist era, which increasingly rely on technical specialities in a fragmentation of production lines, shapes the network state, as they pose new industrial dimensions for the state to come up with a compatible industrial roles

Applying this account specially on the computer industry, production in the computer industry is more globalised nowadays, undermining older notions of national industrial strategies. On the one hand, the neo-liberal school offered industrial development strategies for the latecomers that relied on FDI with technology transfer and knowledge spillovers from MNCs as a source of technological change. On the other hand, the developmental state school offered industrial development strategies that relied on centralised and authoritative state institutional arrangements to implement such strategies, instead of letting market mechanisms do their job as the neo-liberals suggested, with the national innovation system as a source of technological change. However, considering that today production in the computer industry is completely globalised in both degree and kind. The industrial development strategies and technology-upgrading approaches recommended by both schools can no longer connect the state's developmentalist role with the dynamics of their domestic computer industries that have become more globalise and rely more on networks of specialised production.[9] These network of specialised productions do not demand trade liberalisation in order to gain access to an international IT market based on production plants with cheap labour as their competitive advantage. Local firms located in such networks do not compete against each other in order to be chosen by the state to be financially and technologically supported by the state and to operate their business following the state's industrial strategies. What these networks demand is trade liberalisation to position and secure them in an international IT production network (O'Riain 2004: 196), and that the developmental state connects them with the national economy through consultative rather than authoritative industrial development policies (Cooke 2001: 960-961). This embeds the state into the web of global IT networks in the post-Fordist era, and is a backdrop for the network state model.

The higher the degree of embeddedness of the state, the better the state can support the mobilisation of economic resources among players in these different networks, and thus their performances are sustained for longer (Cooke 2001: 960).[10] The question here is: what are the factors that define the degree and extent to which

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[9] However, this argument on the validity of the developmental state has gone in many different directions especially in the information economy. While a few scholars like Amyx 2004 and Jayasuriya 2005 suggest the developmental state had declined since the late 1990s (Kim 2012: 293), recent work by Kim (2012) challenges their views on the end of the developmental state in South Korea by examining the roles of the state in the technological upgrading of a wireless telecommunication technology in South Korea, the American Code Division Multiple Access (CDMA) which was later encountered by the South Korean Version of the Wireless Internet Platform for Interoperability (WIPI). Kim argues that the South Korean state still retains its developmental legitimacy especially in a long-term strategic approach to help domestic firms catch up technologically in this instance rather than leaving it to market mechanisms to do the job (2012: 293).

[10] Cooke (2001) refers specifically to these networks with geographical connection as regional networks.

the state can embed itself within these network as well as embed these networks in the economy at the national level?

Cooke (2001: 959) suggests that the state should provide these network (the regional system of innovation) with some authority over two issues: namely a regional public budget and influence over regional investment in infrastructure and skills units, such as universities and research institutes. This two-part authority will help by economically mobilising the innovation potential of the region. In order to accomplish this, the institutional arrangements of the state, which are used by nationalist states to fill the gaps in imperfect market conditions, are now required to change their bureaucratic structures from centralised ones into a form of flexible network. In other words, the state is required to fragment its unitary authority and cohesion. This new structure for the state's economic developmental institutions has been various titled. Ansell (2000) calls it a 'network polity', Carnoy and Castells (2001) call it a'network state', O'Riain (2004) calls a 'developmental network state', and Breznitz (2007) calls it a 'neo-developmental state.'

In comparison with the old model of developmental state, contemporary governmental regimes – in response to post-Fordist production – are altering local and global capitalism and regional networks of innovation instead of binding local large entrepreneurs, state bureaucrats, national innovation system and public and private domestic financiers together. The regime still retains some flexible authority over the ties between all these fragments to deter the network polity from capture and clientelism (O'Riain 2004: 37-38). What is more, such conditions lead to elementary changes in conventional state structures and the purposes of state intervention. The state intervenes in the economy not for commanding and controlling purposes but rather to construct trust, co-operate in mature learning, and adjust to local and global interests (Ansell 2000: 305; Breschi and Malerba 2001: 819-820). A similar argument is offered by Carnoy and Castells (2001: 2, 12-13), who posit that the state was challenged with multidimensional changes in the reorganization of knowledge that led to the decline of the nation state but gave rise to 'network state' with multi-level state structures, such as sub-state national government or super national government, in order for the state to gain legitimacy in new complex challenges which are posed by the progression of globalisation. These new purposes need to be applied with respect to both policy and organisation at three broad levels from participations at societal association to public agencies to the macro-structure of the state respectively (Ansell 2000: 309).

In terms of the state's bureaucratic structure, the state unit that is preserved through centralised and discrete 'hierarchical (many-to-one relationship)' command structures needs to be broken down into a decentralised and socially exchanged form. Ansell refers to these decentralised state command structures as 'heterarchical (many-to-many relationships)'communicate structures (Ansell 2000: 305 - 308). Undeniably, the border of the latter type of state structure is porous and flexible and thus is difficult to identify. However, one should not confuse the network polity with the pluralist polity or the corporatist polity. Even though both pluralist and corporatist ideas have become increasingly out of date, the network polity is a combination of some parts from both polities, as it adopts the principle of overlapping between jurisdiction between a large variety of organisations from pluralism, but using the cooperative approach of the corporatism polity to operate among them (Ansell 2000: 308).

What will happen if the state is unwilling to embed its institutions in local innovation networks? Will this diminish the state's commanding role in economic development? Ohmae (2004: 85) reveals the true outcome in such situations: the significant features that function in the regional economy will move somewhere else. Of course, the most precious feature here is nothing else but IT human resources, which will consequently emigrate, posing a brain drain problem for resistant governments. This view is confirmed by O'Riain (2004: 200, 203). Although he does not directly discuss the brain drain problem, he constantly contends that Israel and Taiwan developed their computer industries successfully based on the capacity to bring their IT-educated diasporas back home.

Despite centring his analytical accounts on the flexibility in the network bureaucracy of the Irish developmental state that fostered the success of Ireland's IT industry, O'Riain importantly suggests the reasons why developmental network states which employ particular flexible industrial development strategies are not defined by their state structure, but are rather political struggles in an historical context that deliver different degrees and kinds of flexibilities in state structure that differentiate the economic outcome of each developmental network state (2004: 205-223).

This has left a gap for Breznitz to argue that the crucial factor that underpins the variation in industrial development strategies is indeed the political process in industrial decision-making that underlay different industrial paths under the same global conditions (2007: 2). Therefore, the political process should have been an analytical foci rather than the flexible structure of the developmental network state that emerged from developmental bureaucratic state, as the neo-developmental state theory suggests. Breznitz does not deny the neo-developmental state's assertion that the state has to be flexible both in its industrial strategies and its structure to be competent in changing and implementing strategies to respond to the volatile nature of the computer industry. Nevertheless, he fully accounts for the political process as the most influential determinant of industrial development.

As the state is no longer the actor that has the most up to date information about the specific type of technology that its local technical networks of production are working on and type of support they need from the state, the developmental state in post-Fordist production has to figure out the most effective way to connect with the local networks and receive all this information before crafting an industrial development strategy. Therefore, Breznitz puts forward that the political process has enabled the Israeli, Taiwanese, and Irish states (the cases in his comparative study) to have a developmental relation with their domestic IT industries. The variation among their political process explains how the embeddedness of the state in IT industries has developed (2007: 29-30). For instance, the Irish state decided to have an embedded relationship with IT industries in a way that least affected its Weberian bureaucracy by setting up flexible structured industrial developmental agencies outside its central state structure, in order to follow the technical needs posed by the independent technological achievements of the local IT industry (2007: 32-35).

The most important message that this research gains from Breznitz's analytical accounts is that theoretical frameworks for solving the puzzle of how the state can nurture its high-tech industry in the age of economic globalisation with growing dominant of local regional innovation networks, must recognise that the choice of industrial development paths facing latecomers surpasses those which can be put into the boxes of neo-liberal, developmental state, or neo-developmental state theories. The unique sets of sectoral politics have proven their power in creating choices of industrial development paths outside of these three boxes. As Breznitz states ‘Yet I believe that choices still exist, that states and societies, through the political process of crafting and picking alternative modes of action, can follow diverse paths and still achieve industrial success.’ (2007: 3). This message from Breznitz is also confirmed by the more recent study by Kim (2010) who examined the Korean developmental state role in the development of the Korean telecommunications sector after a catch-up process. Kim argues that the classic Korean developmental state has transformed to be a developmental network state as posited by O’Riain (2004). However, his case study illustrates few differences between the Korean and Irish developmental network, which led Kim to put forward that there is no single form of developmental network state in East-Asia (2010: 160-162).

Moving on to a more specific discussion on the new model of technological production, which relies on networks of production, and is the foundation of post-Fordist conditions shaping the network state. These network productions come in many forms. For example, the regional network is connected through geographical connections - the ‘geography of production’ (Saxenian and Hsu 2001), or ‘regional innovation system’ (Cooke 2001). Another example of knowledge network, from the regional network, is IT professional network, which is connected through the type of knowledge used for IT production. The IT professional network will be the focus of technological learning for the thesis, as it provides the research a sector specific framework of IT industry.

The IT professional network is the type of network that is connected through the type of knowledge known as tacit knowledge. Tacit knowledge is considered to be a precious resource for innovative capacity that underlies the differences in technological competitiveness between the contestants in the international race. The superior feature of tacit knowledge compared with other types of knowledge is its elusiveness in being captured and converted into a form of information: it will lose its essence after being converted (Ernst and Lundvall 1997: 24-25).

Innovation theorists like Ernst and Lundvall (1997: 22-24) depict the distinctions between what should be counted as tacit knowledge and what should not. They taxonomically classify the branch of knowledge in science into four levels. The first level is ‘know-what’ knowledge, which is the most basic and least complicated type of knowledge. To obtain this level of knowledge does not require any scientific skill, as the knowledge is presented only in the form of data or facts. The second level is ‘know-why’ knowledge, which is more complicated and requires higher technical skills from the receivers than ‘know-what’ knowledge does. At this level, the receivers will need to have a basic knowledge of the laws of science to be able to know why the facts or data occur. These two levels of knowledge are tangible, thus they can be learnt from formal and direct circumstances such as teaching in a university, learning from textbooks or science publications, and staff in-house training. However, they are not tacit knowledge. The other two higher levels of knowledge are important for innovation generation, hence, are the types of knowledge on which the research focuses. They are ‘know-how’ and ‘know-who’ knowledge. The receivers obtain ‘know-how’ knowledge through modes of learning opposite to the two previous levels of knowledge (know-what and know-why). They need to practice and encounter problems and try to solve and overcome such challenges by themselves, therefore, there is no non-science skill or quick transaction to obtain this ‘know-how’ knowledge apart from leaning by doing and engineers create a set of technical problem-solving algorithms by themselves. The highest level of knowledge is ‘know-who’ knowledge, which is not only a natural science knowledge but also a network management knowledge. To ‘know-who’ means that actors in an innovation system are able to identify who else, in the same system or somewhere else, knows what and knows how. In other words, the engineers or managers have to know other actors and the type of technological speciality in which they have their expertise.

Furthermore, Jensen et al. (2007) put the four levels of knowledge in the context of two modes of learning and innovation. For Jensen et al, there are two types of knowledge: codified (know-why) and tacit knowledge (know-who and know-how) (2007: 682). These two types of knowledge are ideally used in two different modes of innovation: the Science, Technology, and Innovation (STI) mode; and a Doing, Using and Interaction (DUI) mode. Codified knowledge corresponds to the STI mode of innovation which is conducted through R&D agencies, education and training systems (2007: 681-682). Tacit knowledge corresponds to the DUI mode of innovation that is conducted through the experience of skilled workers or artisans (2007: 680, 682). Jensen et al. also argue further that the contribution to knowledge through the STI mode can be made at a global level, while the contribution to knowledge through the DUI mode is likely to be made at a local level as the latter is embedded within a person rather than a system (2007: 681-682).

Ernst and Lundvall's knowledge taxonomy together with modes of learning and innovation from Jensen et al. thus illustrates the origin of and the environment in which indigenous innovations are generated from tacit knowledge. The regional professional network lies at the heart of innovation generation and diffusion. Entrepreneurs positioned in a particular geography are able to learn new technologies and advance their innovative activities though close communication and joint problem-solving activities that are taking place within cultural proximity (Saxenian and Hsu 2001: 915). Tacit knowledge, which is a vital competitive factor to cope with volatile IT market environments, is transmitted effectively within a particular social network, where the vital intangible resources are embedded intensively (Breschi and Malerba 2001; 817-820). These resources, such as common norms and conventions, technical knowledge, skills, institutional and organisation structures; take time move across geographic distance and cultural differences. IT is a sort of technology that enables the mobilisation of tacit knowledge between these more successful areas through various IT applications, especially in the high-tech era where advanced technologies are more complicated. It thus requires co-operative production from larger units a single firm can offer.

To be even more explicit, IT is itself a technological product of so-called IT professional networks. Most computer languages nowadays are developed by IT professional communities; Java and C++ are among the languages that underscore this point. Open source software's increasing share of the market provides further collaboration for this point. Open source software is one of the outstanding phenomena of the information technology community, confirming the point that tacit knowledge cannot be granted intellectual property protection as proprietary software is, and thus cannot be traded in market transactions or by government arranged institutions (Boulanger 2005: 239). This validates the argument that the dynamics of technological development increasingly appear beyond the nation state's institutional arrangements in widespread regional or international professional networks, which lie beyond the national level.

This aspect of technological learning is not limited only to the development of computer languages, but also relates to other disciplines of computer science, such as database technology, web browsers and even operating systems, to name a few. Moreover, professional learning community networks are well connected to the learning bodies that codify knowledge which can be institutionalised, for example in a university IT degree.

This characteristic of IT learning provides greater understanding of why IT professional networks around the globe are often cited as a case study of network knowledge for technological productions. As a result of this historical technical development, local IT professionals interlock themselves with the available complicated sets of international IT technological learning. However, this interlocking does not mean that the IT community in a particular knowledge network is coming into its own or is only shaped by IT knowledge learning approach through such professional network.

The most difficult problem with works on this model seems to be that there is no fixed formula to outline how such professional networks cluster together and connect to the national economy and the broader level of state mechanisms, such as economic institutions and R&D units, in the first place. This gap has led to common wrong-headed state efforts to imitate the Silicon Valley cluster in developing countries employing a state-centric economic model, sponsoring national champion companies to build a cluster to build a bottom up industrial agglomeration through a top-down approach; for example, designing an agglomerated industrial structure, then implementing interventionist economic policy to subsidise the firms located in such industrial agglomerations to be being active in state-chosen niche markets. These Silicon Valley ‘wannabe’ nations are leading their industries in the opposite direction from the original model, as the Silicon Valley is genuinely entrepreneur-centric, with entrepreneurs rather than the state driving the dynamic of the cluster, while national institutions simply perform the flexible role of accommodating the needs of firms in the cluster (Bresnahan et al. 2001; 836), although the state played an early spinoff role through military R&D.

In terms of technology upgrading, this model emphasises innovative technological learning and upgrading capacities that are generated and transmitted at the local level between individuals within the same network or cluster and at the global level between networks from different clusters. This process occurs in two developmental stages: the starting up stage of a nascent cluster and the development of ongoing clusters.

At the emerging stage of the network, the most important role of the state is to be able to recognise the clustering of skilled labour within professionally networked areas. As mentioned earlier, there is no fixed account that explains how skilled labour emerges in the first place. From the experience of successful cases, such a pool of skilled labour comes from different sources, such as US-educated Taiwanese engineers (Saxenian and Hsu 2001: 893), cheap skilled labour with scarce UNIX skills from India (Saxenian 2001: 9), and Russian émigrés and military trained engineers in Israel (Bresnahan et al. 2001: 844). Each of these has its own identity in the global IT market. Carmel and Eisenberg (2006: 851) nicely depicted this phenomenon meaning that '[...], the USA thinks in terms of the cowboy programmer, Ireland the Celtic Tiger, and Israel the commando programmer.'

Such varied backgrounds also provide different technical accumulations of skilled labour, which leads to different paths of specialisation in production. However, one aspect that all the prototypical case studies have in common is that their specialities were a result of the flexibility of their technological upgrading approach that enabled them to respond significantly when new international market opportunities came up that had not been exploited before (Bresnahan et al. 2001:

842). This understanding of technical speciality means that work in this tradition cannot offer a fixed formula for other developing countries that are trying to promote their IT industries to adopt as a standard model regarding how a professional skilled IT labour force emerges, why it choose to specialise in a particular technology, why it chooses to stay, and how the state prevents a brain-drain of skilled IT professionals.

How did these countries develop their specialities in IT production at the nascent stage of IT professional network agglomeration? A small number of them, such as Ireland and India, constructed their specialities on the basis of market-coordinated regimes, while a few of them, such as Taiwan and Korea, built their specialities from plan-coordinated regimes. For example, Taiwan constructed its chip design speciality through a reverse engineer approach, known as an Original Equipment Manufacture (OEM) technique, under a nationalistic economic regime that dated back to the 1970s (Hobday 2000: 144-147). The OEM technique provided Taiwan with a solid basis for assembling simple computer peripherals at the beginning, and combined with Taiwan's well known reputation among international IT firms for being a cheap labour assembly point, clustered all the IT professions. However, during the 1990s, the skills and tacit knowledge accumulated throughout the OEM years have been upgraded to allow Taiwanese IT workers to specialise in 'ChipUp' Technology, in which a leading chip production company like Intel upgraded their single-chips to the dual-Pentium microprocessing system (2000: 147-158).

Once the network shifted to the next stage, the embedded units already had their technological specialties and were connected with other units in different network with knowledge of different technological specialties though the demand and supply positions of each network (Breschi and Malerba 2001; 831).

Despite the rich literature offered by the scholars that are mentioned in this model, there are still many remaining empirical accounts that need to be clarified. If their theoretical analyses take their point of departure from the rise of the latecomers who managed to move to the front row of global IT production during the 1990s, then there are many more contributions to come from the new tier of global high-tech production regions. Moreover, if high economic growth from requires flexibility in economic institutions and political structures as the theory suggests, then how does Vietnam's sclerotic political structure determine its economic outcome? This research aims to answer all of these questions. Highly agglomerated technical IT communities are new to Vietnam. They exist in a vacuum of a highly centralised and controlling state regime of a socialist market economy. With these characteristics, Vietnam's IT industrial development is sure to be able to offer a new theoretical dimension to existing notions of the role state development plays in high-technology industries.

Now we shall turn our attentions to the research analysis of research findings and tool of analysis in the next chapter.

Chapter 4

Technological Upgrade and Research Tools of Analysis

4.1 Introduction

This chapter offers an overview of answers to the research questions. The purpose of the chapter is to offer a summary of the research findings and set out how these findings answer the research questions, rather than offering in-depth research arguments, as the latter will be discussed in a more analytical manner in the chapters presenting the findings (Chapters 5-8). To recall the two research questions: the first research question is how we should characterise the nature of the technological upgrading approaches that are employed domestically in Vietnam, and how these approaches are processed within the context of Vietnam's IT industry. The second research question is how should we characterise the state's roles regarding technological upgrade in Vietnam's IT industry, and to what extent and in which way these different state roles affect the domestic technology-upgrading approaches.

By providing this introductory chapter prior to the chapters on the findings, readers can have a synopsis of research findings: the elements comprising each case study; how each case study links to the other case studies; and the proposed concept of technological hierarchy that provides basic explanations for the different roles of the Vietnamese state. In other words, this chapter offers a framework for the analysis of the research findings.

The chapter's structure is as follows: it begins with how the research defines the term 'technological upgrade' using literature on technological change (Section 4.2: Introduction to Technological Upgrade). Then the research adopts the defined notion of ‘technological upgrade’ as a framework to characterise the fieldwork findings about technology-upgrading approaches and processes occurring across Vietnam’s IT industry into four models (Section 4.3: Technology-Upgrading Approaches: Fieldwork Evidence). This section also gives a short summary of answers to the first research question.

Next, the chapter adds another dimension, the state’s roles, to the four models of technology-upgrading (Section 4.4: Characterising Vietnam’s Counter-Developmental State). The state has different roles associated with each model; however, these different roles yield different degrees of being a counter-developmental state. In this section, the answers towards the second research question are also summarised.

Lastly, the chapter proposes a hierarchy of emerging information technology (Section 4.5 of the same name). The hierarchy is a framework to link the first research question with the second research question. It is discussed here, rather than at the end of the thesis to provide a roadmap for the readers to walk through the research arguments. The hierarchy provides a rationale as to why the research questions are answered in certain ways as well as the logical flow between Chapters 5- 8, to then better focus on the research arguments.

4.2. Introduction to Technological Upgrade

The research defines ‘technological upgrading’ as any positive shift in technological productions (in the process of technological invention, innovation, and diffusion) that implies a sense of 'moving forward', both in terms of scope and scale.[11] The discussion below in this section will illustrate how this given definition is based on two concepts of technological change: Arthur's concept of technological evolutions (2009); and Jaffe, Newell, and Stavins' three-stage model of technological change (2002).

To paint a clearer theoretical explanation of how technologies change, it would be better to start off with an explanation of how technologies are created and produced without taking their economic and social value into account. This research adopts such an explanation from Arthur's *'The Nature of Technology: What It Is and How It Evolves'* (2009) as his explanation chimes with the technology-change process evident from the fieldwork findings. Arthur suggests that novelties come from the combination of existing technologies via a mechanism called 'combinatorial evolution' (2009: 18-22). He posits two major essential elements of the mechanism. The first element in the creation of technology is the novelty of technologies which derive from the combination of previous technologies. The second element tells us how certain existing technologies are picked and combined

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[11] Mainstream literatures on technological change do not offer a clear single explanation of what technological change is; however, the term is commonly used in line with another term – 'technical change'. Both terms explain a shift in technologies regardless of the direction they go in; Solow's explanation of technical change (1957) is honoured as a classic argument outlining economic productivities in technology production (Barrell, Mason and O'Mahony 2000: 8). Solow (1957: 2) notes that technical changes do not have to be a shift in the organism of technology itself. He states 'It will be seen that I am using the phrase 'technical change' as a short hand expression for *any kind of shift* in the production function. Thus slowdowns, speed-ups, improvements in the education of the labour force, and all sorts of things will appear as 'technical change' (1957: 2). The definitions of technological change and technical change provide a background of how this research defines the term 'technologcial upgrading'; however, they are not central to the discussion of technological upgrading in this research.

into the novel technologies. He notes that ‘Technologies are not thrown together randomly as a combination of existing components.’ (2009: 22). Rather, it ‘[...] is the constant capture of new natural phenomena and the harnessing of these for a particular purpose.’ (2009: 22). For a clearer picture he provides an example, ‘In the case of radar and MRI, the harnessed phenomena are the reflection of electromagnetic waves and nuclear magnetic resonance, and the purposes are the detection of aircraft and diagnostic imaging of the body’ (2009: 22). The explanations demonstrate how new technologies are produced, but not developed. For Arthur, technology development arises ‘[...] by changing these interior parts, by swapping in better ones that improve their performance.’ (2009: 24).

Arthur brings us to the central point where we can identify two characteristics of the shift in technologies: firstly, the novelty, and secondly, the improvement in technologies. However, at this point he offers us an isolated explanation of how new technologies emerge or develop in integration with social and economic circumstances, and furthers understanding of how such integrations are different between the context of advance and catching-up economies. In reality, technologies do not shift only in a forward direction, or only in ways that can be characterised as technological novelties or technological improvements. When considering changes in technologies within a social and economic context, there is evidence that technologies can shift in a backward direction, a parallel direction and even slow down to a pace where they become out of date.

To understand what constitutes technological change, an economic point of view is of assistance, as it explains the types of shifts that are involved in technological production for an economic purpose. In this regard, Heeks (1996: 195) put forward an economic classification of technological upgrading in the form of a scale of producer technological capability which Heeks adapts from the works of Narasimhan (1984), Lall (1987), and Schmitz & Hewitt (1991), for a study of India's software industry. His scale comprises of six levels of producer technological capacity: starting from the lowest level of technological selection and usage; technological adaptation without any production which includes technological localisation; a basic level of production such as copying and assembling technology; inward-looking skilled production such as technological modification, redesign and innovation for a domestic market; outward-looking skilled production which is a similar process of technological production with the inward-looking level, but for non-domestic markets; and the highest level of innovation as economic global competitiveness.

However, despite Heeks' detailed guideline to frame the concept of technological upgrade, Heeks' scale of producer technological capacity will not be adopted as a framework for this research to analyse field data on technological upgrading. As there was not sufficient data gathered from research fieldwork to comply with Heek's detailed scale, that scale cannot be used by the research. Nevertheless, his scale offers the research an insight of what could be counted as technological upgrading in the IT industry. Still, the research needs to conceptualise what it means to have a positive shift of technological upgrading in relation to economic purposes. To handle this situation, in this research the term 'technological upgrade' will be defined using an outline of the processes in which features of technologies are changed.

Jaffe, Newell, and Staving (2002: 43-44) suggest that within the large pool of economic literature on *technological change*, Josef Schumpeter (1942, cited in Jaffe, Newell, and Staving (2002)) first discussed technological change in the context of capitalism, where technological change is captured from the shifts in three different economic stages: invention, innovation and diffusion. The shifts between these three stages result in new or superior technology. Based on Schumpeter's three stages of technological change, an invention occurs when the novel scientific piece or technology is developed. After this stage, technological change will happen once this piece is commercialised, referred to as an 'innovation'. Finally, technological change in the form of diffusion occurs when an innovation is adopted by the society (2002: 43).

The importance of Schumpeter's technological change account for this research is not that it helps to characterise technological upgrades in Vietnam's IT industry. Rather, Jaffe, Newell, and Stavins argue that Schumpeter's account has influenced the study of technological change in the invention and innovation stage as being driven by economic motivations to the neglect of other factors (2000: 9). Their argument is in sync with this research's main objectives to capture the state's roles in the development of the IT industry, and more specifically technology-upgrading approaches, as both economic and non-economic considerations determine the character and degree of the state's roles in such approaches. To bridge this gap, Jaffe, Newell, and Stavins offer other approaches examining *the determinants of innovative activities* rather than just economic ones (2000: 9). They suggest that innovative activities can be derived from various factors, namely profit motivations, routine motivations, market structure and public policy (2000: 9-15). As enumerated by Jaffe, Newell, and Stavins, non-economic factors have supplied this research with a model of technological change that is driven by economic as well as social factors. There are also several important variables associated with the flow such as patent and R&D activities. However, none of these variables ensure the certain occurrence of technological change. In more detail, a great invention does not lead to an innovation; therefore, the number of patents does not ensure the innovative capacities of a particular country. In addition, the actors who invent might not be the same ones who innovate, and the actors who innovate do not have to be the same as those who invent (2002: 43). This argument coincides with Lall (2002: cited in Yusuf, 2003: 141), who suggests that the level of R&D activities in one country does not convert directly to a growth in productivity. Therefore, the factors that really determine technological upgrading capacities are not only advancements in science and technological knowledge, but other social and economic components that translate the knowledge into productivity growth.

Given that technology can shift from one particular point to another, and that shifts are associated with economic and social dynamics, we can see that mastering technological policies to cultivate a high-tech industry at emerging and mature stages are different regarding the three stages of technological change. Accordingly, the findings of this research uncover a variety in the process of technological change that challenges the conventional view of the character of technological change. Furthermore, this research argues that the impacts of government policies have a paradoxical impact upon the nature of flows of technological change in Vietnam's IT industry, as detailed in Section 4.3: Technology-Upgrading Approaches: Fieldwork Evidence.

4.3. Technology-Upgrading Approaches: Fieldwork Evidence

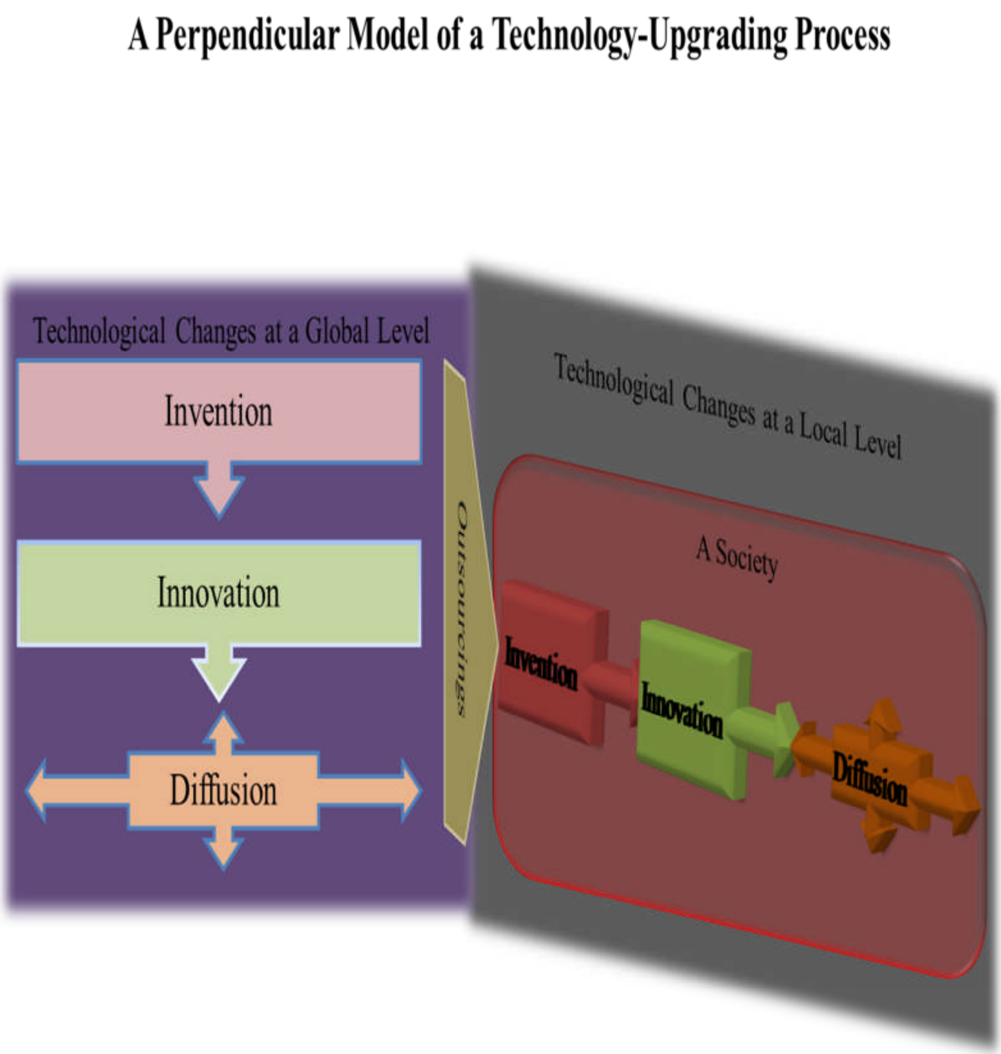
The technology-learning approaches discovered during the research fieldwork, that served as a foundation for firms learning to change their productions both technically and technologically, were close to the conventional methods reviewed in Chapter 3: Literature Review. They yield either some hybrid of the three conventional models or contribute new approaches to the network knowledge model. The research findings can be best seen as a coherent final technology-upgrading approach, when they are understood as multiple pieces of a puzzle of technological change, technical change, and their attached socio-technological interpretations, with strong traces of how they were involved politically with the state. As will be examined in greater detail in the analytical chapters on the fieldwork (Chapters 5-8), the types of technology-upgrading approaches that are available in Vietnam's domestic IT industry have never been acknowledged before in relation to defining the state's high-tech developmental characteristics in association with each approach.

The directions of the discovered domestic technology-upgrading approaches are outlined first to provide some technical background about the diversity in how Vietnam's domestic IT producers upgrade their technological capacities. Next, the roles of the state will be added into the discussions in the following sections of the chapter. Subsequently, the interplay between the Vietnamese high-tech developmental state's defining characteristics and the domestic technology-upgrading approaches is analysed: the most complex area of research findings.

Technological upgrading can occur at many levels from the smallest unit of each individual to firm, cluster, industry and up to the national level. Apart from the variety of scale, the scope of what should be counted as technological upgrading also comes in a wide array of formats. Generally speaking, technological upgrading is perceived as occurring when firms, individuals, or any other collective agencies improve their technological and technical capacities through a technological change process. For the technological change process, this research employs the three stages of Schumpeter as broadly interpreted by Jaffe, Newell, and Stavins (2002). This is to be done in a flexible manner because, while the research needs a framework of how to measure technological changes, the after-effects of technological change are not limited to only those which Schumpeter suggested. According to Schumpeter, technological changes will produce either new or superior technology to that already on the market (2002: 43). However, a look at the fieldwork evidence suggests that the outcomes of technology-upgrade in Vietnam's IT industry are not limited just to new or superior technologies on the market, but also to achieving saturation in a new type of economy (the virtual economy) within the ecology of the original market (the digital content industry). Furthermore, even though the outcomes of technological upgrading are in the form of inventions or innovations, these do not mean that such inventions or innovations are limited to occurring in a form of technological change from an invention and an innovation[12] stage as defined by Schumpeter. The fieldwork findings show that inventions and innovations can occur at any stage of technological change. This point will be examined in Figure 4.1.-Figure 4.4, which illustrate the four models of Vietnam's domestic technology-upgrading processes evident during the research fieldwork. Each model represents a different direction in which technology-upgrading proceeds vis-à-vis different types of technology. This is done in the context of Schumpeter's three stages of technological change.

12 Let alone the incongruent innovation classification, which can be categorised by many approaches, including by using levels of change and beneficial effects of innovation such as Gobeli and Brown (1988, cited in Huizenga 2004: 15) who put forward four innovation classifications: application (high level with low benefits); radical (high level with high benefits); incremental (low level with low benefits); and technological (low level with high benefits).

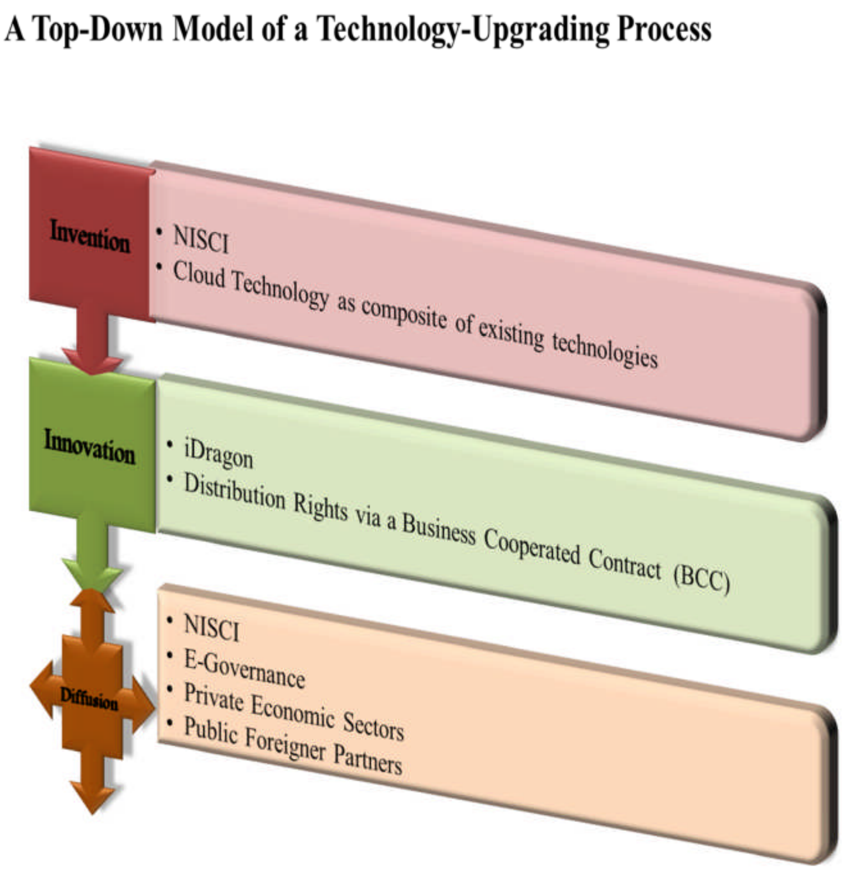
Figure 4.1 A Perpendicular Model of Technology-Upgrading Process



Source: Author's Compilation from Fieldwork Findings

To start with Figure 4.1 which illustrates the perpendicular model illustrates a technology-upgrading approach in the process of a global value chain. At the infant stage of Vietnam's domestic IT-industrial development, Vietnam secured its position in a global IT market as a low-wage labour site both regarding weight (hardware manufacturing) and weight-less (software outsourcing and testing) economies. As foreign companies began to move or 'outsource' activities in their global production chain to Vietnam, the Vietnamese outsourcing sector contributed to the prosperity of Vietnam's IT industry in general. Technological upgrading from the outsourcing industry occurred when Vietnam's outsourcing firms accumulated enough technological capacity through years of outsourced activities to create technological change outside of the outsourcing industry.

Figure 4.2 A Top-Up Model of Technology-Upgrading Process

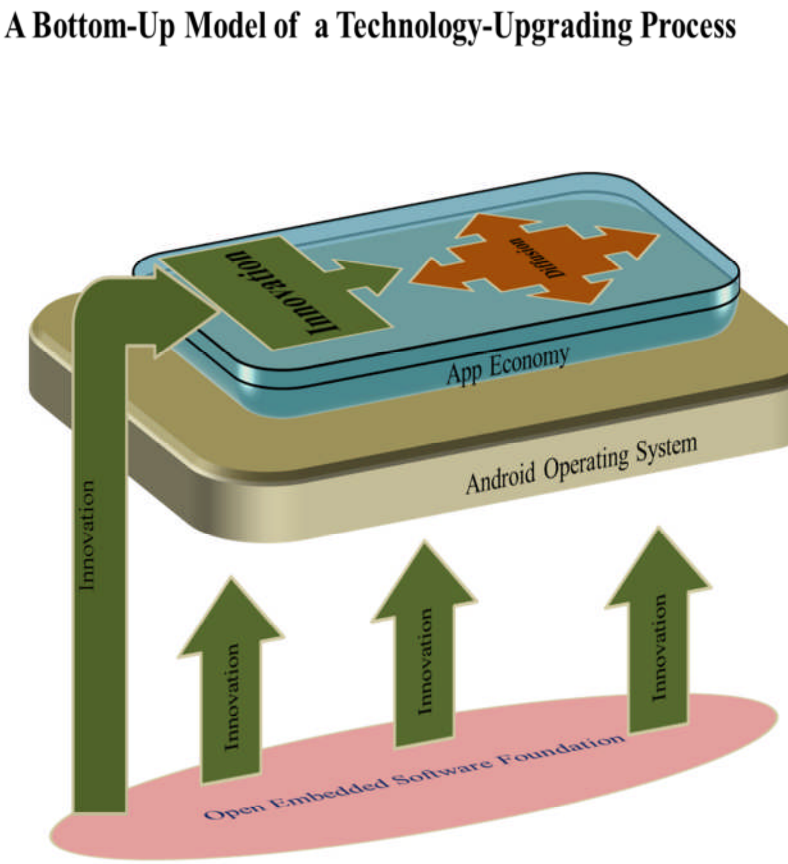


Source: Author's Compilation from Fieldwork Findings

Figure 4.2 illustrates the top-down direction showing the technology-upgrading approach of the National Institute of Software and Digital Content Industry (NISCI) is broken down into Schumpeter's three stages. Cloud Computing is the technology demonstrating the upgrading process. NISCI, a national-level government industrial R&D body, utilises the state's facilities to upgrade technology at the sectoral level and triggers technological change at the invention stage by attempting to invent local utility features of Cloud Computing to fit domestic requirements in Vietnam. However, the invention stage is not completed until the innovation and diffusion stages are implemented. The innovation stage is carried out by the iDragon Project, in which NISCI and public Japanese partners cooperate via a Business Cooperation Contract (BCC). The BCC splits the ownership of technological changes generated by this stage geographically between NISCI and its public Japanese partners. The innovations in this are to be diffused into the society though various channels such as adoption by other projects in NISCI, e-governance, private industry, other public sector bodies, and the BCC's partnership.

The diffusion stage occurs at the same time as the completion of the invention stage. Given that Cloud Computing is a composite of several existing technologies to achieve a highly user-oriented utility – such as being tailored to users' requirements – the adoption of the Cloud is cyclically linked to invention via the expansion of Cloud Computing's utilities.

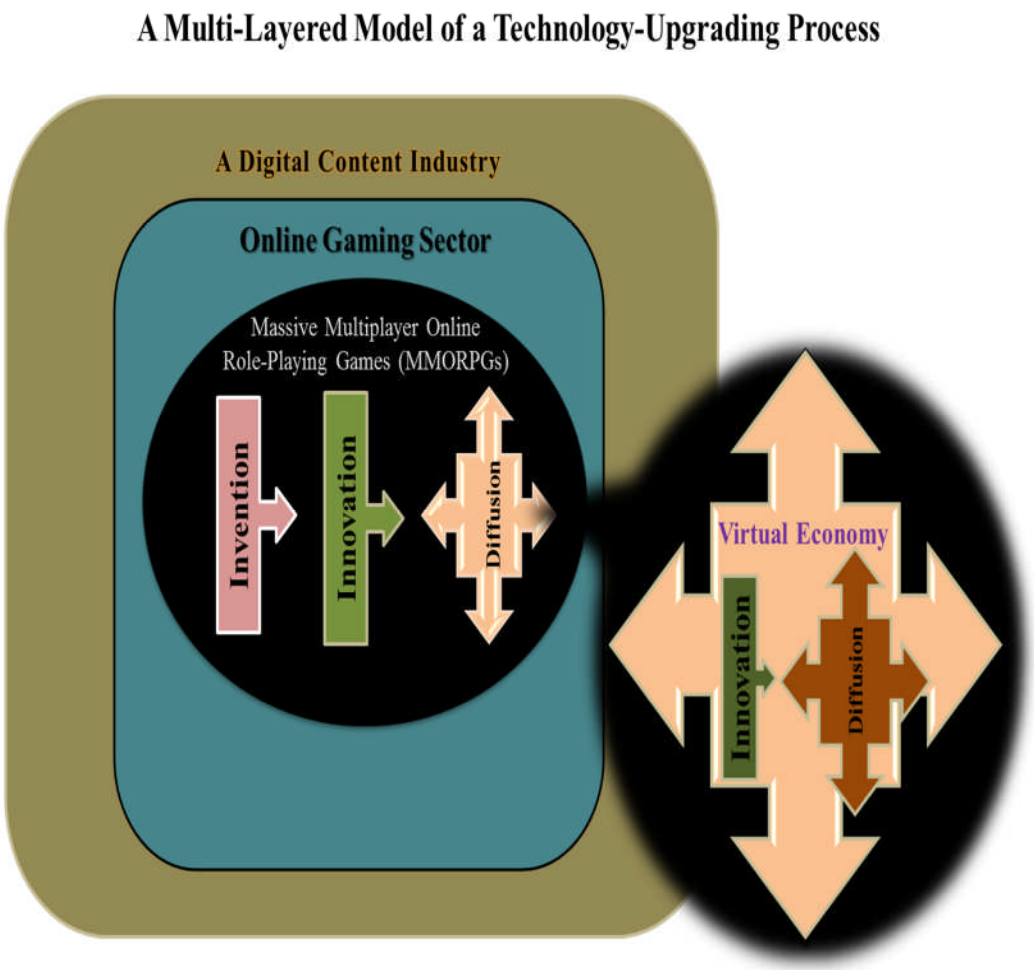
Figure 4.3 A Bottom-Up Model of Technology-Upgrading Process



Source: Author’s Compilation from Fieldwork Findings

Figure 4.3 illustrates the bottom-up model of technology-upgrading approach in Chapter 7: The App Economy and the Irrelevant State. This model provides a more complicated picture of the technology-upgrading approach that emphasises the informal setting of the technical network which also acts as a linkage between global and local technological changes. The complications in this model arise from the fact that an inventive and an innovative stage are embedded outside the national setting, while the diffusional stage occurs within and outside the national setting. Accordingly, technological change in this model depends on both global and national factors, due to the global context outside Vietnam’s national setting. The case study used for this model is an outsourcing company that turned into an innovator, ISB Vietnam Corporation (IVC), who obtain knowledge for its technological upgrading from an online technological knowledge sharing community (an Open-Embedded Software Foundation). The results of its R&D activities were diffused both to the domestic telecoms market, and contributed back to the online technological knowledge sharing communities where the companies first obtained the knowledge necessary for its technological upgrading.

Figure 4.4 A Multi-Layerd Model of Technology-Upgrading Process



Source: Author’s Compilation from Fieldwork Findings

Figure 4.4 illustrates the multi-layered model, presenting an emerging technology upgrading approach from the case of an online game and its Virtual economy in Chapter 8: Online Game, Virtual Economy, the Counter-Developmental State and Forward Trends. The multi-layered characteristic of this model derives from the diffusion stage of a virtual economy (which is a result of technological upgrade in this model), lying within with the digital content sector. This diffusion stage acts as an environment for a new form of economy, in this case a virtual economy within the digital content sub-sector, which is home to a new technology-change process. The complication in this model arises not only from the development of technology itself, but also from the emergence of a new, inevitable virtual economy from the digital scarcities that are created during the social consumption of the digital content by gold farmers.

These four models of technology-upgrading approaches can result in either higher value products or services in the IT industry, or its expansion into another type of economy that relies heavily on the existence and activation of the original IT economy. No matter what form the outcomes take, they determine the ability of the country to catch up.

These four models of technology-upgrading approaches are employed to help answer the first research question in this thesis. Furthermore, the models will be linked to another important element, the Vietnamese state, to answer question two: how to characterise the Vietnamese state's roles in technological upgrade within the IT industry. Table 4.1 presents the different levels of the state's embeddedness within and between each model by using two factors driving technological upgrade: 'technological advancement drivers' and 'political drivers'. Table 4.1 provides a brief introduction to how the state fits in with all the variables involved in the technology-upgrading approach, before the characteristics of the Vietnamese counter-developmental state are discussed further.

4.4 Characterising Vietnam's Counter-Developmental State

The research defines the counter-developmental state the state that allows non-technological factors to undermine its technological drivers in the development of a domestic IT industry, even though such factors would jeopardise the advancement of Vietnam's IT industry. This section outlines the different degrees in which such technological and non-technological factors interplay with each other, which also reflects different degree of the Vietnamese counter-developmental state as are presented in Table 4.1.

Table 4.1 The Matrixes of the Interplay between Vietnam's Counter-Developmental State and Technology-Upgrading Approaches

Technological Advancement Driven	**Political Drivers**	
	Low Level State Involvement	**High Level State Involvement**
High Level Technological Drivers	Perpendicular Model (Co-Operative state and an outsourcing business)	Top-Down Model (the Technocratic State Cloud Computing)
Low level Technological Drivers	Bottom-Up Model (the Irrelevant State and an App economy)	Multi-Layered Model (the Counter-Developmental State and online games)

Source: Author's own compilation (as will be explained in Chapters 5-8)

Table 4.1 presents a matrix demonstrating the level of technologically driven change and state involvement in the four models of Vietnam's domestic technological upgrading approaches. The matrix displays how the characteristics of the Vietnamese counter-developmental state are embodied in several characteristics to differing degrees.

All of the four technology-upgrading approaches comprise an engine that is empowered and constrained mainly by two driving forces: the evolutionary traits of information technology as a technological force and the Vietnamese counter-developmental state's characteristics as a political force. The two forces integrate with each other to act as a mechanism that then shapes the domestic IT industrial structure, as well as creates a certain environment where technology-upgrading opportunities occur. The variation of technological and political drivers conditions the opportunities that underpin the specific path of technology choices, likely progress with different technology-upgrading approaches, technological outcomes and their social, political and economic implications.

Within this mechanism, the roles of the state in IT industrial development change tremendously according to the state's socio-technological perception or cognition of the four case studies' technologies. The research elucidates four characteristics of the Vietnamese state's response to the contemporary setting of IT advancement: the cooperative state, the irrelevant state, the technocratic state, and the counter-developmental state. All the four characteristics echo differing degrees of the counter-developmental state. These four state characteristics are introduced below in short outlines of the four case studies. Chapters 5 to 8 each presents an in-depth analysis of each case study relating it to the research arguments.

Case Study 1: Outsourcing Businesses and the Cooperative State

The defining characteristic of Vietnam state developmentalism, according to the perpendicular model of the technology-upgrading process involving the outsourcing sector, is that of a cooperative state. The cooperative state occurs when the Vietnamese state allows non-political actors, in this case a local IT entrepreneurial class and overseas Vietnamese citizens with IT occupations, to influence IT industrial policy advice, both in drafting and implementing the processes.

Tracing back the history of outsourcing in Vietnam sheds some light on how the cooperative state was formed at a stage when Vietnam's IT industry was still at the infant stage. Initially, Vietnam's IT policy was heavily state oriented and had little success. Nevertheless, amidst the failure of the first IT policy a prominent outsourcing trend emerged, similar to India's well-known outsourcing business. An IT entrepreneurial class arose comprising Vietnamese living overseas and working in the IT sector, and those who had worked previously for the state's science and technology divisions. Together these factors shaped the cooperative state in the domestic outsourcing business. Logically, the state responded to the failure of the first IT policy by cooperating with the contemporary entrepreneurial class in IT to make the second IT policy more industry oriented than the first one. The lack of domestic demand for IT entrepreneurs' products and services also led these entrepreneurs to seek work outsourced from abroad. As a result of this dynamic, the cooperative state is linked to not the domestic IT industry in general, but is heavily focussed on the domestic outsourcing business. This backdrop explains why Vietnam's outsourcing industry has overshadowed other sectors of its domestic IT industry, especially at the infant stage.

The cooperative state in the perpendicular model of the technology-upgrading process fertilises the outsourcing business in a cooperative manner by providing enough facilities for the firms in this sector to accumulate sufficient knowledge and skills to move their technological production higher up the value chain. Generally speaking, even though outsourcing firms are hardly likely to specialise in the development of certain technologies through research and development, they have somehow accumulated the knowledge and skills necessary for technological upgrading in two areas: software implementation and global business practices. These two sets of knowledge and skills are essential when it comes to technological upgrade, as they enable outsourcing firms to move out of outsourcing and apply these sets of knowledge and skills to R&D activities that relate to software production. The two software outsourcing companies in the case study illustrate the relations between the cooperative state and the perpendicular technology-upgrading model.

These two firms, FPT and TMAs, represent two influential groups of Vietnam's entrepreneurial class which have participated in the formulation of the cooperative state. FPT is a local entrepreneurial firm and state spin-off, while TMAs is an entrepreneurial IT firm founded by Vietnamese overseas (TMAs). Despite their different origins, both of these firms share a common approach to technological upgrading. After years of cooperating with the state and building their success in the outsourcing business, the two firms are now ready to apply the knowledge accumulated through this business to non-software sectors and to enter R&D activities, such as innovating software to solve flooding problems. Even though their technological upgrading no longer depends on their outsourcing business, the state continues to cooperate with them based on connections established earlier due to their outsourcing business.

Case Study 2: The Cloud, the iDragon, and the Technocratic State

The reaction of the Vietnamese state towards the world-wide adoption of Cloud technology is analysed here in terms of an insecure state facing information security issues. State insecurity is one of the initial motivations for the state to upgrade its technological capacities by establishing an industrial research and development institute, NISCI. NISCI is home to its Cloud project, iDragon. The state directly implemented iDragon, demonstrating the technocratic characteristic of the Vietnamese state.

In terms of the technology-upgrading approach, the case of iDragon represents the most straightforward approach the Vietnamese state executed at the national and cross-national level, as the required knowledge for innovating, the Cloud platform, was acquired from Japan. The role of the state in this type of technological change process is a leading technocratic role. The state chooses a particular technology to invest in for the country's R&D activities based on both its economic and social purposes. It finds technological partners to consult with at the technology selection stage and the innovation and diffusion stages. Finally it creates a domestic market for diffusing the technology into the public sector such as through the Vietnam Post and Telecommunications Corporation (VNPT) or the Ministry of Natural Resource and Environment (MONRE).

Case Study 3: The App Economy and the Irrelevant State

As mobile phone technologies have advanced into smart phone technologies, a related technology, mobile applications (or the 'App' for short), has bloomed simultaneously. The technological trend of the 'App' is being cultivated in Vietnam, where a huge and growing domestic telecommunications market has developed with a high rate of mobile phone subscriptions. App producers benefit as the nature of App production requires types of knowledge and skills that are mostly available outside formal institutions at a minimal cost.

Evolution in IT advancement does not always require wholesale engineering and big scale manufacturing. On the contrary, the fieldwork found a case study firm, ISB Vietnam Cooperation (IVC) that has transitioned from being a software outsourcing firm to being an innovator conducting R&D activities in the App economy, by acquiring knowledge from an informal and sharing knowledge-based online community. The community enables the development of non-proprietary software from non-privatised knowledge and IT skills. IVC decided to learn how to innovate from a non-proprietary software online community as its main approach to upgrade its technological production due mainly to the company's resource constraints, although there were additional reasons.

IVC is based entirely on foreign investment from Japan. It has been in Vietnam since December 2003. The company's Japanese mother is ISB Japan, who outsources software development and system integration tasks to IVC's IT engineers. The company was originally established for the main purpose of being an offshore hub implementing IT work for the Japanese parent company. Since there has been no incentive for ISB Japan to divert resources from outsourcing to R&D, especially since the global economic downturn, IVC decided on the 'R&D with no investment' option. Under this option, the company acquires new knowledge for its own R&D activities from open-source mobile platform knowledge of Android. Among IVC's approximately 121 local employees, only two, who are Android developers, work in the R&D department. They have been learning new knowledge from and exchanging solutions with other Android developers from all over the world via an Open Embedded Software Foundation (OESF). IVC is now launching an application called an ‘Android Printing Framework’, which claims to be a very innovative Android printing solution with its own algorithms.

This sharing of knowledge and skills is a crucial element that currently drives advancement in the development of IT as a technology in itself and its related economies. Moreover other research arguments about high-technology industrial policies have missed out these key elements in the evolution of information technology. In this case, government policies, which aim to promote the upgrading of the technological capacities of domestic IT firms, have no direct influence upon domestic firms’ acquisition of novel and superior IT knowledge and skill from the international network community. In this regard, the role of the state in industrial development is irrelevant: the counter-developmental state has no weight in firms' technological upgrading processes. The state is behind the curve of development because it does not understand the full potential of non-proprietary software beyond its being a cost-saving alternative to proprietary software.

Case Study 4: Online Games, Viet Gold Farmers, and the Counter-Developmental State

The characteristics of the Vietnamese high-tech developmental state in the leisure-related sector of the domestic IT industry are captured by the term ‘counter-developmental state, as in the case studies here of online games and gold farming activities. Although the state expresses a desire to empower the development of a domestic IT industry, it suppresses certain emerging economic activities in this industry, such as online games and gold farming, because it associates them with conceptions of ‘social evils’. The Vietnamese state in this case has a counter-developmental role, as it has questioned the ethics of certain emerging economic activities. This questioning has not only had negative effects on the development of such activities, but also prevented the state from optimising any related economic benefits. Technology-upgrading in this case in the digital economy has occurred in a multi-layered manner, in which the consumption of certain digital content when the gamers play online games has produced a new type of economy, the virtual economy. This new virtual economy resides within online games and thus depends on its existence to be productive.

In Vietnam especially, online games is booming as a high potential hi-tech economic activity. The case study of a local online game distributor (VNG) is investigated in Chapter 8: Online Gaming, the Virtual Economy, the Counter-Developmental State, and Forward Trend, to illustrate how online games has benefitted Vietnam's IT industry. However, Vietnam's online games hve been criticised as a 'social evil' and blamed for negative effects on young gamers. The sector has been subject to several state restrictions, such as limiting playing time. Technological upgrading in online games occurs when gamers adapt the game to overcome the game's scarcities that come in several forms, such as challenges to be overcome, passing though the game's levels, or obtaining certain virtual in-game items.

Gamers sell such achievements as virtual commodities to other gamers who are willing to pay rather than play. This type of activity is called gold farming, where the gamers play the game to trade their in-game achievements to other gamers. In the broader picture, gold farming is part of a new type of economy referred to as the virtual economy, the economy whose products are based on digital scarcities. Furthermore, the gold farming business places Vietnam in a global production chain of such businesses: it has been reported that Vietnam and China are key suppliers in this gold farming business.

A multi-layered technology-upgrading approach, as in the case of online games and gold farming, is a complex phenomenon; however, it affirms the extent to which IT as a technology itself has evolved to the point where the division of labour between producers and consumers on the one hand, and work and leisure on the other hand, is blurred.

Since the Vietnamese state views most of the economic activities related to the virtual economy as socially unacceptable and much of the Vietnamese public sees online games as a social evil, state policies that support the development of digital content try to suppress and control online games activities rather than nurturing them. Moreover, suppressive policies towards online games activities affect not only the development of the digital content industry (online games), but also the survival of the virtual economy (gold farming). This is truly the case of a counter-developmental state, where the state allows non-technological factors to guide the state's economic decisions in the online games sector.

4.5. The Hierarchy of Emerging Information Technologies

In this section, the research proposes a hierarchy of emerging information technologies as a tool of analysis to be used in Chapters 5-8. The four case studies derived from the fieldwork findings have prompted the question of why certain types of information technological advancement receive different treatment from society in terms of their perceived value, economic advantages, and political implications. The thesis puts forward possible answers to this question based on the perspective of the technological consumer. These answers were developed from fieldwork in Vietnam; nonetheless, they are also relevant in other global contexts. One explanation is that when society becomes aware of particular features in the context of information technology, it constantly assigns non-technological meanings to such features. This assignment of meaning gradually creates a collective system that places these technological features into different levels of social values, creating what is referred to here as a hierarchy of emerging information technologies.

The social consumption of such features of information technology products redefines their social value as technologies. These redefined values are not based on their real technological merits, but rather on their perceived social merits, in which the technological values, functions, and meanings, collectively are referred to here as the perception of IT, are socially delineated based on what society values or believes to be true, normal, or factual. Such perceptions do not represent the actual technological reality of IT advancement. Instead, understandings of emergent information technologies constantly privilege some technologies while 'othering' different ones. This behaviour eventually leads to the gradual formation of a hierarchy of emerging information technologies. This hierarchy has a tremendous impact on economic development in information technologies, especially as it underpins the interplay between politics and IT industrial development, as the fieldwork's findings suggest.

The notion of 'othering' is a foundation upon which the hierarchy of emerging information technologies has been developed. 'Othering' posits that how we understand other societies is defined by a subconscious hierarchy of people, rather than being purely defined by sets of scientific facts. This concept was made famous in Edward Said's *Orientalism*, where he discussed how the West's view of the East was greatly shaped and tarnished by this subconscious hierarchy (Said:

1978). Michel Foucault (1980: 131-132), upon whose ideas Said built *Orientalism*, explains this point:

> ‘In societies like ours, the ‘political economy’ of truth is characterised by five important traits. ‘Truth’ is centred on the form of scientific discourse and the institutions which produce it; it is subject to constant economic and political incitement […] ; [‘truth’] is produced and transmitted under the control, dominant if not exclusive, of a few great political and economic apparatuses (university, army, writing, media)’.

Adopting a Foucaultian perspective, this thesis outlines how certain types of emerging information technologies are privileged or are made to be less than what they are though social mechanisms. However, the thesis moves beyond the ‘othering’ doctrine to elaborate a more technologically specific notion of ‘bricolage’, the discourse of institutionalised human ideas that are used for technological innovations. The idea of bricolage in relation to knowledge was famously laid out in the key work of Lévi-Strauss, *The Savage Mind* (1966), which offers ways to categorise human thoughts related to science and technology. Lévi-Strauss suggests how knowledge is acquired through two groups of people: the engineer group and the bricolage group. The engineer group contains thinkers who generate novel thoughts at different levels and do not reuse existing thoughts for achieving other purposes. This mode of thought is referred to as scientific thought (1966: 10-13)), while the bricolage group is comprised of bricoleurs, people who take existing thoughts or ideas to create knowledge for different purposes. Lévi-Strauss refers to this mode of thinking as mythical thinking (1966: 16-17).

Ciborra (2009) takes the concept of bricolage applied specifically to the case of information technology. Ciborra advocates bricolage as a radical source of innovation in strategic information system, as it emerges at the grass-root of an organisation close to end users, and in an organisational reality where skills are constantly experimented with and perfected (2009: 208, 217).

The importance of the distinctions between these two groups is that they underline the modes and tools that are used to process human thoughts into knowledge. This aids the thesis's formulation of the proposed hierarchy of emerging information technologies as it appears that the less institutionalised elements of information technological production (beyond but broadly surrounding the mode of bricolage) are 'othered' by society to be a peripheral class in the hierarchy of information technology, while the more institutionalised and formalised elements of information technological production are privileged by society as the core class of the hierarchy.

Based on the concept of 'othering' and 'bricolage', the thesis develops a hierarchy of emerging information technologies, whereby the elements of information technology are classified broadly into two groups: core and peripheral artefacts, as are presented in Table 4.2.[13]

[13] The term 'artefact' is employed in this section (a discussion on the hierarchy of emerging information technologies) instead of using the term 'technology' to reflect the outcomes of reciprocal interactions between a social-shaping and a techno-shaping of technologies in an IT evolutional process. Using the term 'artefact' also covers both products and by-products of such processes better than the term 'technology'.

Table 4.2 Comparative Perspective of Core and Peripheral Artefacts

ARTEFACTS' ATTRIBUTES		CORE ARTEFACTS	PERIPHERAL ARTEFACTS
1. Human Resource	**Human Resources**	Employee-Centric	People-Centric
	Innovation Model	Open and/or Mass but not Ubiquitous	Open and/or Mass but Ubiquitous
2. Societal Linkages	**Distribution and Monetisation**	Embedded Within an Official Framework of NIS	Embedded Outside an Official Framework of NIS
	Economic Competitiveness	Appearing to Public in a Straightforward Manner	Appearing to Public in a Non- Straightforward Manner
	Lack of Visibility	Mainstream Government Awareness (step by step, gradually)	Outside Mainstream Government Awareness
3. Private-Owned and Public-Owned Knowledge	**IPRs Protocol**	Applicable	Inapplicable
	Resource Scarcity	Imposed Scarcity	Artificial Scarcity from Imposed Scarcity
	Consumer Relations	Black Box (customer cannot modify)	White Box (customer can modify)
4. Formal and Informal Economic Setting	**Process of Improvement**	From Non-Technological Hype to Technological Reality	From Technical Hype to Technical Reality
	Informational Flow	Original Digital Content's Creator, and the Creator of Related Service	Navigator of Already Created Content
	Capital Accumulation	Strong Dependency on Capital	Weak Dependency on Capital

Source: Author's Compilation

In Table 4.2, there are eleven attributes that distinguish core from peripheral artefacts into four main categories.[14] The term 'artefact' is brought into play here rather than the term 'technology' because I want to distinguish between technology as a socially shaped outcome, and an artefact as a piece of artificial intelligence that is initially produced in a technological and science environment. Furthermore, the proposed hierarchy of emerging information technologies is the thesis' ultimate attempt to capture the contemporary traits of the ongoing progression of IT in the post-industrial economy.

The relations between the proposed hierarchy of emerging information technologies with the matrix of the interplay between the different degree of Vietnam's counter-developmental state and technology-upgrading approaches, as presented in Table 4.1, is outlined here to provide a connection of how different concepts in this research relate to each other. To begin with, the perpendicular technological upgrade model of the out-sourcing sector with the cooperative role of the state, is dominated by the core artefacts of IT. The top-down technological upgrade model of the Cloud sector with the technocratic role of the state, is also dominated by the core artefacts of IT. However, the bottom-up technological upgrade model of Android's application sector with the irrelevant role of the state, is dominated by the peripheral artefacts of IT. Lastly, the multi-layered technological upgrade model of the online games sector with the counter-developmental role of the state, is dominated by the peripheral artefacts of IT.

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[14] These are ideal types. There is no suggestion that the artefacts must have all the proposed features to qualify as either a core or peripheral artefact. As technologies mature at a fast pace and can be incremented from one to another, a certain technology might be referred as a peripheral technology if it ticks only one of these eleven features at a certain point of time and later on might gradually transform to meet the criteria for being a core technology. This makes it hard to find technologies that stay as either core or peripheral.

It is obvious that there are certain relations between the hierarchy of emerging information technologies (as presented in Table 4.2) with different degrees of the Vietnamese state's counter-developmentalism. The Vietnamese state poses more economic supportive and active roles on IT sectors that are dominated by the core artefacts, while in the sectors that are dominated by peripheral artefacts, the state poses more negative and less active roles. Here, I employ the Culture Political Economy approach (CPE) to explain my claim on the relations between the hierarchy of emerging information technologies and the different Vietnamese state's roles in post-Fordist production.

Theoretically, CPE is an approach concerning the cultural aspects of how semiotics (such as signs that appear in a form of visual symbols, texts, data, and the contexts where they are represented as well as who representing them) constantly reorganize the existing of political economic materiality (Jessop 2006). The CPE approach refuses to accept the existence of economic components and knowledge as naturally shaped, as they are relentlessly reproduced by social relations (2006: 160). The CPE approach recognises how social materiality(-ties) interact with each other through semiotics and reproduce meaning in the economic components. The emergence of a knowledge based economy is an economic order that was socially constructed through different scale components of post-Fordist activities via a chaotic web of representative terms and their related regimes such as smart machine, lifelong learning, e-government and cyberpolitics (2006: 168-169). Another example to understand the CPE approach in the post-Fordist economy is by Sum (2009), who employed the CPE approach to illustrate how the discourse of economic 'competitiveness' was continuously reproduced or reinvented after the economic crisis in East Asia through the everyday practices of a knowledge apparatus, such as benchmarking reports, indicts, and charge.

Nonetheless, the CPE approach was brought into this research to act as a theoretical back-up, for the research's recognition of the four state's role with the hierarchy of IT artefacts. We shall now turn our attention to see how the relations between these two orders can be explained by the CPE approach.

The ten artefacts, as posited in Table 4.2, are semiotics in a different form of information technology. However, the social approach means these ten artefacts are not interpreted by the Vietnamese state according to their objective materiality but are assigned new meaning through different social relations (each artefact will be outlined along with these different social relations in the rest of this section). As the result of this process, the meaning of these ten artefacts were given in terms of an economic order characterised as core and peripheral, which determine different state industrial roles in Vietnam's IT industry.

In the next four chapters (Chapters 5-8) four case studies representing four variations of state-industrial relations regarding the technological upgrading of core and peripheral artefacts are discussed. The analyses from these four chapters will further illustrate the point from the table above that the state's role in the technological upgrading process differs between core and peripheral artefacts; however, first the other elements of the hierarchy will be discussed.

4.5.1 Human Resources

Human Resource Model

The core artefacts are developed mainly through an employment contract. This does not however suggest that the numbers of employed developers exceeds that of volunteer developers. Nonetheless, human resources in this case refers to the source of knowledge and information that is taken as the main input into the developmental process of particular technologies. In other words, it is the source of knowledge from human participation that counts, not the humans themselves.

The core artefacts are employee-centric. The knowledge that is embedded within each employee is vital to the success of project development. Employees may learn something from an open source community, but the real potential of the project relies mainly on the knowledge processed though the project's employees, who will have received formal training from their employers.

While the core artefacts use the employee-centric human-resource model, the peripheral artefacts imply a people-centric model. People-centric means that the knowledge input for a particular project comes from non-project employees. In this case, the projects' employees take the knowledge necessary for implementing an artefact into the project with some degree of its original features intact and coordinate or adjust them to fit into the project's technological requirements. I use the term 'people' here to emphasise that individuals who contribute to knowledge by making their contributions available though many channels on the Internet, such as an open-source community or an online technological problem shooting site, are not necessarily engineers. This activity could be just a hobby for them to learn and advance their computing skills via these channels. Many technologies that are classified as peripheral artefacts are heavily people-centric, as they are not dependent on formal training. Technologies analysed in Chapters 5-8 are an example in this regard.

Innovation Model

Information technology is naturally a highly networked technology itself. This has posed some difficulties in making distinctions between open, mass, and ubiquitous innovation models, as all of them are subject to differences in the degree of networking. These degrees of networking take place in particular aspects of the social structure of knowledge or information accumulation for innovation.

An open innovation model is subject to the social structure of information accumulation for innovations based upon the process of consumer feedback. Additionally, this accumulation is limited only in the form of information but not knowledge. The type of innovation within this model is likely not to be limited to incremental innovation, where the innovations' features are user-oriented and created from the users' feedback itself.

In terms of the mass innovation model, the degree of networking is greater than in the open model, as it is subject to the social structure of information accumulation at many stages of the innovation process, rather than just from the customers' feedback, as is the case in the open innovation model. Furthermore, information accumulation within this mass model is perceived both in the form of information and knowledge; nevertheless, this knowledge input is not taken directly as technological knowledge, but rather as technical knowledge for innovation management.

In contrast, the ubiquitous innovation model has a greater degree of a dependence on social structure than the previous two models, as this innovation process is subject mostly to both technological and technical knowledge acquired from a social structural network. The project's team members are likely to be connectors or compilers rather than conveyors. The knowledge accumulation in this regard is taking technological knowledge from its original source and putting it together with other technological knowledge to create a final product, unlike in the mass innovation model, where knowledge is taken as technical knowledge.

To sum up, the ubiquitous innovation model emphasises more exposure to information and knowledge outside firms as a main source of innovation, in comparison to the open and mass innovation models. As such, innovations that are generated by the open and mass models are seen as the core artefacts in the hierarchy. Innovations that result from the ubiquitous model are classified as peripheral artefacts.

The case of innovations based on knowledge obtained from an online open-source software community, the analysis of IVC in Chapter 7: The App Economy and the Irrelevant State provides an example of how innovation with the ubiquitous model is reflected by the irrelevant state being peripheral.

4.5.2 Societal Linkages

Distribution and Monetisation

Not all ideas in the digital world have been implemented in a piece of technology, such as a software product, and not all of the implemented technologies are distributed and monetised widely in the market. There are many stages to go through before a piece of technology is realised through the market mechanism. Additionally, there are certain types of artefacts that are distributed and monetised informally within a formal setting among a very specific group of users. Artefacts with these characteristics are viewed here as peripheral artefacts.

An explanation offered here as to why the peripheral artefacts are distributed and monetised informally is that they are developed in response to needs arising from the use of core artefacts that have already been formally distributed and monetised. The original distributor might not provide these functions or services when releasing their distributed artefact, thus leaving a gap and opportunity for the peripheral artefacts to thrive. Furthermore, it can also be the case that the core distributor provides these functions and services but that they still do not fit well with the users' needs or are more costly, thus leaving a gap for the peripheral artefacts to emerge.

These peripheral artefacts can be distributed and monetised in a form by the core users of artefacts and, therefore the market organization of peripheral artefacts is in a form of by-users-for-users, while the core artefacts come in the form of by-distributors-for-users. Technologies analysed in Chapters 5-8 are an example in this regard.

Economic Competitiveness

The distinction between the perceived importance of core and peripheral artefacts for economic competitiveness has consequences for the other ten aforementioned attributes in Table 4.2. As the core artefacts take place in mainstream and more formal settings than the peripheral artefacts, the core artefacts' importance for economic competitiveness is more obvious and easily calculated than that of peripheral ones. Not only is peripheral artefacts' effect on economic competitiveness perceived to be less than of core artefacts, most of the time peripheral artefacts are also viewed as a grey area which needs to be restricted, censored, controlled, or clamped down on. This is a way that society justifies the value of the peripheral artefacts based on social perceptions rather than on technological or economic ones. Technologies analysed in Chapters 5-8 are an example in this regard.

Lack of Visibility

If we use an explanation of humanity's desire for technology to broadly classify social cognitions of artificial intelligence in computer technology, it can be divided into two types: artificial intelligence that was crafted in response to the desire to push the boundary of science and technology; and artificial intelligence that was crafted in response to societal demands.

The significant point of this classification is that the variation in humanity's desire to advance already existing artificial intelligence underpins the hierarchy of newly emerging information technologies. Starting with an examination of archival artificial intelligence that is produced due to the desire to advance science and technology knowledge, some of it is archived intentionally while the rest is not. Not all scientific projects manage to accomplish the project's objectives. The projects that were classified as failures either produced nothing or produced something that was not intended originally, which underlines the importance of human involvement in and recognition of that project.[15]

Archival knowledge and incremental artificial intelligence are sometimes commoditised by the market mechanisms within a society. They are presented to the society as a piece of technology with a social value added, and thus can be placed in the same group of artificial intelligence that is crafted in response to societal demands. Again, in the realm of such market desire, the technologies become involved with social and market values differently. Some technologies are involved and embedded more within the society, which determines their market value. This can be either because technologies are socially accepted or become cheap due to the demand and supply rules of the market.[16]

This progression is the basis for how society's technological cognition works; however nowadays this artificial intelligence has advanced to the point

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[15] Nonetheless, this discussion is not going into greater detail as it is not a focus point of the on-going analysis of the hierarchy of core and peripheral artefacts. They are outlined here to illustrate the possible paths in which artificial intelligence and market mechanisms become involved, and determine a hierarchy of newly emerged technology.

[16] However some technologies do not become widely adopted socially, perhaps of cost or lack of public awareness.

where its products are released in an invisible manner. Hence, the visible appearance determines different levels of social cognition of the merged artificial intelligence. Visibility makes some technologies widely recognised and adopted both in terms of their existence and their benefits; additionally, they also are perceived as a contemporary strategic technology with great economic competitive advantage. These technologies secure their place as core artefacts in the hierarchy of emerging information technologies. Alternatively, some technologies receive lesser or minimal recognition of their existence and impact due to their lack of visibility. These fall into the hierarchy as peripheral artefacts regardless of their impact and wide adoption by the society. People might feel their impacts indirectly, as with an enabling piece of technology, or they may feel the impacts directly but without an awareness of their different elements. Cloud Computing, as analysed in Chapter 6: The Cloud, the iDragon, and the Technocratic State, is an example in this regard.

4.5.3 Private-Owned and Publicly-Owned Knowledge

IPRs Protocol

Another feature distinguishing core from peripheral artefacts is their differing abilities to be assigned to private possession. May (2005) explains that both material property and intellectual property did not originally exist with a legal ownership right; they were originally material and knowledge commons. The ownership right of both commons was created later on through a commoditization process for commercial purposes under the justification of particular social relations.[17] However unlike the material commons, where multiple consumers can diminish the quantity and/or quality, the knowledge commons is non-rival: multiple consumptions do not

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[17] May explains such social relations by stating that the consumption of material commons reduces both the 'social utility' and commercial impacts of them, while the free consumption of the knowledge commons hollows out only commercial impacts not the 'social utility' impacts.

diminish either the quality or the quantity of that knowledge (Shadlen *et al.* 2005: 49). On the contrary, the consumption of knowledge outside market transactions multiplies both the quality and quantity of the knowledge; for example, if people exchange ideas with each other, both parties will end up having more ideas at the end.

Additionally, there is also another type of knowledge property over which private possession can be assigned that was not initially of interest to IPRs advocates: software. This type of knowledge has more recently been assigned special public ownership as free software to prevent it from being transferred from the public commons to private ownership. Chapter 7 (Section 7.2.2.1: The Economy of Free Software) discusses the mechanisms for keeping this type of knowledge in the public common using the case of GNU's public general agreement, which is a license for a free software operating system (GNU is not Unix). As this chapter shows, artefacts that are constituted as privately owned knowledge or are released on to the market with private ownership rights are classified here as core artefacts, while the rest are classified as peripheral artefacts.

Resource Scarcity

Resource scarcity of particular emerging information technologies relates to the commodification of knowledge and information as technological goods. As described above, the resources in software and digital content are non-rival. Therefore, to claim ownership of them is to impose a human-created scarcity with a temporary monopoly right; such as creating intellectual property rights for software and digital resources, which are mostly in the form of knowledge and information. As such, the resource scarcity of software and digital content is not natural but imposed, and this has been a central development in the software and digital content realm. The ownership of emerging information technologies to which this logic has been applied are categorised here as a core artefacts in the technological hierarchy.

However, within the imposed scarcity, there is another type of scarcity that has emerged: an artificial scarcity. An artificial scarcity is not imposed for the purpose of extracting a price out of the knowledge and information resources that are used to produce the environment where the artificial scarcity takes place. Rather, the artificial scarcity emerges from the conditions of usage arising from the imposed scarcity. Online games and gold farming are a clear example of this. Digitizing games to make them available on the Internet means game providers can earn revenues from several sources such as advertising, user subscriptions and the digital goods available for gamers. These revenues arise because game providers make assets scarce for online consumers of a particular game. By doing so the game providers own the game content, middleware and other related commercial aspects such as the trademark. What is more, the storyline content (with all the challenges that are set initially for the gamers to achieve) creates an artificial scarcity within the shell of the digital content that is protected by an imposed scarcity. This artificial scarcity emerges because of the gamers' entertainment experience, as gamers themselves set the challenge, requiring more time in the game trying to obtain the artificial prizes as a special feature or to proceed to other levels in the game. This has also created a technological gap for the gold farming business to emerge either though purely human labour as a service or with the help of a new piece of technology like a 'farmbot'. A 'farmbot' is software that automatically plays online games rather than having real human gamers engage in highly labour intensive gold farming. The prices of artefacts are justified by the logic of the artificial scarcity that places them as peripheral artefacts in the proposed hierarchy of emerging information technologies. Technologies analysed in Chapters 8: Online Games, the

Virtual Economy, the Counter-Developmental State, and Forward Trends, are an example in this regard.

Consumer Relations

Consumer relations are a feature related to the release of the final artefacts into a market, or in other words the final product model. The conventional way of releasing the final artefacts under the umbrella of IPRs protection is the black box model. This is the model where the final product is marketed as a given piece of technology. The users pay for the technological product without being able to access, copy, modify or redistribute the product. This is the realm for the core technologies.

While the core artefacts rely on the black box model for releasing the final product onto the market, the peripheral artefacts offer a white box model on the market, or base their technological process on the white box model. With this model, the users can access, copy, modify and redistribute the final product either to a certain extent or with no limitations. Nowadays, in particular market niches, most products use both models; nonetheless this distinction is made to refer to the difference in the logic of the openness underlining the two models and their influence upon the division of core and peripheral technologies. Technologies analysed in Chapters 5-8 are an example in this regard.

4.5.4 Formal and Informal Economic Settings

Process of Improvement

The process of improvement here does not refer to an improvement in the features of technologies. Rather, the process of improvement here refers to the progress of the public perception of particular products: about how deeply rooted technologies are within a public cognition of technology. Since the Internet has become more and more affordable and easier to access, the life cycle of many newly emerging information technologies has become shorter, because the Internet acts as a free platform to test and trial any technological idea, regardless of its source, size and form. Everything can be accepted to be released to the public in the Internet world. The Internet determines processes of improvement that can be seen in four distinctive trends: an increase in unreleased IT projects; an increase in IT hype; an increase in IT hype that does not progress to technological reality in the public realm; and an increase in technological realities that do not progress beyond hype.

In the early days of the Internet as a publicly accessible computer network, the number of unreleased computer projects increased due to the Internet connecting projects to a mass of consumers with just a click and at minimal cost. Furthermore the Internet also acts as a large pool of information, where each project can keep an eye out for duplication that can emerge at any time. This means large numbers of projects in their last stages do not release their computer products in the form that was originally planned, since the market niche has already been taken.

Furthermore, a large proportion of the Internet has become more and more user-centric. This user-centricity has occurred in many possible ways such as the rise of Web 2.0 and peer-to-peer user-generated content, and Internet-based source code sharing communities. This assimilation between technology-producers and technology-users upon the net space also unsettles the boundaries among computing activities related to the Internet; the lines between career and hobby, producer and consumer, and professional and amateur are blurred, and which explains why much user-generated content is transformed into an artefact with strong Internet hype around the Internet. Against this backdrop, technological hype can be defined as the sense of how popular and well known certain technologies are among Internet users. However, this hype is not proof that such technologies will have commercial success once further developed into a formal economic transaction.

Taking the example of the applications industry for smart phone or mobile phone devices (hereafter the App economy), in the early days they were just peripheral artefacts which society perceived as a hobby, uninnovative, dependent on advertisement revenue or at worst an opportunity for young, amateur developers to practise their IT skills. However the App economy has recently been perceived socially as more of a core artefact, because of widely-publicised examples such as seventeen year-old Nick D'Aloisio, who sold his news summary App (Summly) to Yahoo! Inc. for USD$ 30 million (MacMillan and Thomson, 26 March 2013).

The developments of Android phone application technology as analysed in Chapter 7: The App Economy, and the Irrelevant State, is an example in this regard.

Information Flows

As the Internet is a universal space where computer networks connect with each other worldwide, the size of the Internet depends on the type of measurement employed. Units of measurement include counting numbers of Internet subscribers (which does not represent the number of Internet users who do not subscribe), by counting the number of websites, by counting the bytes of data available on the Internet, and so on. It is pointless to attempt to measure the size of the Internet for two main reasons: the size multiplies every second so it is hard to capture its current size, and it does not matter how big the Internet is, as it is the social relations within the Internet that matter. The latter reason is what distinguishes the core from peripheral artefacts with regards to information flow.

Regarding core artefacts, sites that contain original digital content and other related services that are approved by the original digital content creators are protected by legislation and thus can be seen as core artefacts in comparison with what are seen as peripheral artefacts. In terms of peripheral artefacts, many websites or Internet-based tools that act as an enabler or navigator to content available to the public on the Internet is not protect by legislation. These artefacts thus end up in a different position to that of the core artefacts. Technologies analysed in Chapters 8: Online Games, the Virtual Economy, the Counter-Developmental State, and Forward Trends, are an example in this regard.

Capital Accumulation

The difference in capital accumulation is related to the distinctions in human resources between the two artefacts were mentioned earlier. Success in the development of peripheral artefacts does not rely on financial capital since the materials required to process the innovation for these artefacts are mostly free of charge or freely available with the computer and the Internet, as in the case of ubiquitous innovation previously mentioned. Furthermore, the nature of peripheral artefacts is highly collectively distributed. To elaborate, even though each of the peripheral artefacts is small in comparison with the core artefacts, they need collective action to functionally disseminate into the market. For example, smart phone applications are collectively distributed through the App store and gold farmers are organized collectively to be paid through a gold farming website. Technologies analysed in Chapters 5-8 are an example in this regard.

4.6 Conclusion

This chapter has provided an outline of the way that this thesis will answer the research questions:

Research question 1: How should we characterise the nature of the technological upgrading approaches that are employed domestically in Vietnam, and how these approaches are processed within the context of Vietnam's IT industry.

Research question 2: How to characterise the state's roles regarding technological upgrade in Vietnam's IT industry, and to what extent and in which way do these different state roles affect the domestic technology-upgrading approaches.

These questions will be answered fully using four case studies, explored consecutively in the next four chapters, from Chapters 5- 8..

This chapter started with a discussion of how technology-upgrading approaches and processes have been conceptualised, based on several sets of literature, for use in this thesis. The chapter then introduced the basic concepts and structure of how the first research question, regarding the characterisation of Vietnam's technology-upgrading approach, is going to be answered using four models. After these four models were outlined, the chapter linked these models to another dimension, that of the different roles of the state in relation to four different technology-upgrading approaches occurring across Vietnam's IT industry. This section of the chapter also summed up the answers to the thesis' second research question, concerning the character and impact of the Vietnamese state's roles regarding technology-upgrading.

Finally the chapter proposed a hierarchy of emerging information technologies to explain the factors that shape the perceptions and categorisations by society, including the state, of emerging information technologies as core or peripheral technologies. This proposed hierarchy has been developed based on the concepts of 'Othering' and 'Bricolage'. The hierarchy also explains why the Vietnamese state has either privileged or disparaged certain IT forms from a socio-technological point of view. In Chapters five to eight, the hierarchy of emerging information technology will be discussed along with other relevant factors to provide the answers to the research questions in a more detailed and analytical manner.

Chapter 5

Software Outsourcing and the Cooperative State

5.1. Introduction

This chapter discusses the perpendicular model of technological upgrade in an outsourcing business (Figure 4.1: *Four Models of Technology-Upgrading Process*). The Vietnamese state has a cooperative role in this model. This cooperative state arose after the Vietnamese state allowed certain non-political actors to take part in the policy-drafting stage of the main national IT policy, Directive 58, during the period from 2000 to 2010. These non-political actors consisted of two main groups: local IT entrepreneurs and Vietnamese overseas IT entrepreneurs. Prior to Directive 58, Vietnam's earlier IT policy was considered by the state itself to have failed to reach its goal because the policy was not sufficiently industry-oriented. The state sought to ensure Directive 58 did not suffer the same problem by adopting a cooperative role, rather than keeping a leading economic role.

The outsourcing business is one of the original pioneer businesses of Vietnam's IT industry, having started when Vietnam first tried to construct a local IT industry, which at that time did not consist of many sub-sectors. Hence, the development of the local outsourcing business happened consecutively with the growth of Vietnam's local IT industry. In addition, this period saw the emergence of Vietnam's IT entrepreneurial class and the rise of their influence in the drafting of IT industrial policies.

This backdrop affects the way in which the perpendicular model of technology-upgrading of an outsourcing business occurs at an industrial level

(Vietnam's IT industry) rather than at a sectoral level (as an outsourcing business), despite the cooperative state having built a connection with outsourcing businesses for longer than for most of the other sub-sectors in Vietnam's IT industry. In this regard, the cooperative state continued its cooperation with the pioneering outsourcing firms after the local IT industry was established, through the process of technology upgrading. This relationship, based on technological upgrading, was also enhanced by the highly institutionalized knowledge and modes of innovation that were employed for conducting the technology-upgrading processes. The highly institutionalised knowledge and the modes of innovation are categorised in the hierarchy of emerging information technologies as core artefacts.

This chapter will start with a short introduction outlining how the advancement of technologies enabled the rise of a global outsourcing business. Then, the chapter will examine how the emergence of the domestic outsourcing business dynamically interacts with the rise of local IT entrepreneurs and the growing role of these entrepreneurs in shaping the cooperative state through the making of hi-tech industrial policies. Finally, this chapter will characterise the cooperative state and its limitations within the context of technology-upgrading approaches in Vietnam's outsourcing business.

5.1.1 The Rise of the Global Outsourcing Business and Its Technological Opportunities for Technologically Backward Economies

In his book *The Big Switch: Rewiring the World, from Edison to Google*, Carr (2009) discusses the evolutionary processes of certain types of technologies which have had a significant impact on industrial transformation from the invention of electricity to the technologies that were part of the computer revolution, such as the emergence of information technology and the establishment of software as an industry in its own right. Carr acknowledged that the economy of the computer (and its related technologies) and electricity closely echo each other, as he refers to both of them as General Purpose Technologies (GPTs). These are the types of technology that serve multiple purposes, perform various functions in various formats and, above all, can be remotely accessed:

> But electricity and computing share a special trait that makes them unique even among the relatively small set of general purpose technologies: they can both be delivered efficiently from a great distance over a network. Because they don't have to be produced locally, they can achieve the scale economies of central supply (2009: 15).

Indeed the development of electricity and computing are significant, not only as GPTs, but also as powerful enabling technologies that empower other businesses (including IT related business) to break down their production procedures into smaller tasks and send them to other locations to implement before returning them to the original source for the assembly of the whole product. This is the backdrop against which the outsourcing business has been taking place. The network of production in various industries has been fragmented down not by the type of product or component as the unit of production, but rather by tasks (whether completed parts or not). The outsourcing business has been shaped slowly by both sets of GPTs, which have become more affordable and accessible over time.

In terms of the computer industry, outsourcing offers opportunities for technologies in backward societies where the domestic IT industry has not yet become well established enough to connect their skilled IT labour to an already existing IT industry elsewhere. India and its famous software outsourcing business exemplify this phenomenon. More important here, in relation to Vietnam's IT industry, Indian's software outsourcing business has greatly inspired local IT entrepreneurs who strove to find IT demand outside of Vietnam's then under-developed IT market. This rise of global IT outsourcing occurred concurrently with the rise of Vietnam's local IT entrepreneurial class as an influential policy lobbying group, which has continue working closely with the state in a cooperative manner. This provides one side of the historical background that forms the context for this research, where the proposed cooperation between the state and entrepreneurs takes place.

The difference between a supportive and cooperative state lies in the further developmental stage of the domestic IT industry after the initial constructional stage. Once the industry has officially emerged, the relationship between the outsourcing entrepreneurs and the state strengthens in a linear fashion with further development of the industry, as many IT entrepreneurs have gained power as IT industry representatives. This means that even though the outsourcing business is not done by the state, it nonetheless has a closer and stronger connection with the state than other IT industrial sub-sectors.

The relations between the cooperative state, together with the nature of the outsourcing industry, create a unique path for the technology-upgrading approaches of domestic firms who chose to upgrade their technological capacities in other economic sectors while still continuing their outsourcing business: this is referred here as the technology upgrading in scope approach.[18] However, there is still another type of technology-upgrading approach in Vietnam's outsourcing business. This is

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[18] Chandler's distinction between the economies of scale and scope (1990) are employed in this chapter. For Chandler, economies of scale in production and distribution are 'those that result when increased size of a single operating unit producing or distributing a single product reduces the unit costs of transaction involved', while the economies of scope in production and distribution are 'economies of joint production or distribution' (1990: 17).

the technology-upgrading in scale approach, which demonstrates the counter-developmental characteristics of the state in that the state's financial structures contradict the cooperative character of the state.

5.2. Vietnam's Information Technology Industry Building, its Constitutive Circumstances, and the Rise of the Cooperative State

This section discusses the circumstances under which Vietnam's information technology industry has developed. The discussions of these circumstances will be channelled into two main topics which highlight the indigenous factors that gave birth to the cooperative state. The first topic is the three main fields on which Vietnam's domestic IT industry has taken shape. The second topic examines the extent to which the domestic outsourcing businesses become a significant sub-sector in the domestic software consortium as well as in a local IT industry, especially at the early industry building stages.

Examining the first topic offers an analytical account for such circumstances. These circumstances are the state's intention to industrialize and modernize the country in conjunction with the rise of the industry globally; the emergence of Vietnam's domestic IT entrepreneurial class; and its connections with overseas Vietnamese or *Viet Kieu* who work in the IT field. Since there was limited domestic IT demand during the construction period of the domestic IT industry, the rising IT entrepreneurial class and returning Viet Kieu had to seek IT demand from external markets that were outsourcing work. This explains the large industrial share of outsourcing businesses in Vietnam's domestic IT industry. This background demonstrates that Vietnam's outsourcing industry has been highly institutionally constructed in two senses: in an active sense when the outsourcing business is embedded in hi-tech industrial policy making processes, as will be outlined in Section 5.2.2: The Rise of the Local IT Entrepreneurial Class; and in a passive sense when the domestic outsourcing business needs collective agencies and the state's structures to do their business. Later on in this chapter, two examples illustrating these two senses will be provided. These examples are of business matching via industrial consortiums and of a technology-upgrading approach that is highly subject to industrial financial systems.

5.2.1 Vietnam to be Industrialised and Modernised by 2020

Vietnam is set to be modernised and industrialised by 2020 under the 'Strategy of Information and Telecommunications to 2010' and Vision to 2020 (Government of Vietnam 2005 cited in Nguyen Thanh Tuyen 2010: 87). Even though the strategy was issued long after Vietnam's first IT policy, it still is considered by the government to be contemporary with Vietnam's current economic trajectory.

A deputy minister from MIC, Dr. Nguyen Thanh Tuyen, clarifies in an interview the meaning of modernisation and industrialisation that are mentioned in this strategy document in the sense of the technologicalisation of Vietnam's main economic sector:

> there are many terms about "modernization", or even about ""postmodernization", and some of their synonyms, such as "industrialization" and "post-industrialization" […] In Vietnam we seldom use the word "post-modernization" but only "modernization" [….] In 1996, at the 8th Plenary Congress of the Communist Party of Vietnam, the term "the course of industrialization and modernization of Vietnam" was initiated in the official document of the Congress. It defined "modernization" is "a process that fundamentally and comprehensively transforms the production, business, service activities and

economic management from a labour-basis as the main means to a basis of advanced technology and scientific progress to create high productivity". By default, the term of the course is understood in 2000-2020 (personal communication with author Nguyen Thanh Tuyen, 2012).

This strategy can be seen as a broad canvas for Vietnam’s long-term techno-economic trajectory for other industrial and economic policies. In this strategy, the IT industry has already been prioritised in comparison with many traditional sectors, as it is one of the strategic industries fuelling Vietnam to achieve this vision, as well as being an enabling technological industry that modernises and industrialises other industries in the Vietnamese context, as Nguyen Thanh Tuyen outlined in the personal communication.

Understanding this strategy as well as the government’s IT policies alone is not sufficient if one is to understand the influence of the contexts that have shaped the current character of Vietnam’s IT industry. An understanding of other related policies, including a grasp of the historical background encompassing how technology-based sectors have developed in Vietnam, is crucial to this research’s analysis as it provides a broader picture of the national context under which Vietnam’s IT sector has developed. Thus, this part of the thesis will outline the related technology-development policies prior to the year 2000, the year in which the IT sector was officially established in Vietnam.

In contrast with the extensive literature on the Vietnam war, the literature on Vietnam’s technological development before 1995 is limited. Vu Vao Dam (1995), Goodman and Press (1995), and Do, Pahn Dinh and Goodman (1996) are among the few scholars who paid attention to Vietnam’s high-technology development during the mid-1990s.

A prolonged period of war, together with a lack of military technology as well as the non-existence of domestic industries with technological requirements, such as a petrochemical industry, and the lack of well-equipped ports (Goodman and Press 1995: 13) left Vietnam in a technologically backward condition by the 1970s. However, there is evidence that the technological development of the Science and Technology (S&T) sector did exist in Vietnam even before the economic transformation programme (*doi moi*) was initiated in 1986. Nevertheless, Vietnam's socialist regime and centrally planned economy created a concrete obstruction for its national technological capacity. The S&T sector operated under a highly centralised command system and state-monopoly economy, which prohibited communications between S&T institutions. This prevented the diffusion and utilisation by society of any particular piece of technology. As a result, Vietnam was drastically failing to reach its national scientific objectives (Vu Vao Dam 1996: 251-252).

After 1981, the state responded to this situation by loosening its highly centralised command system governing S&T (1996: 252-254). One of the key policies for S&T development was Decree No. 175-CP, which enabled S&T units to enjoy a degree of autonomy, manage their financial affairs and profit from their productive achievements. The interesting point is that this Decree also enabled S&T units to obtain funds from state financial sources (1996: 254-255). At first glance, the S&T sector seems to have gained advantages from this policy; however, it is very doubtful whether any public financial resources were actually available at that time.

After the economic revolution in 1986, the S&T sector underwent partial privatisation. Private S&T activities were no longer prohibited in Vietnam (Decision 134 – HDBT, 1987), and this decision was followed by the consideration of protection for owners of S&T products (Decree and Law on Protection of Industrial Property 1989). In this period, however, the concept of patents and intellectual property rights did not exist in Vietnam. The state used the term ‘initiative movement’ in reference to a product’s initial ownership, yet enforcement still remained very weak in practice (1996: 257-259).

In 1991, five years after *doi moi* had begun, fostering a minuscule private sector, bilateral trade with the USSR came to an end. The state had to seek new trade and investment partners; thus, Vietnam agreed to lift its trade embargo on the United States in 1995. This event introduced western computing technology and American computer firms to Vietnam’s economy, while American firms started to standardise the domestic computers and software used (Do, Phan Dinh Dieu and Goodman 1996: 88).

The 1990s were a period that opened the door to international S&T dynamics as well as decentralisation. In 1992, private enterprises were allowed to transfer foreign technology into Vietnam for commercial purposes (Decree 35-HDBT) (Vu Vao Dam 1996: 257-259). In addition, a series of regulations were promulgated in order to decentralise state autonomy in S&T administrative and fiscal management to local governments (Circular 1292 in 1992, and Decision 419 in 1995) (Vu Vao Dam 1996: 251-252).

However, the emergence of private economic participation as well as foreign investors convinced the Vietnamese authorities of the necessity to develop ICT for the advancement of communication in response to new demands from the private sector. If the ICT and computer technology sectors remained small and elitist, Vietnamese individuals and enterprises would be at a disadvantage in comparison with foreign firms (Do, Phan Dinh Dieu and Goodman 1996: 90). With this concern in mind, the state declared its first IT policy in 1993 (Resolution 49/CP) with the title ‘Resolution of the Government on the Development of IT in the Country During the 1990s’ in order to computerise the public sector and promote the use of IT in the private sector (1996: 90-91). This Resolution laid the foundation for all of Vietnam’s IT policy structures after 1993. Notably, IT was not considered as an economic activity, and this was reflected in this policy through its separation from the ICT sector (Dang 2009: 102-103). Resolution 49 was drafted with heavy influence from the Research and Development (R&D) sector (2009:119), home to the type of professionals that were kept embedded within the state arena (2009: 105), rather than being industry-oriented as in the case of Directive 58, discussed below.

5.2.2 The Rise of a Local IT Entrepreneurial Class

IT was considered as an industry for the first time in 2000 under Directive 58, which this chapter considers to be the intersection where the state and domestic outsourcing industry began to interact in a cooperative way. Despite the policy, Nguyen Thanh Tuyen (2010: 87) suggests that the ICT and IT sectors were in practice merged together only in 2002, when the Ministry of Post and Telematics (MPT) and a National ICT Steering Committee (SC58) were established to govern both the ICT and IT sectors as a united industry.

One phenomenon under Directive 58 that embraces the cooperative state in association with an outsourcing business is the level of participation of the IT entrepreneurial class in the policy drafting period of Directive 58. Unlike Resolution 48, which had researchers from state bodies as a powerful policy lobby, the IT entrepreneurial class was one among others that participated in – and thus influenced – Directive 58. As such, Directive 58 is more industry-oriented than Resolution 49.

The rise of an entrepreneurial class, as well as the participation of this class in an industrial policy-lobbying process, were gradually formulated against the backdrop of the transformation of the Vietnamese state's role from being highly centralised to less centralised since *doi moi* was announced back in 1986. Since then, the Vietnamese state has been characterised by scholars of South East Asia and socialism, for example Gainsborough (2003), Kokko and Sjöholm (2000) and Dixon (2002), as a state that endeavours to centralise and maintain its economic autonomy, in strong contrast with other successful states involved in the IT industry which consulted their citizens more extensively, as discussed earlier in greater detail in Chapter 3: Literature Review, Section 3.3: The Network Knowledge-Led Model, on the notions of the network state The proposed cooperative state might appear to fit well with the notion of the network state at first glance, but this is not always true. The Vietnamese cooperative state has limitations, and such limitations are the result of the centralised financial system that hinders technology-upgrading processes in local outsourcing businesses as will be discussed below.

Branding themselves collectively as a 'Developmental-State Performer' (Abrami 2002: 92), Vietnamese economic policy makers have no choice but to process elements of the neo-liberal economic development model because of pressures from international economic integration, international trade partners, and donors (Abrami 2002: 95; Evans and Bui Duc Hai 2005: 219). Vietnam has joined a number of international economic associations, such as ASEAN in 1995 and the WTO in 2007, which have required Vietnam to meet their membership pre-conditions by increasing free competition in its domestic market. In addition, the collapse of a traditional donor, the USSR in 1991, forced Vietnam to find new donors who later became its major trade partners. These partners demanded fair market competition conditions for their companies to operate in Vietnam. For instance, the U.S.-Vietnam Bilateral Trade Agreement was signed in 2000, and became effective from 2001 onward. Additionally, Japan became a major source of overseas development aid (ODA) and a long-term trade partner for Vietnam's automobile manufacturers (Abrami 2002: 93).

The Vietnamese state has reacted to such pressures by partial decentralisation of its economic authority to local government bodies, privatisation, SOE reform (regarded as an equalisation process) and offering an open door to foreign direct investment. A few of these policies illustrate this liberalisation, such as the Law of Enterprise and Decision 171 on bureaucratic reforms in S&T bodies. However, many scholars criticise the government's self-projected image as an actor taking a liberal role in the economy. Gainsborough (2003) perceptively analyses the evidence to conclude that the state has reasserted political control against the increasing local autonomy created by economic reform. He suggests that this control can be seen in the way that the central state can rule local authorities through the appointment of important local positions and mandates to local institutions (2003: 73). Furthermore, Evans and Bui Duc Hai (2005) support Gainsborough's argument by characterising the hidden intention of the state in economic liberalisation as 'statecraft'. They use this term to describe the Vietnamese state's manoeuvres behind the expansion of privatisation and equalisation processes, which are actually aimed at preserving the political idea of the state in the face of threats via globalisation (2005: 237).

Against this backdrop, the cooperative state model set out here contributes to the notion of the Vietnamese state characteristics in its economic transformation from a planned to a market economy. The cooperative state emerges out of both political and economic forces and, as will be outlined here, also privileges certain groups in the IT entrepreneurial class who represent a large proportion of the domestic outsourcing sector and who have a connection with the state regarding the development of the IT industry. In other words the rise of the IT entrepreneurial class as part of the hi-tech industrial policy drafting process has a significant meaning for outsourcing businesses rather than for the whole IT industry for two reasons. First of all, outsourcing entrepreneurs constituted the majority of the IT entrepreneurs who lobbied for Directive 58. Secondly, this occurred at a time when outsourcing businesses had the biggest share of the infant domestic software sector, and when software was considered to be an official IT industry, coinciding with the time when Directive 58 was issued.[19]

Dang (2009: 114) provides first-hand accounts of the details of different policy lobbying groups in the drafting processes of Directive 58 (including preparation processes). She names some IT entrepreneurs and their contributions in these processes: Troung Gia Binh (FPT Cooperations) and Ha The Minh (CMC Software). At the time of Directive 58's drafting processes, the condition of market competition in Vietnam was in its least mature condition despite having undergone an economic revolution since Doi Moi. State-owned enterprises and a few private-owned ones dominated the market. Troung Gia Binh and Ha The Minh[20] led companies in these groups. Vietnam issued the Law of Enterprise 2000 which officially introduced an influx of private enterprises into the economic system; the law reflected the new economic ambitions of the socialist political regime. At the tenth National Congress in 2006, the Government of Vietnam (GOV) declared its mission to industrialise the country with a target of 7.5-8.0 per cent annual economic

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[19] (Resolution 07 is a five-year plan aiming at building and developing a domestic software industry, issued on 5/6/2000 (Dang 2009: Appendix 6)).

[20] Considering that FPT, and CMC System and Software Department were established in 1988 and 1996 respectively (FPT Cooperation (n.d), CMC software (n.d.))

growth rate by the end of 2020. It also allowed members of the Vietnamese Communist Party more participation in private ownership and capitalism. The result is that the domestic IT market has been dominated by a few companies that have connections within the political bureaus of the Communist Party. Again, as said before, the proposed cooperative state is one type of such connection, and Troung Gia Binh plays an important role in crafting this connection.

Additionally, the rise of the IT entrepreneurial class during the turn of the century was not limited only to those who took part in Directive 58's drafting process. Apart from domestic entrepreneurs, some foreign entrepreneurs have gradually increased their shares in Vietnam's IT industry, the majority of whom are American or Japanese. While the U.S. companies are major outsourcers in Vietnam, Japanese companies are said by the World Bank to be the main importers of Vietnamese software (2007: 53). Although the software sector has dominated Vietnam's IT industry, there are signs of a growing hardware sector. Intel Corporation has invested in an integrated circuits and IT peripherals plant in Vietnam. Intel claims that this plant is the company's biggest ever for chip production (Manager Online unknown date 2009). According to the mission statement issued by Intel's chairman, Craig Barrett, who aims to transform the Vietnamese IT industry, the country needed to move from "made in Vietnam" to "created in Vietnam" (Craig Barrett interview in Manager Online unknown date 2009). Later on in the second half of 2000s, the digital content industry emerged. This shows the steady growth in the diversity of the sub-sectors that constitute Vietnam's IT industry, as well as how the international economy increasingly drives Vietnam's economic development trajectory during the period of Directive 58: Vietnam's economy is more industry-oriented than ever before.

The emergence of an entrepreneurial culture in response to Vietnam's transition into a market economy and passage of the Enterprise Law in 2000 also is in part due to the spin-off of researchers from the state's R&D sections into the private sector. Dang states that pioneer IT entrepreneurs in Vietnam had close ties with other state institutional bodies, such as academics, as they used to be state employees (Dang 2009: 117). This was done in various ways; however, in this present research only those who cooperate with the state are discussed, since they posed a great deal of significance for the construction of Vietnam's domestic IT industry. These former state researchers cooperated with the state through a collective agency, a software consortium called VINASA that tried to connect to the global IT market in Japan. Tran Cong Tuong, a member of the senior management board of VINASA Ho Chi Minh City Branch, discussed during a fieldwork interview strategies to attract overseas Vietnamese who were working in the international IT industry back to work in Vietnam. He mentioned that the phenomenon of Bangalore's outsourcing business had encouraged them to pay it a visit, during which they realized that the socio-cultural aspects of working in the outsourcing business were very different between India and Vietnam:

> Tran Cong Tuong: […] We were very impressed by the successful approach of India.
>
> Uer-Aree: Was it about the development of the industry or was it about certain technology?
>
> Tran Cong Tuong: Developing the industry! So we were very impressed by the successful approach of India, and we were trying to copy it. That is why back to year 2000 and 2001 Vietnam and India had a kind of an agreement that India will help Vietnam to build the software industry.[…] You see they learnt from India for three to four years from 1998 to 2001, and they learnt that they could not do the same thing

> India did because of cultural differences. For example I still can recall back in 1999 we had a conference with Indian companies like Infosic or Apptec, and after the conference some business owners told me that they could not do the same things India does, because we had different cultures. When they visited Bangalore they were very impressed by the way Indian people were working and living in very poor conditions. […] and Vietnamese people cannot live in the same way as Indian people. They told me that typical Indian developers can work about twelve hours a day. They can sit side by side and after six hours of working non-stop, they just sit down on the floor to have they lunch, eat very fast in fifteen minutes and they go back to work. Vietnamese workers cannot do this! It is not the way we're living. We are used to living an easy life, not hard work like that. So we have to find our own way to do business to develop the industry. (Interview with author, Tran Cong Tuong, 2010)

After crossing India off of the list, Vietnam's search continued for other venues for them to start their outsourcing business. Close trade connections and Japan's longstanding status as an international donor to Vietnam made Japan an obvious choice. Eventually, a joint venture of seven Vietnamese and six Japanese companies was established, which also included VINASA. Tran Cong Tuong told me that even though the joint venture was terminated two years later, VINASA had already made its name as a business matcher that had mediated the supply of local IT labour with global IT demands though its outsourcing business.

Furthermore, despite being established with the intention of business matching, VINASA as an industrial association has other objectives. It conducts public relations though an annual award programme, and acts as a mediator between members, but most of all VINASA is a policy consultancy board for the state, since it is the pioneering software consortium in Vietnam. This consortium exists due to the needs of local IT firms to find demand for their work, together with the push from government, described earlier here, to use the IT industry as a strategic industry to modernise and industrialise the country. These factors enable VINASA to cooperate, despite its being a private software association run by private firms, with the state being closer to VINASA than to other industrial associations in Vietnam's IT industry, as Tran Cong Tuong states:

> […] VINASA is the only business association in Vietnam that does the policy consulting board. We are the board administrator or policy player in every move. Every movement in policy making we have a voice. (interview with author, Tran Cong Tuong, 2010).

In addition to this, the cooperative state also shares its autonomy in IT industrial development with VINASA from time to time. For example, with regard to domestic IT consumption, the government is trying to promote the use of IT applications within the state administration and state-owned enterprises in the hope that this will increase the amount of IT demand domestic enterprises are able to supply by producing new technologies. However, in practice the process of granting concessions for the state's IT demands are not equally spread throughout the local IT industry. The government gives priority to a small number of big companies, authorising them to issue industrial standard certificates and finance small firms. For example, the government is in a partnership with VINASA, headquartered in Hanoi, which is led by a few companies who already dominate the IT market (such as FPT, TMA, and Paragon Solutions), to provide the industrial standard for IT firms eligible to receive grant concessions for government IT projects. In this respect, the cooperative state starts to show some degree of counter-developmentalism, as it appears not always to be beneficial to all outsourcing firms, especially to small firms. Hence, the cooperative state could be seen here as a state that tries to get the upper hand in the transitional economy, especially in the IT business where the state has few business skills and the local enterprises have many more, as became apparent in the failure of Vietnam's first IT industrial policy.

5.2.2.1 Nepotism and Cronyism Within VINASA

VINASA Corporation, an extremely successful and influential company, has become a virtual by-word for cronyism and nepotism in the Vietnamese IT industry. Troung Gia Binh, one of the main founders of Vietnam's giant technology company FPT (the Corporation for Financing and Promoting Technology) is the best example of this. He provides FPT with safeguards and privileges for its commercial activities but is also allegedly claimed to have personal connections with the Communist Party (Lan Anh Nguyen 2007). According to *Vietnam ICT Outlook 2007* (Le Truong Tung 2007), which names the top companies in each IT field, FPT dominated three main fields in the market: software outsourcing, the domestic software market and Vietnamese brand-name PCs. Binh hit the headlines in 2007 when he was ranked at the top of Vietnam's richest people list by *Forbes* magazine in the USA due to his FPT shares on Vietnam's stock market. He was followed at the head of the rankings by his FPT colleagues, though only about seven years had passed since Vietnam's stock market was established in 2000 (Lan Anh Nguyen 2007; Tuoi Tre unknown date 2007). This has raised the question of how equal a post-socialist economy can be when under the direction of a single-party state.

However, the topics of FPT's nepotism and cronyism were not a focus of the investigation during the research's fieldwork with FPT, as neither issue forms part of the thesis' objective. However, the issues are mentioned briefly here because FPT, under the leadership of Troung Gia Binh, is also a powerful leading company in VINASA (Troung Gia Binh is the chair of VINASA). These relationships strengthen the chapter's argument that the state has been cooperative, especially to particular industrial institutions that already have established cooperative relations in various forms.

5.2.2.2 IT Industrial Development During Directive 58

'Directive 58 now is something of a legacy'

Tran Cong Tuong: VINASA HCMC

Apart from the rise and participation of the IT entrepreneurial class during the Directive 58 that constituted the cooperative state, Vietnam's IT industry also underwent a great deal of development as an economic sector within the period of this policy (2000-2010). Ho Chi Minh City in particular underwent a great reconstruction, being transformed into a high-tech hub with four out of ten of the national high-tech and software parks.[21] These parks are operated under the autonomous jurisdiction of municipal, provincial and relevant central-state agency authorities. Following the agglomeration of technology by these high-tech parks, Decision 181 was issued in 2005 to favour enterprises located within the high-tech parks (Vu Xuan Nguyet Hong 2007: 29). The state provides a four-year tax exemption for the companies' income tax, income tax incentives for software industry workers, a fee exemption and a support fund for Vietnamese software enterprises, and concessions in renting land and on land use taxes (Nguyen Trong Duong 2004: 3).

[21]Quang Trung Software Park, Saigon Software Park, Ree E-Town, and Unisoft at Ho Chi Minh National University are in Ho Chi Minh City. The other seven are: Hanoi Software Centre; Hoa Lac Hi-tech Park; Danag Software Centre; Haipong Software Centre; Cantho Software Centre; and Hue Software Centre

During this period, the government issued notable sector-related regulations to favour conditions for IT development (Decree 06, Law on Science and Technology, Decree 122, Decree 115), including the S&T bureaucratic reform in Decision 171 in 2004, and several legal documents penalising administrative wrongdoing and the violation of intellectual property rights (Decree 16 (2000), and Law on intellectual property rights No. 50/2005/QH11 (2005)) (Vu Xuan Nguyet Hong 2007: 28-29).

Despite policies that promoted investment in the sector, Vietnam failed to reach its goals in the first phase of the national IT master plan (2000-2005). The aim to develop a software industry worth $US500 million by the end of the plan period was too ambitious, and Vietnam only managed to achieve this two years later in 2007 (Dan Tri, 5 December 2008). This failure was deeply rooted in numerous political influences, as the sector had developed without the benefit of competition among domestic firms. Despite the fact that there are six Vietnamese basic infrastructure licensed providers in the country, VNPT – which is a state-owned enterprise – still retains a monopoly status in international and domestic markets. The mobile phone business is run in accordance with government decisions, VNPT being the major and most influential shareholder (ESCAP (n.d.): 24). However the state responded to this failure by being more industry-oriented, as can be seen from other policies afterwards and can thus still be characterised as a cooperative state. For example, the state demonstrated its awareness of this failure by carrying out the development of information technology including telecommunications infrastructure to support the growth of the IT sector in accordance with the principal GOV IT vision 'ICT Orientation to 2020', which aims to make Vietnam one of the top three countries in ASEAN for ICT sector growth. This vision statement was issued on 6th October 2005, in the year that saw the beginning of the continuous second national

IT master plan (IT2005). The government introduced two subsequent related policies: the National Strategy for ICT Development to 2010 and the National Master Plan for Telecommunications and Internet Development to 2010. The chapter is not going to go into greater details on how the state continued to be cooperative regarding these two policies, as it is outside of the scope of this thesis, which focuses mainly on the state's cooperative roles in technological upgrading processes and the constructive factors that foster the state's cooperation in this matter.

5.3. Characterising the Cooperative State and its Limitations in Describing the Technology-Upgrading Approach of Vietnam's Outsourcing Business

The Vietnamese state still maintains its cooperative roles despite the fact that the domestic IT industrial building stages are now finished. The cooperative state can be seen in technology-upgrading processes of an outsourcing business, both of which aim to increase the scale and scope of technological production. Nonetheless, the cooperative state faces its own limitations in certain approaches to technological upgrading, as will be examined in this section.

The motivations to upgrade the technological capacities in Vietnam's outsourcing business come in many forms. Some that were captured during the research fieldwork include the maturity of the outsourcing business, the economic down-turn (which decreases the amount of global demand for Vietnamese outsourcing firms). the international creative culture which has been cultivated in Vietnam through the return of Viet Kieu in IT industry (the latter has created people who are over-qualified for low skill jobs and thus after successfully establishing a connection with the global IT industry through an outsourcing business they simply would like to obtain higher skilled jobs). Despite these various drives, the research categorises technology-upgrading approaches in Vietnam's domestic outsourcing business into two main approaches: an upgrade in scale and an upgrade in scope.

5.3.1 A Technology-Upgrading Approach: Increasing the Scope of the Outsourcing Industry

The aims of this type of upgrade are to move up the value chain into higher skilled production. Higher skilled production can be broken down into two classes: an upgrade within the implemented line of production, and an upgrade that moves from an implemented line of production to an innovated line of production. The chapter offers an analytical case study of the latter upgrade based on the technological experience of two big domestic companies in the outsourcing business: FPT Corporation and TMAs.

During the time of my fieldwork in 2010, FPT and TMAs had not released any products that were the result of their technology-upgrading processes; however, both of them have founded R&D institutes within their company and the size of their R&D institutes and projects are large. Unlike the case of IVC found in the last chapter, FPT's and TMAs' R&D projects are highly related to other non-business sectors within Vietnam's national innovation system. Many of their R&D projects are aimed at tackling other problems at the national level by introducing the use of software as a tool for solutions, such as innovating software for flooding notification. This is a government concession project.

To start with FPT, its central research body is called the FPT Technology Research Institute. The institute is part of the private FPT University, to keep its activities integrated with the higher educational system regarding IT studies. R&D

activity is not new for FPT. Such activities had been conducted prior to the institute's establishment but within a division of the company and these activities were still kept within the company after the institute was established. The differences between R&D activities before and after the foundation of the institute would be that before they were product oriented but today FPT's R&D activities are technology capacity oriented. RD2, in a senior position, stated:

> We didn't have a central research department in the FPT Company before, but we had some research activities which started around in the divisions of the company, and these activities are still maintained. So it's independent from the central activities, but the research activities in the divisions are more product-oriented, while the research here is wider. It supports the technological strategies of the whole company of FPT, not just a division. (Interview with author, RD2, 2010).

The Institute was founded in 2010 out of the pressure to grow. In the interview, RD2 explained that after the successful establishment of the FPT's domestic outsourcing business (by connecting local IT-skill suppliers to global IT demands) this business faced pressure to grow both internationally and domestically. However, he did not experience this pressure to grow in terms of an increase in the scope of production. Rather, he believed that increasing FPT's technology capacities would sustainably tackle these pressures, whether they were external or internal. He described this point:

> FPT so far has been a successful company but its success relies mainly upon the trading of low level manufactures such as outsourcing software, testing etc [...] but to go outside Vietnam and to compete with the international market we must transform ourselves and we are in the process of transformation from a trading company to a manufacturing and innovative technological company and to do that we have to have the intellectual property which should give us some competitiveness in the technology. […] The purpose [of the institute's establishment] so far is to increase the intellectual

> assets of the company […] we have pressure to grow in both the domestic market and international markets. Our strategy is that in the next ten years we would confirm ourselves as a leading IT company in Vietnam and to do so it has to have technology and some assets that are not visible but invisible assets [from a further conversation an 'invisible asset' refer to knowledge]. (Interview with author, RD2, 2010).

Since the demand for Vietnam's local technology capacities in the software sector is for primitive level work (as the sector consists to a great deal of outsourcing work for foreign markets), the need for high technologies domestically has been relatively low. Thus according to RD2, domestic demand needs to increase to allow companies to move into higher skilled production. This logic underlines the institute's R&D trajectories.

If the state's cooperation with FPT during the domestic industry-building period is an expression of nationalism in high-technological industrial development, FPT's technology-upgrading approaches still contain a high degree of this same sense of nationalism. The upgrade in FPT's technological capacities affects more than the FPT's or the domestic IT industry's intellectual assets; it also affects the state's abilities to modernize the country. This is obvious in two areas which are associated with FPT's R&D activities: the use of innovations in software to handle other non-technology issues at a national level and cooperation with the university. In these two senses, FPT completes Vietnam's national innovation system by acting as a link between the other national actors in the system, as suggested by the Triple Helix theory (discussed in Chapter 3: Literature Review), instead of waiting for the state to do so as in the original National Innovation System theory. To illustrate this argument further, the details of FPT's R&D activities are examined in greater detail below. Even though the details of these activities were obtained during the activities' planning stages, which are at a very early stage in an innovation cycle, they provide strong evidence of FPT's R&D roles as a link in Vietnam's national innovation system.

FPT's R&D activities were planned with a ratio of 70 per cent to be consumed by FPT's companies and 30 per cent to serve others in society. To start with the former, information and communication technologies lie at the heart of the institute's R&D activities, followed by biomedical and satellite technologies:

> […] besides information and communication technology we plan to invest also on biomedical like stem cell research and things like that and also space technology, like satellites. We could have a station and we could have a data service and communication services so those things in space technology we are interested in. We are interested also in green technology, sustainable technology, because it is a trend of the century and we don't want to miss, or be outside of the wheel. (Interview with author, RD2, 2010).

Funding for 70 per cent of their activities has come from the FPT Corporation; however another 30 per cent of their activities will be funded by the government who will own the final innovations, but have hired FPT to implement such innovations. RD2 provided further information on FPT's joint research with the government, firstly, on an air force project, and secondly, on a project on simulating the flooding situation in central Vietnam. In this respect, there are clear signs of the cooperative state, as the government increases the demands on domestic IT R&D activities by either proposing initiating joint projects, as in the case of FPT and the air force project, or by enabling R&D firms to propose projects to be funded.

Moving on, RD2 provided examples of occasions when the FPT Technology Research Institute acted as a link between various actors in the national innovation system. FPT's research was governed by the Ministry of Science and Technology (MOST) and the company also worked closely with other government bodies in

R&D activities, such as the Institute of Information Technology under the umbrella of Vietnam's Agency of Science and Technology (VISIT), which is part of MOST. In terms of academic research collaboration, FPT also works with local academics on Vietnamese-Japanese language translation software that aims to pair the two languages together and database the pairs. These two examples illustrate well the FPT Technology Research Institute's role as a link between academic research institutes, government research institutes, private/public funding organizations and the private technology industry in Vietnam's national innovation system.

5.3.2 A Technology-Upgrading Approach: Increasing the Scale of the Outsourcing Industry

With regard to a technology-upgrading approach that aims at an upgrade in the scale of production, the nature of the outsourcing business is such that it is already about a scale of production, where the quantity of outcomes a priority before quality. This is not to say that the outsourcing industry does not care about the quality of their work, but most outsourcing in Vietnam begins with lower skill jobs. Tuan Phi Ahn (Chair of HCA) mentioned during an interview that the majority of outsourcing firms are on a foundational level in the outsourcing value chain. They perform tasks such as data input, testing and developing components. A few firms are on a higher level conducting business analysis and business consultancy (interview with author, Tuan Phi Ahn, 2011). Vietnamese outsourcing competitiveness initially offers a number of heads rather than intellectual assets, thus any upgrade in this sense is all about an expansion in the scale of the business.

Considering this backdrop, technology venture capital serves as a prominent financier to enable the technological upgrade of scale. The business nature of technology venture capital requires unit measurements in the scale of innovation or technological production, especially venture capital that is foreign funded as explained by Breznitz (2007). Breznitz argues that foreign-funded venture capitalists aim to put firms on a stock exchange as a business objects so, they can be acquired by an MNC (2007: 27). There are two technology venture capital funds in Vietnam among fourteen other private commercial banks and venture capital funds in Vietnam, and both of them are foreign-financed technology venture capital funds. [22] The first technology venture capital firm in Vietnam is IDG Venture Vietnam which was established in 2004, followed by the establishment of DFJ Vinacapital in 2006. Even though there are no official statements from the two stating that Breznitz's account is their business model, the funds were known among local IT professionals for going public with foreign shares to aim at a larger scale of production. Tran Cong Tuong from VINASA agreed on this point when I asked him about the roles of technology venture capital as a financier for the software industry:

> I tell you, I'm working with many companies who received budgets from VCs. The only message the business owners can keep in their head is 'burn'! They said the faster we can burn our money, the more we will get.[…] They spend on investment, for example, the simple application they need for a server maybe 10 machines or 100 machines, they can actually buy 200 or 400. This is the way to burn. The way to burn is to do PR. When they sell the company shares to the public, all of them are targeting IPOs and to get money back from initial public offerings (IPOs) not from sustainable model. (Interview with author, Tran Cong Tuong, 2010).

Technology venture capital in Vietnam has a strong bond with the IT industry in general via several linkages. One of these two ventures is led by an IT veteran, Than Trong Phuc, who is a managing director of DFJ Vinacapital with a

[22] Source: http://www.amchamvietnam.com/?id=479, AmCham Member Banks and Venture Capital Firms in Vietnam - Financing Development, Accessed 22 March, 2012.

formal fundamental role in Intel's Vietnam USD 1 billion chip testing facility[23]. Both IDG's and DFJ's portfolios have a bigger presence on the Internet and in digital content than other Vietnamese venture Capital Funds. DFJ is part of the Draper Fisher Jurvetson network (USA) with vital experience in technological turning points. The DFJ parent company was behind the success of Skype and Hotmail. There are also empirical ties between the two venture funds and the growth of the domestic outsourcing sector, as DFJ publicly supports the India-plus-one model of Vietnam's IT outsourcing (DFJ (n.d.)).

With regard to their roles in the development of domestic Internet space and digital content in Vietnam, the portions between the numbers of venture capital funded Internet space and digital content companies are compared with other venture funded companies in Table 5.1.

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23 He was also selected as one of the top ten IT persons of the decade (2000-2009) for his role in locally establishing an Intel assembly facility in the HCMC hi-tech park (the ranking was made by the co-operative of IT journalists from over 30 newspapers, including the Post Newspaper under the Ministry of Information and Communications (PV November 16, 2010)).

Table 5.1 Domestic firms funded by domestic technology venture capitals by sectors (numbers of firms)

Tech-VCs	IT Industries		Other Industries	Total
	Internet Space and Digital Content	Other IT Sectors		
DFJ Vinacapital	5	-	2	7
IDG Venture	32	7	2	42
Total	37	7	4	49

Source: Author's compilation: from DFJ Vinacapital. Portfolio official site (Accessed 11 February 2012) and IDG Venture Capital official site (Accessed 11 February 2012)

From Table 5.1 it is obvious that most companies funded by the local technology venture capital funds are in the digital content industry. This can be analysed as arising from two different directions: digitalisation of non-digital businesses increases the size of the digital industry and local venture funds capitals digitalise the domestic economy.

In terms of the role of technology venture capital and the outsourcing business, despite the statistical analysis from Table 5.1 indicating the unpromising linkage between the funds and the outsourcing business when compared with the digital content business, outsourcing still attracts significant local technology venture capital, as evidenced in fieldwork findings and several reports. There are a few cases that suggest two major routes by which the pioneers of outsourcing firms entered at the very beginning: the technocratic Viet Kieu, especially those from the USA with an empirical network extending from Silicon Valley; and local firms with international links to traditional international donors, such as Japan. Than Trong

Phuc, DFJ-Vinacapital manager director who is also a Viet Kieu with an industrial connection to Silicon Valley, displays support for upgrading local outsourcing companies towards a larger scale. In interview, Than Tround Phuc mentioned that despite the trend of many local outsourcing pioneers turning to the higher-skilled business of innovation, the domestic outsourcing sector still has a huge opportunity to grow to a larger scale on the international market. This refers to the India-Plus-One model:

> I don't know what Thailand has, but one thing that Vietnam has is software outsourcing…and the software outsourcing is set up by Viet Kieu who come back to set up software outsourcing so that piece is going nicely. It's not where India is, it's not where it needs to be yet. But it's going and my goal is to help it becomes an India-Plus-One, for companies world-wide. India-Plus-One means if you don't go to India where else you go to get software done? So India-Plus-One means Vietnam. (Interview with author, Tran Trong Phuc, 2010).

The India-Plus-One model (IPO) mentioned by Tran Trong Phuc is novel in the business word. IPO is risk diversification strategies for the demand sites and marketing strategies for the supply sites (Enderwick 2011: 85). The model came from India as a famous investment destination with a relatively cheap labour cost for multinational companies in outsourcing businesses. However relying solely on India as a production site is risky, in addition to increasing labour costs in India. This has resulted in MNC investment in other sites with lower labour costs in nearby locations, with popular choices being Cambodia, Indonesia, Thailand, and Vietnam (Enderwick 2011: 85-88; HSBC 2008). As many can tell, the India-Plus-One model operates on the same principles as the China-Plus-One, just specifically for outsourcing business. Furthermore, in order to technologically upgrade in the scale of production, another competitive advantage that Vietnam offers is its cheap skilled labour in this business. There was no single set of comparative international statistics on labour costs in the IT industry. Therefore, I compared the average annual wages of IT workers in USD between Vietnam and the USA in 2010.

In Vietnam, IT occupations (covering those who are employed in hardware, software and digital content) receive 4,073 USD per year on average (MIC 2001: 27). In comparison, workers in IT occupations in the USA (under the category of computer and mathematical occupations) earn 77,230 USD per year on average (Bureau of Labor Statistics, the USA 2010).

However, it has to be noted that even though the statistics mentioned here derive from the same type of occupation – computer and related – the jobs in Vietnam are not as advanced. There are many more research and scientists jobs included in the U.S. statistics. However, the comparative statistics are still worth mentioning here as they show the cost incentives that Vietnam's IT industry can offer and that make Vietnam industrially competitive, especially in the global IT outsourcing business.

Nonetheless, having a cooperative state that works together with financial resources from domestic technology venture capital is not always a guarantee of a successful technology-upgrading story. The cooperative state has its limitations.

5.3.3 Limitations of the Cooperative State

The proposed cooperative state has certain limits. These limitations are highly political, involving the intentions of the state behinds its cooperative involvement with outsourcing business. The limitation arises from the interplay between two main factors: firstly, the political ideology that appears in the state's control over finance; and secondly, the domestic market domination by giant outsourcing firms that prospered from the foundation of the cooperative state (these firms are often the pioneers of Vietnam's IT entrepreneurial class). These limitations of the cooperative state are also a sign of counter-developmentalism in which – in this context – the state's cooperative developmentalism undermines the long-term development of the domestic software outsourcing business.

This counter-developmentalism of the cooperative state is captured in the case study of a technology-upgrading in scale approach of a Vietnamese-based IT outsourcing consortium: ITCon. ITCon emerged under pressure caused by the success of FPT. In other words, FPT as an industrial champion served the purpose of industrial promotion at the threshold of the global market. Later on this posed difficulties for domestic outsourcing companies who wished to grow their businesses further after an international introductory phase. It was the size of market share that FPT acquired at that time that acted as a barrier to the growth of other small outsourcing firms. ITCon grew out of the realisation by several Vietnamese IT outsourcing firms that their inability to secure large contracts from foreign customers was inhibiting their ability to grow their businesses. IC1 (interview with author, IC1, 2010) ITCon's chief financial officer, stated during an interview that a number of the members and potential members of ITCon had started their business at about the same time as FPT, the largest IT outsourcing firm in Vietnam; however, at time of interview FPT had over around 1,500 software engineers it could offer to its foreign customers whereas almost all other Vietnamese IT outsourcing firms had far fewer, somewhere between 50 to 350 engineers. This discrepancy enabled FPT to secure the lion's share of the software outsourcing business with large foreign corporations. One of the reasons for the growth of FPT and the relative stagnation of the other local IT outsourcing firms was that FPT had, from the beginning, other sources of revenue, including a dominant position in the mobile phone distribution market. These other revenue sources allowed FPT to hire software engineers without having to immediately place them on contract. FPT was then able to approach foreign customers with a large pool of qualified engineers.

In contrast, most of the other local IT outsourcing firms had been unable to hire a large number of engineers without the assurance of placing them on contracts, as they did not have revenue from other sources to cushion cash flow hits. Therefore, these firms' revenues and professional staffs grew and shrank with the rise and fall of business on hand, leaving the large contract market to FPT alone, with just a few exceptions (e.g. TMAs and Global Cybersoft). These smaller firms then saw that by merging with a number of their local counterparts, they could reach the necessary critical mass of approximately 1500 software engineers to compete for these larger contracts (interview with author, IC1, 2010). However, merging the other non-FPT firms together created some challenges. First of all, the main aim of the ITCon consortium was that it was to integrate and merge Vietnamese software outsourcing and regional telecom systems and then take the merged company public on the Ho Chi Minh Stock Exchange (HoSE). To do so required a sufficient level of revenue and profits to qualify as an initial public offering on HoSE. A decision was made to invite a number of foreign telecom solutions providers into the ITCon consortium. These companies were based in South Korea, Malaysia and China, according to IC1.

This was the force behind the formation of ITCon, which can be seen in the context of a technology-upgrading as a collective approach to upgrade the scale of outsourcing firms' technological capacities. Nonetheless, the cooperative state has limitations. The limit appears to be due to the monetary regulations which act as a huge policy hurdle for the technological upgrade in scale of Vietnam's outsourcing business.

The ITCon capital controls case can be explained as part of the state's centralised financial structure. As an important foundation of the transition from a planned to market economy, Vietnam's financial sector has undergone reform since 1988. Lying at the heart of the financial sector the banking system. Vietnam had adopted the banking system based on the command economy ideology, in which the main engine of the economy is state-owned enterprises. Thus, and in contrast to the market economy, financial resources – which were mainly state budgeted – were allocated to state activities through the state-owned enterprises rather than other forms of business or via the market's needs for profits (Nguyen Dinh Tai 1995: 3-4).

The initial phase in reform resulted in the on-going transformation of the monobanking system into a two-tiered banking system.[24] The second phase of reform came after 1990, with the establishment of a banking system that was more market oriented, including non-state joint-stock banks, joint-venture banks and the local presence of foreign banks (Nguyen-Xuan Nghia 2005: 200).

Despite undergoing reforms toward a market economy with a positive growth rate of the banking sector, the financial system in Vietnam is still largely characterised as far from market-oriented. [25] Secondary analyses on this topic can combine with this research's findings about the impacts of Vietnam's financial system on the development of the domestic IT industry. First of all, not only the case

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24 The two-tiered banking system consists of the first State Bank of Vietnam (SBV), with primary responsibility for central banking both on a daily-banking basis and for the plan to reform the financial sector. The second tier of this system is four state-owned commercial banks (SOCBs) (Kovsted, Rand, and Trap 2005: 79, Nguyen-Xuan Nghia 2005: 200, Ratliff 2008: 36).

25 A few reports suggest the growth rate was a result of the reforms. Nguyen-Xuan Nghia (2005: 200) reports the doubling rate of total bank deposits as a share of GDP during the period of 1990-2000, continuing with 20 per cent annually growth rate of the sector during the period of 2001-2008 (Ratliff 2008: 37).

of ITCon, but also in the development of a domestic digital content industry, e-commerce has faced difficulty in growing locally due to the reason that Vietnam is still considered a cash-based society. Cash is commonly kept in households rather than securely deposited at the banks; having a bank account is not common, and neither is the use of credit cards as a means for exchange (interview with author, Than Trong Phuc, 2010; Ratliff 2008: 37). The paucity of credit cards in Vietnam is a serious obstacle to the development of e-transactions. Tran Ngoc Ca (2005) characterises the impact of the Vietnamese state and its industrial policy mechanism on the development of the domestic e-commerce as being contradictory. For Tran Ngoc Ca, supportive interventions from the state come in the form of the state trying to manage economic elements rather than creating a beneficial e-commerce environment; thus the state’s role in e-commerce development is characterised through its controlling industrial policies as a restrictive rather a supportive state (2005: 75). This issue has pushed this research to further investigates how the lack of a restrictive financial legal framework and an e-transaction platform affect and determine the way that a domestic virtual economy grows and connects to the global one. Tran Ngoc Ca’s analytical account also supports the proposed concept of counter-developmentalism, when the state appears to strongly support a particular economic trajectory, but not necessarily always in a cooperative way with finance.

Secondly, the lack of formal commercially oriented funds in the NIS highlights the performance of other formal financial sources in the NIS. Fieldwork evidence suggests a more visible industry funded role for technology venture capital as a formal source of funding for the IT industry compare to others. However, the interests of technology venture capital do not always cover all domestic financial demands for conducting technology-upgrading processes, as in the case of ITCon.

Lastly, the growth of Vietnamese IT firms at a global level is obstructed by the restrictions upon local banking. In spite of long-term sectoral reform into a market-oriented base, there are still strong residues of state-control in the banking system which restrict financial mobilisation in favour of business operations, as in the case of ITCon. Investigating further (by hiring an investment bank and law firms) ITCon found that, if they were to make an overseas investment, they would have to keep the investment under the equivalent of USD 300,000. Investments up to this amount only require the approval of the Ministry of Planning and Investment and the State Bank of Vietnam. Any investments above and beyond that amount would require multiple ministry approvals and so very few if any had been applied for or granted, said IC1. The problem with capital mobility is a two-way dilemma; firstly to take money out of the country, then to bring money back. Vietnamese multinationals are required by law to repatriate any profits made overseas back to Vietnam every 6 months. Even though the law allows businesses to extend such repatriation up to a year or 18 months, it is still very hard to do business and let it grow under such conditions, IC1 argues. Ratliff (2008: 37) explains ITCon's experience of this as international specialists in an account in which he divides the reform into two characteristics: international standards legislation and traditional communist implementation which retains the traditional practices of Vietnam's financial system despite reform.

Eventually ITCon ceased to exist as Vietnam's financial structure, with a high degree of state control, greatly limited the cooperative state with regards to technology-upgrading approaches for the domestic outsourcing businesses. Even though the state can be very cooperative, as seen by the way the representatives of Ministry of Information and Communication (MIC) listened attentively to ITCon's lobbyists arguing its case in the forums they sponsored, IC1 told me they generally received sympathetic responses but no assurances of action.[26] Carroll summed up ITCon's experience that MIC is certainly an important ministry in the development of the domestic IT industry, but decisions regarding the acquisitions and ownership structure of ITCon were beyond the MIC's control. In summary, the way of doing business in Vietnam did not create a sufficiently smooth capital flow to ITCon. Even though the government did not give the consortium a big 'no', ITCon started to lose momentum, and sadly ultimately became non-viable.

The case study of ITCon in conjunction with the secondary literature discussion of Vietnam's financial structures and their contradictions were reviewed in this section to outline the counter-developmental traces behind the front of the Vietnamese state's cooperative developmentalism.

5.3.4 The Return of the Viet Kieu

One natural characteristic of outsourcing businesses is the international connection of human resources through particular production lines. The legacy of the Vietnam War fits well with the nature of outsourcing businesses regarding human resources because it builds on an already established international connection: the IT Viet Kieu.

Outsourcing firms owned by Viet Kieu did not go through the same route as the firms behind the establishment of VINASA in terms of finding work from the external market, yet they have the same cooperative state on their side. Despite the brain-drain issue that Vietnam has faced, remittances from Viet Kieu have been welcomed by the state as a source of economic and intellectual advantage. The 'bring the Viet back home' motto, together with the global IT connections of the

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[26] These were forums where MIC listened to the concerns and problems of the software industry (Interview with author, IC1, 2010).

Viet Kieu all over the world (especially those who have been embedded in the US IT industry) fit well with the state's aspirations for the country's industrialisation and modernisation, hence obtaining the Vietnamese state's intercession since the very early stage of the domestic IT industrial building in a cooperative way.

TMA Solutions (TMAs) is a good example of this. TMAs started from an outsourcing business with a good connection with the west. Established in 1997, when Nguyen Huu Le returned to Vietnam after having been educated and working overseas, he returned with some job offers from North American companies (interview with author, Nguyen Huu Le, 2010). TMAs is fully privately owned, but often cooperates with the state as an IT expert as well as representing the local outsourcing industry at the international level in various capacities. TMAs nowadays is not only the pioneer and one of the most internationally well-known of Vietnam's outsourcing firms, it has also commenced R&D activities since 2010 (interview with author, Nguyen Huu Le, 2010).

If the industrial prosperity of FPT shines in a collective manner through VINASA, TMAs' success shines through the Ho Chi Minh City Computer Association (HCA). Tuan Phi Ahn, a Director of HCA, mentioned that TMA is a case study for HCA to promote international business practices in global IT outsourcing (personal communication, Tuan Phi Anh, 2011). Le refers to this set of skills as a 'soft skill' (personal communication, Nguyen Huu Le, 2010). This strongly echoes the 'select-a-champion' method that once drove the East Asian developmental state, with the difference that the champion is not just being promoted by the state but also by an industrial consortium.

Another collective industrial agency for the Viet Kieu with IT occupations to connect the domestic outsourcing business with the global market (apart from purely having Viet Kieu return home and establish IT firms) is an out-sourcing portal. Tim Vo worked for the company MacAfee from its U.S. site. Vo is one of those Viet Kieu who try to promote their homeland in their current state of residence. He created the 'Vietnam Outsourcing Portal' which offers comprehensive details about Vietnam's outsourcing businesses.[27] Prior to the construction of this site, Vo paid a visit to Vietnam to have a closer look at the industry himself, and he had a chance to meet with government officials as well as other local firms – some of which he already knew from this circle of work in the USA- to discuss the idea of his portal (interview with author, Tim Vo, 2010).

The 'select champions method' has not yet completely died, despite the argument that the volatile nature of product life in the IT industry no longer allows the approach to be practicable. This argument has proved to be very valid especially in the IT industry; however, there is an exception. Considering sector-specific characteristics, the 'select champions' method works well with Vietnam's outsourcing sector at its infant stage. The cooperative role of the Vietnamese state mirrors the method in Vietnam's outsourcing industry. Even though the state does not select the champion directly, by being cooperative the state indirectly picks winners in terms of those with whom the state particularly chooses to cooperate. The case studies in this chapter that support this argument are VINASA as the state's 'little helper,' and the Viet Kieu. The limitations/challenges at the beginning of the industry's foundation and establishment restrict the local demand for work while the number of suppliers exceeds demand: hence seeking out external demand is essential. This is especially the case with the type of business that will bring higher profits than having local clients, since they get paid in a strong foreign currency.

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[27] For more details visit http://www.vietnamoutsourcing.org/

To sum up this section, Vietnam's outsourcing business has been a fundamental constitutive element not only in the structure of Vietnam's IT industry, but also domestic local IT industry consortiums: This means the outsourcing business has a lot of power in the policy lobby and financial support. Such a backdrop determines the path along which technology-upgrading processes of Vietnam's outsourcing business progress.

5.4. Conclusion

This chapter offers an analysis of the cooperative state, which is the state that arose from the perpendicular technology-upgrading approach in Vietnam's outsourcing industry. The outsourcing industry consists of many pioneer businesses that started at the very beginning of Vietnam's IT industry. Because it is well-established the outsourcing business has gained some connections with the state and, consequently, was given access to decision-making procedures, in the form of helping the state to draft Directive 58. Outsourcing entrepreneurs also continue to cooperate with the state in the implementation of Directive 58 and give feedback to the state. This cooperation between the outsourcing entrepreneurs and the government of Vietnam exemplifies the cooperative characteristics of the Vietnamese state economic developmentalism in the IT industry.

In terms of the technology-upgrading approach of software outsourcing business discussed in this chapter, the model was conceptualised from the inward direction taken by technological upgrade in Vietnam's software outsourcing business. In more detail, the process of upgrade started from global software business inwardly came into Vietnam's software outsourcing industry like a perpendicular shape. The technological opportunity and essential knowledge for technological upgrade started to flow from the global software market into Vietnam's software outsourcing business without having any solid base in Vietnam. The reason for this is that at the time Vietnam's IT entrepreneurial pioneers sought global outsourcing demand, there were few traces of domestic software demand and the domestic IT industry was at the liquid stage, the direction of technological upgrade in this model is in a perpendicular way from the global market into Vietnam's local IT industry. The connection with the global IT market through software outsourcing business acted as an arrow helping Vietnam's IT entrepreneurs to break the barriers of minimal domestic IT demands, and got connected with global sources of demand and skill suppliers to upgrade the skill of local workers. This is the first step, where knowledge and essential skills started to accumulate, that enabled technological upgrade to happen in Vietnam's outsourcing sector. Against this backdrop, technological upgrading in this chapter is conceptualised as a perpendicular model.

There is no specific technical feature of IT that shapes the cooperative state in the outsourcing business. Nonetheless, this does not mean the cooperative state worked independently from the hierarchy of newly emerged information technologies; this is because the outsourcing industry is not dependent upon particular technologies; in other words, the outsourcing business is not a technology-production industry but it is a technology-servicing business, even though the services are provided for technology-production purposes.

The outsourcing business in Vietnam has many elements that qualify them to be core artefacts in the hierarchy of emerging information technologies. The human resources model of the business is employee-centric, the distribution and monetisation is by-distributors-for-users with a strong dependence on formal capital accumulation, and the economic competitiveness of the industry is more straightforwardly obvious and is recognised by many economic performers as well as the state. Moreover, the knowledge employed for technological upgrade in the business is private-owned, thus the consumer relation between the business and users is in the black-box mode.

The technologies involved in Vietnam's outsourcing business are also perceived by the state to be core artefacts. One of the main reasons for this is that the nature of the outsourcing business requires institutional support from the state. For example, institutionalisation is required in the form of a trade agreement between Vietnam and its outsourcing partners that allows Vietnam to do business with them, or an adjustment of the state's monetary rules to comply with international monetary practices so as to allow the payment for outsourcing jobs to be paid to Vietnamese citizens.

The Vietnamese state retains its cooperative developmentalism with regard to the sector's broad scope of technological upgrading. Nonetheless, when it comes to the sector's technological upgrading in scale, the cooperative state proves to have the structure of a counter-developmental state that dwells behind the disguise of a cooperative state. This disguised counter-developmentalism occurs when the cooperative state appears to pose a huge limitation to the domestic outsourcing business when it comes to the stage of technology upgrade in scale in this business. The limitation is deeply embedded in the state's monetary structure, which works to undermine the technology-upgrading processes of outsourcing firms.

Now we shall turn our attentions to the next research findings, concerning the technocratic state and Cloud Computing technology.

Chapter 6

The Cloud, the iDragon, and the Technocratic State

6.1. Introduction

This chapter discusses a top-down model of technology upgrading used for Cloud Computing (Figure 4.1: *Four Models of Technology-Upgrading Process*). The Vietnamese state's roles associated with this model are characterised as being technocratic, so the technocratic state is characterised through the Vietnamese state's R&D activities in Cloud Computing. The state is technocratic because it conducts R&D activities by itself through a newly established industrial research institution known as the National Institute of Software and Digital Content Industry (NISCI). NISCI acts as the state's IT industrial researcher and conducts R&D activities in response to the needs of Vietnam's local software and digital content industry. NISCI is the state's first R&D institution that is industrially oriented.

Cloud Computing was selected by NISCI for two reasons, as revealed by NISCI staff in interviews. The first reason is technological: that Cloud Computing is an up and coming technology in the global technology market. Because the Cloud can be tailored according to users' requirements, Cloud technology transforms users' computing experiences by giving them a utility technology, which is a technology that is highly user-oriented. Moreover, the Cloud is a technology that reduces visible computing infrastructures in many respects. For example, a Cloud's database service can allow users to input information into the Cloud and then the database can be configured from the Cloud side with minimal physical installation from the user side. This also means Cloud providers, not the state, can centralise data management of the Cloud users, which has raised concerns with the Vietnamese state. This concern is mirrored in NISCI's second reason for its technological choice of Cloud computing: the Cloud decentralises the state's control over the management of national information. These two reasons together mean that the state works in a technocratic manner and is conducting R&D activities to make the state a Cloud provider in Vietnam.

NISCI's Cloud services are a result of a top-down approach of technological upgrading. For NISCI, innovations in Cloud Computing are conducted through highly institutionalised knowledge and modes of innovation. This means the Cloud falls into the core category in the hierarchy of emerging information technologies. Being in a core category, along with the two reasons mentioned in the previous paragraph, means the Cloud is considered by the state to be more prestigious than those technologies from peripheral categories.

This chapter will commence with a short introduction of Cloud Computing, which contains some technical details for non-IT professional readers. The chapter then will examine the local situation of Cloud Computing in Vietnam. In the third section, the chapter will examine the relation between the top-down model of the technology-upgrading process of the Cloud and the characterisation of the Vietnamese state as technocratic. Additionally, the chapter will discuss the interplay between the social shaping of technology and the technological shaping of society.

6.2 What is the Cloud? A Short Introduction

Cloud Computing is a new way to deliver and consume computing experiences across several aspects (including server, data storage, and software services such as configuration, backing up, and updating) that can be managed from the service-provider side (the Cloud), rather than from the client side, as has been the conventional practice. Most IT workers and IT-related scholars inharmoniously define this with the term ‘Cloud Computing’ (Kuyucu 2011: 1; Weinhardt et al. 2009: 36; Buyya et al. 2009: 4) but there is some contention over what the term actually defines. There are several explanations for this contention in terminology: Vaquero (2009: 50) posits that Cloud Computing is composed of a handful of already existing technologies which makes it hard to define, while Kuyucu (2011:1) notes that contention around the concept of Cloud computing implies unexplored areas for further researching opportunities that have been raised by the Cloud. Kushida et al. (2011: 211) suggests that disagreement over the definition arises from the overmarketing of firms that include other non-Cloud Computing services. However, this chapter does not propose any further definition or attempt to contest the meaning of Cloud Computing. The most commonly accepted definition of the Cloud is provided here just in order to portray the playing field in which high-tech policies, economic competitiveness and the technology-upgrading approach interact for the development and adoption of the Cloud. IT technologies are moving at an incredible pace and only time will tell which facets can be included in the most up-to-date definition; therefore technologies that are not counted as the Cloud today might be a significant feature of Cloud technology in the future.

The definitions of Cloud Computing provided by the U.S. National Institute of Standards and Technology (NIST) and IBM Corporate appear to be solid for two reasons. In the first case, NIST is the R&D unit providing technological standards under the Department of Commerce of the U.S., which is the home of many global Cloud Players. In the second case, IBM is working closely with Vietnam’s R&D agency to develop Vietnam’s public Cloud Computing and the corporation also has its Cloud Centre locally in Vietnam. In other words, NISCI emphasizes the technical details of the Cloud, while IBM emphasises the impact of the Cloud. For NIST (2011: 2):

> Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. network, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

IBM puts forward the following:

> Cloud computing is a new model of consuming and delivering IT and business services. It enables users to get what they need, as they need it - from advanced analytic and business applications to IT infrastructure and platform services, including virtual servers and storage". The chapter will discuss the novel technical points and economy of Cloud Computing based on these two definitions. (IBM (n.d.)).

The novelty of the Cloud is that it makes the computing experience more virtual, and this is a central reason why Cloud Computing has been referred to as a transformative technology (Yoo 2011: 17). So far there are three types of Cloud service models: Software-as-a-Service (SaaS); Platform-as-a-Service (PaaS); and Infrastructure-as-a-Service (IaaS). Cloud users can now enjoy new software without having it installed on the company's PCs. This means that if something goes wrong with the software or it needs to be updated, there is no need for engineers to come in and perform those tasks on a company's PCs, as these can be done from the Cloud providers' side. Another popular use of the Cloud is as a server to store data: with Cloud Computing, the server is no longer operated at a local level on users' machines because the server now is on the Cloud. The Cloud provider carries out all the computing required and delivers the server service to the Cloud users. Furthermore, the Cloud is a made-to-order technology that can be tailored to meet the size and capacity requirements to suit any individual user. This helps small enterprises to reduce unnecessary computing spending costs and makes the Cloud more affordable than traditional company computing. Perhaps the most crucial aspect that makes Cloud Computing such a phenomenon is that, unlike other traditional forms of computing, the Cloud users only require simple computing skills to be able to employ cloud computing, as everything is carried out by the Cloud provider.

Cloud computing has been named a key information technology for the years 2010 - 2011 by some academics (Luftman and Zaden 2011), but when did Cloud Computing originate? Many learned about the Cloud for the first time back in 2006 when the commercial website Amazon publicised their famous Amazon Elastic Computing Cloud (EC2).[28] However, it is hard to tell when exactly Cloud Computing first emerged mainly because of its nature as a resultant technology employing a mixture of various existing technologies, such as the Web (Reese 2009, cited in Roux 2011: 110). An account given by Kushida et al. 2011 confirms this point:

> Cloud Computing was not invented by any one architect - person or company. Today's Cloud offering emerged from the infrastructures created by the major providers for their core business. (2011: 224).

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[28] The beta version

Here it is made clear that Cloud Computing is a sort of enabling technology, the type of technology which many might refer to as an incremental IT innovation that arises from putting together different aspects of technologies.

6.3 Vietnam's Cloud Computing Panorama

This section aims to examine the broad picture of the local Cloud situation in Vietnam. It will map out key Cloud providers in Vietnam. This, in turn, will enable relationships to come to light between global and local Cloud providers regarding Cloud knowledge procurement, spillovers and technological aid (or a partnership). By identifying the key actors in this business, the local Cloud market gap can be described. This gap has led the state of Vietnam to be a technocratic state in a case of inventing the Cloud.

Tracing back the very first point where the Cloud was adopted locally in Vietnam is easier than pinpointing the first adoption on the Cloud-user side. Since the nature of Cloud Computing is less geographically specific than traditional computing (Kushida et al. 2011: 213) and since it is a package of several existing technologies that are put together, it is hard to specify the exact time when Vietnam's Cloud users first emerged. However, there are some sources that inform us that Vietnam employed Cloud technology at the same time as the rest of the world, if we consider the establishment of the two major local Cloud providers: the iDragon project and IBM Cloud Lab. The idea of forming iDragon was initiated back in 2006 (interview with author, RD3, 2010), which is the same year that Amazon Elastic Cloud (EC2) launched its beta version. iDragon was officially founded in 2008, the same year that IBM established its Cloud Lab in Vietnam, with the lab officially opened in 2010.

Not much needs to be said about a well-known and much familiar Cloud provider like IBM; indeed, a description of IBM as a Cloud provider is beyond the scope of this thesis, which focuses on Vietnam; however; iDragon needs further explanation. iDragon is a Cloud project falling under the responsibility of the National Institute of Software and Digital Content Industry (NISCI). NISCI is one of thirteen units in the Ministry of Information and Communications (MIC). NISCI was established in 2007, under the Prime Minister's Decision number No. 901/2007/QD-TTg, and became operational in 2008. The institute is authorised to be a higher skilled software and digital content research and development body.[29] NISCI acts as a government mechanism to enable the growing domestic software and digital content industry to move up the IT value chain to be at a more advanced technological level. These responsibilities are to be carried out via research and the implementation of projects. Such projects are subject to increasing demands for improving the local software and digital content industry (Vietnamnet 28 October 2008).

Vietnam's domestic IT market appears to be a potential Cloud technology market niche for the global Cloud providers, both in terms of being an unexploited market and having great potential for on-going market growth. This opportunity arises from several factors. First of all, Vietnam's economy is a large-scale developing IT adopter. High scores on two indicators of IT adoption – the Internet and telecommunication penetration rates - have enabled Vietnam to have a large pool of IT devices ready and available for adopting the Cloud. In addition, Vietnam

[29] According to one of the Vietnamese government medias, Vietnamnet online newspaper, the duties of NISCI are penned down as '[It will] carry out research projects and participate in the development and implementation of strategies, policies, and developmental projects for highly-skilled personnel in the IT and communications industries, and the development and transfer of technology in the production of software and other digital products, as well as supplying a range of industry-relevant services.' (Vietnamnet 28 October 2008).

has impressive recent IT-adoption statistics with a total number of 126 million telephone subscribers and around 3.7 million Internet broadband subscribers (MIC 2011a). Additionally other circumstantial factors make Vietnam stand out regionally among its neighbours, such as cheap labour, political stability and an impressive on-going rate of IT expenditure. For example, the IDC predicted an annual growth rate of IT expenditure in Vietnam from 17.0 per cent in 2010 to 24.9p in 2011 (IDC 2011). There are other financial benefits in Vietnam that include lower costs for IT infrastructure and state privileges for the IT industry, such as tax exemptions. Kshetri (2010: 54) suggests that one of the reasons why global Cloud players such as IBM are attracted to the developing world is because the latter can offer a cheaper hosting service.

Furthermore, Vietnam has already established a foundation technology for Cloud Computing to adopt. Cloud Computing can also be understood as a modern version of a data centre technology; therefore, as Vietnam has an existing presence within the data centre business sector, the investment of foreign companies in local Cloud Computing has a higher chance of widespread adoption and less risk of rejection by the local economy. There was definitely some established Vietnamese demand regarding data centre and computing prior to the arrival of Cloud Computing. IDC (2011) names a few of the leading local data centre providers, such as Vinadata, Lacviet, Matboao, Viettel and FPT.

IBM states on their site that their Cloud Labs are located in every region around the world, with the UK representing Europe, Silicon Valley the USA and Brazil South America. Vietnam seems to be the only emerging South East Asian site in terms of IT development compared with other advanced nations in the region such as Malaysia, Singapore and Thailand. However, the factors above explain why Vietnam was unsurprisingly chosen to be one of IBM's ten global Cloud Labs.

With regards to relations between NISCI and other Cloud providers in Vietnam, such relations mainly come in two distinguishable forms: a cooperative and a competitive form. While the latter is discussed in this section, the former one will be outlined later in the following Section 6.4: The Vietnamese Developmental State as an IT Researcher. Domestic market competition between the state's Cloud provider, NISCI, and other local private Cloud providers is examined in the course of their service models, as their competition can emerge from the same or different models of Cloud services locally. Before going ahead with this discussion, it needs to be noted that the information used for analyses in this chapter is from available sources outside Vietnam at the time of writing. As the development of Cloud Computing is fast moving, these sources might quickly be superseded. The information used is limited to that made available to the public by online news reports, online journals and online government documents. With careful selection from trustworthy sources, and cross-examination, these pieces of information are sufficient to provide an overview of Vietnam's domestic cloud situation as the basis for an analysis of competitive relations between the state and other private Cloud providers.

To start the discussion with NISCI, NISCI's Cloud activities are in the technological area of a platform-as-a-service model (PaaS). Under NISCI, iDragon's Cloud solution is referred to as an 'iDragon Cloud Platform' which acts as an enabling platform for Cloud users to connect to the Cloud (the data centre). The platform comes on top of middleware –the Cloud PC or the Cloud Box (Hoang Le-Minh 2011). The originality of the iDragon Cloud Platform comes from the disadvantages of other commonly used Cloud platforms such as Web2.0 and Virtual Desktops (Le Minh 2011).

Regarding another major Cloud provider, IBM Corporate, the company has its global Cloud Lab and a ‘High Performance on Demand Solutions’ presence locally in Vietnam. The Cloud Lab was originally established back in 2008 under a different title: the Cloud Computing Center. As IBM covers most areas of the Cloud business (IaaS, PaaS and SaaS) and deployment models (public, private and hybrid), the Cloud Lab is there in Vietnam to build a market based on Cloud demands nationally. This foundation is built by consulting local business and government with the aim of building an understanding of Cloud technology, as well as developing Cloud solutions and planning to fit specific local demands (Tran Viet Huan, interviewed by Strukhoff 2010).

There are also other Cloud providers in Vietnam. The research pays less attention to them in contrast with IBM for several reasons. IBM is one of the global pioneer Cloud providers, and therefore the presence of its Cloud Lab in Vietnam has implications beyond the economic; IBM keeps Cloud-technology development in Vietnam up-to-date with global developments. Additionally IBM’s Cloud Lab acts as the state’s technology partner, as well as the state’s technology competitor, which underlines this chapter’s analytical theme of the state as an IT researcher. Furthermore, other local Cloud providers are mostly at an earlier stage of their service development than IBM and NISCI. For example, IDC (2011) says that the local giant IT company, FPT is still in its infancy in terms of developing Cloud technology. It is also early days for both Microsoft’s Cloud in Vietnam which was initiated at the end of 2011 jointly with FPT (DTiNews April 18, 2011) and Intel, whose Cloud focus will be rolled out during 2012-2017 (2011).

At this early stage, there are already a number of local Cloud adopters both in the public and private sectors, for example, Vietnam Technology and Telecommunications Joint Stock Company (VNTT) and Quang Trung Software City. Both are IBM PaaS clients. Others are the clients of NISCI, such as the Ministry of Natural Resources and Environment (MONRE) which has adopted a Cloud solution along with other technology to handle the national disaster warning system (MONRE 2011), and other local enterprises such as the Software Business Incubator (SBT), Tan Binh Hotel and Vietnam National University (IDC 2011), who can all be considered early local Cloud adopters.

6.4 The Vietnamese Developmental State as an IT Researcher

The case of Cloud development by iDragon under its parent organization, NISCI, provides a case study of the state's roles in IT research and innovation. With regard to iDragon, the state does not intervene in high-tech industrial development by exercising its intervention through its conventional impetuses such as regulations, financial measures or other measures that encourage the technology procurement and technology incubation of the domestic firms. Rather, the state directly integrates as a researcher itself to nurture the domestic technological capacities of the nation. As a researcher, the state is thus involved at a very early stage of technology development: researching basic problems in science and technology; selecting certain pieces of technology to work on; acquiring the necessary knowledge and skills for the R&D process of selected projects, then obtaining funding and equipment; followed by technology implementation and testing and eventually diffusion.

However, the establishment of the NISCI is not the first time in Vietnam's history that the Vietnamese state has intervened in technology development. I use the term technology development instead of high-tech industrial development because the former gives a broader sense of technology development for any purpose rather than only an economic one. Prior to NISCI, there were other institutions that expressed the IT researcher characteristic of the Vietnamese state. The reason that the technocratic characteristic is captured in the workings of NISCI is because, unlike any other previous state R&D institution, NISCI illustrates the changing direction of Vietnam's public R&D agencies from being state-oriented to industry-oriented. With this point, this research further argues against the usual portrait of the state's R&D activities in Vietnam as a classic 'Ivory Tower' situation, where the state fails to diffuse any research and innovation out of the laboratories to society, as this caricature is only partly true. The diffusion of the state's R&D activities might appear to come from an ivory tower, but not because the state fails to push the R&D outcomes to be adopted in society. Rather, the state's R&D agencies are set to carry out research for the state's administration in various industries, and thus technology diffusions happened at the state level rather than the societal level. Accordingly, the whole experience of the state's R&D activities is unconnected to technological needs arising from society.

The argument can be further examined through a comparative-institutional analysis of NISCI and the state's traditional IT R&D entity: the Institute of Information Technology (IOIT). On a timeline, IOIT should be placed before NISCI to illustrate changing Vietnamese state R&D orientations over time. IOIT was established in 1976 as part of the Vietnamese Academy of Science and Technology (VAST). Over three and a half decades, IOIT has proved its position as a R&D entity serving the state's science and technology requirements. Having said that, however, the thesis does not suggest that IOIT as an R&D agency was set up solely by the state and only for the state. IOIT's R&D activities involved the state and other actors. The same can be said for NISCI: no matter how much the institute is industry-oriented and established for responding to growing demands of the domestic digital content and software industry, at certain stages of NISCI's R&D activities there will always be an orientation towards the state's science and technology requirements. Nevertheless the two institutes illustrate a difference in the approaches towards upgrading IT capacity employed by the state as a researcher. At this point, the chapter posits its second argument that amongst the diversity of the two institutes' IT-upgrading approaches, there is a profound resemblance of adherence to technological nationalism in both mentioned approaches, especially in terms of the state's choice of technology.

The research views IOIT as an impetus for 'technologising' the Vietnamese state. The research uses the term 'technologise' to refer to four main R&D activities carried out by IOIT at the state level: the implementation and application of any algorithms for the state's requirements; the state's computerisation; its policy and strategy consultations and its provision of IT studies through the national educational sector. Furthermore, the research captures the IT researcher role of the state through IOIT from three perspectives grounded in evidence: its functions; the relations between its R&D directions and its achievements in terms of application projects; and its administrative structure. IOIT functions as Vietnam's primary R&D entity that specialises in IT at two functional levels: the theoretical and application levels. At the theoretical level, IOIT researches theoretical aspects of natural science that comprise IT, such as informatics and mathematics; this includes learning through international cooperation, then diffusing the knowledge gained through IOIT's roles of consultation and training. Regarding the application level, which is more industry related, IOIT also functions to research and develop IT applications for the state's bodies to deploy them in order to solve certain problems, management issues and other requirements. Apart from the implementation and application of state-level IT projects, IOIT also commercialises its R&D applications through several channels such as IT implementation through an outsourcing contract with Japan, the establishment of a NetNam Company in order to commercialise IOIT's inventions in small PCs and assistance to the state in promoting Internet adoption (IOIT 2010). From these functions, it is reasonably clear that IOIT is a state technological initiative with priorities to focus on building the state's science and technology capacities for the state's administration as well as to increase the state's share of science and technology in the economy.

Moving on to the second analytical point concerning the relation between IOIT's R&D directions and its achievements, during the five-year period of 2006-2010, IOIT focused on the theoretical aspects of key technologies and IT applications for systems and management at the state level. IOIT underlines that the institute's R&D activities are concentrated in five areas: informatics; networking; the theoretical foundation of IT; automation and control; and system and management. This last direction is coordinated with achievements in what IOIT refers to as 'typical application projects'. These projects typically involve the computerisation process and the implementation of information systems in the state's bureaucracy, such as the Ministry of Finance, and the Ministry of Education and Training. Moving onto another of IOIT's achievements, software as a main IT product, strongly implies the idea of nationalisation, as IOIT's common software achievements are concentrated among localised versions of software such as Vietnamese character recognition, and Vietnamese text-to-speech software.

Regarding the final analytical point about IOIT's place in the governmental administrative structure as one of the institutes under VAST, IOIT has clearly been passed down VAST's main functions aiming at being the state's leading science and technology, both in terms of studying natural science for responding to the state's science and technology trajectory and consulting with the state for strategic planning and policy making (VAST 2012). This inheritance is not a new issue in this discussion. Nevertheless, analysing IOIT's administrative structure will shed some light on the route that IOIT has been taking to technologise the state as claimed, despite having both state and non-state involvement. The relationship between the state, IOIT, and the domestic IT industry is depicted through the interaction between IOIT and a line of related ministries with regard to technology development, including the MIC. The Ministry of Science and Technology (MOST), which controls the country's science and technology trajectory as well as the government's science and technologies activities, steers the direction of IOIT's R&D. The institute plans its R&D activities accordingly. As has been emphasised throughout this section in relation to IOIT's functions, which mainly are state-orientated with some minor industry-level projects, the institute interacts with the domestic IT industry by giving advice from its expertise in IT to the MIC (Interview with author, RD1, 2010). At this point it can be seen that IOIT does not subject itself directly to the dynamics of the domestic IT industry, but positions itself as an advisory body to the Ministry who monitors the industry instead.

In contrast with IOIT, the establishment of NISCI was intended to focus more heavily on industrial dynamics, as it was being managed directly by the MIC. As mentioned earlier, the NISCI was set up to be a higher-skilled R&D agency responding to the growing demand from the domestic software and digital content industry, so the institute has more flexibility in its administrative structure than the

IOIT. Instead of researching basic problems in informatics and within an ample scope of research direction similar to IOIT, NISCI's projects pinpoint specific pieces of software and digital content technology. NISCI represents the Vietnamese state as a researcher in three important aspects: obtaining foreign advanced knowledge and skills; then processing the obtained knowledge and skills and, lastly, transferring the processed knowledge and skills at a societal level.

In terms of obtaining foreign advanced knowledge and skills, NISCI obtains them mainly from industrial experts at a global level in order to upgrade its researchers' technological capacities. It was reported back in 2008, at the time when NISCI was first established, that NISCI first trained and transferred knowledge and skills specifically about digital document imaging and digital information security (such as wireless network security and digital information copyright security) from foreign specialists in these areas within the US-based LaserFiche Company and the Japan-based Trinity Security Systems Incorporated (T-SS) respectively (Tuoi Tre 31 October 2008). Obtaining this knowledge and skill from industry experts benefited NISCI: it gained more than just the essence of the technology, as the experience of a veteran of the global commercial industry regarding a specific piece of technology was also transferred to NISCI.

The second step after obtaining the desired technological knowledge and skills is to process them into different forms. NISCI offers to transfer the processed knowledge and skills at three different levels: training, consultancy and commercialising the end-users' products or services to both domestic economy and government bodies (Tuoi Tre 31 October 2008). Furthermore, as NISCI obtains knowledge under a Memorandum of Understanding (MoU), after the knowledge is processed by NISCI in association with its foreign partners, NISCI is a copyright holder as well as the foreign partners (MIC 2011b). This demonstrates that the processed knowledge and skills by NISCI are transferred to both global and local markets.

In order to be more specific here about relations between NISCI and Cloud Computing, iDragon will be examined in more detail. iDragon is NISCI's internal project of researching and developing innovations in Cloud technology. The idea of forming iDragon was initiated back in 2006, when Dr. Hoang Le-Ming, the director of NISCI, approached RD3, who worked at that time in a private IT company in Ho Chi Minh City, with the idea of researching Cloud Computing (interview with author, RD3, 2010). They then submitted the research proposal on Cloud Computing to the MIC. The iDragon project officially began two years later in 2008.

In order to obtain an essential set of knowledge and skills (for innovating Cloud technology), iDragon would first need to have Cloud-related tangible and intangible assets. With regard to the tangible assets, in the case of iDragon this translates to Cloud-related infrastructure. As part of the MIC, NISCI received R&D resources from MIC only in terms of the basic infrastructure, such as servers and PCs. Additionally, more advanced and specific infrastructure came from foreign partners. For example, a Cloud laboratory for testing a data centre was partially supported by IBM. It was reported that IBM first became the Vietnamese government's Cloud Computing consultant prior to its local launch of the Cloud Centre (Trang Anh November 27, 2010). Back in 2008, IBM with MOST established locally the Vietnam Information for Science and Technology Advance Innovation Portal (VIP). Even though the VIP did not specify only Cloud Computing, the portal was based on Cloud technology which illustrates clearly the position of Cloud technology in global technology trends at the time. The second collaboration between IBM and the Vietnamese government was directly within an R&D unit of NISCI in 2010, when IBM assisted NISCI to construct the institute's Cloud Laboratory using IBM products and expertise in this area.

It is clear, then, that IBM provides iDragon with both tangible and intangible assets to innovate in Cloud Computing. iDragon gains both infrastructure (the laboratory) and the knowledge (IBM's expertise in Cloud Computing) from IBM in one instance. The same applies to financial support from foreign partners that come with a string of knowledge and skill transfer and the commercial benefits of end-user innovation attached. Considering financial support, iDragon and its foreign partners are tied in a commercial way. As the iDragon is financed through a Business Cooperated Contract (BCC) (interview with author, RD3, RD4, and RD5, 2010) and a MoU (MIC 2011b), the financiers at the knowledge and skills acquiring stage will become co-opted copyright holders at the processed knowledge and skills transfer stage. In an interview with iDragon's senior position, RD3, he explained how the Japanese partners benefit from collaborating with iDragon through a geographical division of the final innovation's ownership. With the BCC, the Japanese partners hold ownership in Japan, while NISCI has ownership to distribute its Cloud solution in Vietnam's market.[30] This coincides with a report from MIC that T-SS is a co-opted copyright holder of the coreless computer technology researched and developed by NISC. With regard to this, NISCI acts as a mechanism to innovate incrementally by taking inputs from its workforce and foreign partners. NISCI as an institutional machine processes inputs using infrastructure and specific knowledge provided externally, building upon the scientific and engineering knowledge of

30 Interestingly, there is the same market niche for iDragon's Cloud solution in Japan and Vietnam, considering the fact that Vietnam is far behind Japan in many aspects of IT readiness.

NISCI's staff. The outcomes of this process are innovations that are commercialized by both NICSI and its foreign partners.

This practice exemplifies how less technologically-advanced economy, such as Vietnam, can manage to keep itself connected and up to date with global technology trends, a global technology market and global technology financial sources. It can also be seen that a mobilisation of cross-country financial sources enables an economy that is catching up technologically to learn how to research and develop cutting-edge and parallel technology through the global market, even if it has limited domestic technology-financing sources to invest. Discussing Vietnam's domestic investment related to R&D circumstances which is still relatively rare, RD3 outlined how difficult it was to resource a domestic financial investment for a premier innovation institute such as NISCI:

> RD3: [...] I think it's very difficult to cooperate from NISCI with the IT companies, very difficult. Because you can't see how much income (profits) you can get. But you see, if you have (the) ready product. […] And in Ho Chi Minh City they don't care a lot about R&D, they would like to have a (finished) product.
>
> Uer-Aree: (you mean) It's quick money, and you have many Viet Kieu return to Saigon that are ready to take all the clients from the Silicon Valley here. And that is the purpose of their work they are just there to test...to outsource
>
> RD3, RD4, RD5: [nod in agreement] (Group interview with author: RD3, RD4, and RD5 2010).

Furthermore, the cooperation through a BCC is suggestive of a technical alteration in the state apparatus that creates technological change in the context of Vietnam's industrial policies. Through this contract, NISCI is automatically subject to the dynamics of the international and domestic IT market. The Japanese partners would not invest in the iDragon if there was no market for the final products in Japan. Moreover, conducting research on a novelty technology that is an expansion of the notion of Cloud Computing technology is a market non-monopoly approach in itself which is a new step forward in the Vietnamese R&D institutional context. Additionally, a BCC is clearly a commercial approach to financing innovations. Against the background of all of the discussions so far, the research asserts that NISCI, as a state initiative, is clearly more flexible and has a greater level of freedom than IOIT, based on its place within the state administrative structure, in terms of finance and the laboratory.

This analytic institutional comparison between IOIT and NISCI has verified the research arguments on the transformation of the Vietnamese state's role as a researcher from a state orientation towards an industrial orientation.

6.5 Debating the Chicken or the Egg? Evaluating the Cloud or the Dragon?

According to the discussions so far in this chapter, the advancement of Cloud Computing and the emergence of iDragon pose two significant questions for the discourse on the state's roles in high-tech development, specifically in the technology-upgrading process: whether the roles of the state are shaped by the advancement of technology (instrumentative) or the advancement of technology is determined by the roles of the state (substantive).

Beginning this section with these two opposed perspectives is like viewing technology from two different angles and as much as such a debate does not seem to be realistic, it is a useful heuristic device. It does not seem to be realistic because we have advanced technologically to a point where we are used to the presence of technologies in ubiquitous and pervasive ways. This blurs the line between the active and passive interplay between technological advancement and the state's roles, especially in technology-developing economies. However, the questions are realistic because in reality the roles of the state and the evolutionary advancement of technology do interact in just such a diametrically opposed manner, just in different phases, contexts and stages along the lines of technological change.

Additionally, depicting things using such polarised opposites helps to ground the analysis in this section in two ways. First of all, the questions reflect a conventional polarity-theme characterising how relations between the state and high-tech industrial development are studied systematically. Industrial scholars have analysed the experiences of historically technologically backward economies (both in general or sector-specific senses) - particularly the East Asian Newly Industrialised Countries - who managed to transform out of such backwardness through the role of the active state, such as in the concept of the developmental state, and its younger sibling, the neo-developmental state, and achieve recognition by the global community for their success. Analysing industrial-technology development in such a manner is looking only in one direction. Even though sectoral analysis exists that advocates that the relationship between the state and technological development is sector-specific, there is considerably more analysis of the state's characteristics and its apparatuses that shape different paths in technological achievement rather than *vice versa*. In opposition to the view that the state has a determinant role in hi-tech industrial development, the study of science and technology policy focuses on the crucial implications posed by new types of technology, or by the further advancement of already existing technologies that require reconsideration from policy makers. Good examples of this body of work include those from whom this thesis has drawn earlier in this chapter in relation to Cloud technology (for example Yoo 2011 and Kushida 2011).

This reflection on the conventional polarity characterising this field maps out a gap that can be bridged in the study of state-industrial development relations. This chapter argues that the state's roles and the advancement of information technology are reciprocal, to be given the same importance. Information technology is advanced by a knowledge- advancement driven strategy on the one hand (a common example of this is the evolutionary development of the computer and computer machines) and by a socio-cultural driven strategy on the other hand (there are plenty of examples for this, such as the case of Amazon's EC2). Furthermore, this chapter contends that, based on fieldwork findings, the technology upgrading carried out by the Vietnamese state acted in both a technology-instrumental way, at the very first stage when the Cloud was initially being recognised by the state for technology-production purposes; and in a technology-substantial way, later on at a technology-diffusion stage after the iDragon's Cloud platform was implemented.

In relation to the Cloud as an instrumental technology for the Vietnamese state, the gradual developmental process of the Cloud along with its increasing global popularity was free of the Vietnamese state's social influence. Even though the Cloud had already been adopted locally by Vietnam's domestic firms prior to the announcement of iDragon, this did not contribute to the advancement of the Cloud as a technology itself. The crucial point is that when NISCI first realised the potential technological changes posed by Cloud technology, it was well aware of the Cloud's technological impact as well as possible socio-cultural and political implications for Vietnam. All of these implications had later on shaped NISCI's decision to select the Cloud as its technology of choice. As NISCI is the state's apparatus, its technological choice is also the Vietnamese state's choice. At this stage, the influences from the Cloud technology's features determined the state's choice of technology in a deterministic way.

Nevertheless, I do not in any way put forward an argument based on technological determinism to cover all the processes involved in technology development. The point I am trying to communicate is rather how the features of Cloud Computing were instrumental when the Vietnamese state first recognised its determinant tendency. This is just one of the starting points in Vietnam's IT industrial development history where the notion of technological determinism is applicable; however, Mackenzie and Wajcman et al. (1999) offer a series of arguments about and evidence on how social contexts shape both the adoption and the emergence of technologies. In one of their editorial works, Kline and Pinch (1999), question whether applying the logic of technological determinism to the state's first recognition of the political disadvantages coming as a package with the advancement of Cloud Computing oversimplifies or overlooks the logic of socio-cultural influences in such circumstances. As Kline and Pinch posit, the identities of social groups are arguably significant in an analysis of technology-society relations (1999: 114). Following on from this, the identities of the Vietnamese state create the diversity in the recognition of Cloud Computing's potential exclusive only to Vietnam's social and political contexts, which are not necessarily valid in other, different social and political contexts. This can be considered an application of technological substantivism rather than technological determinism, as I have claimed.

While I value Kline and Pinch's suggestion, I want to emphasise that paying attention to this point (when the state was attentive to the political and economic impact of Cloud Computing in a determinist way) highlights the contrast between the two theoretical thoughts underlining the different phases of the Vietnamese state's Cloud invention. After the state recognised Cloud Computing, it intervened in technological developments according to the notion of technological substantivism. iDragon - which is a reflection of the Vietnamese state as an IT researcher – has moved on from being influenced by Cloud technology towards being an influence itself on further advancement of the Cloud technology's features by inserting more technological knowledge, the state's identities and political values into the process of research and development for iDragon's innovation: the Cloud Platform. Once the Cloud is in the iDragon's R&D processes, it is no longer merely an instrumentality. Along its R&D processes the Cloud has entered a larger technological conversation: substantivism. Through the iDragon, the state as an industrial innovator has localised Cloud Computing with great potential political implications: the Cloud as a means to control and as an expression of technological nationalism. Vietnam's state-Cloud adoption is no longer viewed as 'the development of Cloud technology that determines the state's roles in Vietnam's technology-upgrading process', but is transitioning into 'the state's roles that determine the development of Cloud technology in Vietnam's technology-upgrading process'.

In fact most imported technologies are to be localised, not only the Cloud. Localisation has to be stressed more with technologies that are initially developed with the embedding of a specific culture or socio-economic contents once they arrived at the new locations, or are set up to target a different market with a different culture and socio-economic contents. Vietnam is a society with strong IT consumption, especially over the last decade which I term the period of the 'initial technological localisation phase'. This is due to some characteristics of the decade when the level of innovation was very minimal and most IT spending was on the primary adoption of IT at the implementation stage or as an enabling technology, such as the configuration of database systems in local enterprises.

This paragraph will explain how the Vietnamese state employs the Cloud as a means of control and an expression of technological nationalism. There are many reasons why Cloud Computing has been chosen to be the Vietnamese state's technology of choice. Firstly, there is the outstanding rate of growth of the software and the digital content industry; secondly, there is the global trend of currently important information technologies (especially as a transformative technology for the developing world); and, thirdly, as Vietnam is one of the emerging hubs for the global outsourcing business, there is a need for local firms to offer an outsourcing service with an enabling technology compatible with the rest of the global market. Therefore, Cloud Computing is an inevitable, compulsory technological tendency for high-technology industrial development in Vietnam, which partly relies on other countries' technological circumstances due to its outsourcing business. This means that even if the Cloud was not selected as a government technology of choice, the local IT enterprises, especially those in the outsourcing sector, would eventually be compelled to adopt the practice of Cloud Computing without the government's persuasion. Nonetheless, there is another major concern that perhaps offers a legitimate explanation of the government's technological push: the security and data privacy issues.

Cloud Computing appears on the list of the government's high technology priorities.[31] It comes in seventh place on a national list of high technology priorities for development investment. The first eleven entries, out of forty-six entries on the

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31 Prime Minister's Decision No. 49/2010/QD-TTg 'Approving the list of high technologies prioritized for development investment and the list of high-tech production eligible for development promotion.'

list, are from IT industries. It was stated clearly on the list that all the prioritised technologies are selected in accordance with the trajectory of socio-economic development, and defence and security requirements. Cloud Computing is obviously important for both. The Cloud can be used as a powerful implementation tool in the defence industry, however; this does not pose a new issue to be discussed since any security-related technologies can be used for defence purposes. Additionally, the economy of Cloud Computing adds a great security issue to its unique advantages as an information technology. With Cloud technology, the providers compute everything and delivery it to the users to consume. This means Cloud providers have full access to information and data storage live on the Cloud. This is the reason that has led NISCI to research and develop its Cloud solution. RD3, remarked during an interview:

> […]if you have important information on the Google Information Cloud, Google can see your information. It’s not fair and it’s not good, so Vietnam will have to build Cloud Computing. But you know Vietnamese companies now cannot do it by themselves. (Interview with author, RD3, 2010)

The great advantages of Cloud Computing therefore come with a great dilemma for data security and protection. As the Cloud virtualises data storage and dismisses the conventional way of localising the data at the end-user side, this opens up a new gap for the regulation and implementation of new practices in data security and protection. This also stirs up a sense of nationalism in the Vietnamese state, who as much as they want to keep up with international technology trends by developing a parallel technology, strongly wish to prevent its national data - especially governmental data - being stored by and accessible to other Cloud providers, who are mostly at this time foreign companies. Cloud technology as a government technology of choice evidentially illustrates a public technological push motivated by technological nationalism as a mechanism to rein in the fast growing high-tech economy, as well as to assist an economic area where the government feels insecure about losing control. This validates the idea of a deeply embedded state exercising control and using the role of the state to shape a market economy. As information technology becomes more virtual - in general, not solely in relation to Cloud technology - it diffuses and merges with society even in non-technological areas, in as much as it involves unskilled technological workers who constantly redefine the dynamics of the domestic IT industry both as producers and consumers. This is a two-way dependence, now that such non-technological areas and unskilled technological workers determine the new form of the economy. The state's role in this industry has been minimised. The Vietnamese state has tried to adjust to its enabling role in this industry to create some flexibility that will allow the industry to acquire new knowledge and obtain financial resources, as in the case of the iDragon project. However, there are also areas where the government prefers to take control and take on a jeopardising role that distorts the true dynamic of the industry and its consumers, the society. The nature of knowledge and skills for mastering IT technology are moving toward more and more tacit characteristics which are embedding outside of institutional settings, out of the state's view and come with non-technological characters. This leads to an expansion in sub-sectors with a virtual character as never before. Not only do sub-sectors of the IT industry become more virtual, but as the case of Cloud Computing demonstrates, the provision and consumption of IT can also be virtual. These signs show that innovations in the IT industry increasingly engage with those who are unskilled and non-institutionalised. This strongly contests conventional accounts of technology-industrial policy in various aspects, such as the state's technological choice, the pattern of technology learning and the domestic technology market's ethical environment (for example the security issue in the case of Cloud Computing's development in Vietnam that prompted technological nationalism in an economy that tried to catch up technologically).

It remains to consider the issue of the state's technocracy, an important topic in the discussion of instrumentalist and substantivist technology. Feenberg posts a thought-provoking question about technology-politics relations: whether to view technology as a subdivision of politics in the substantive way where an advancement of technology is politically driven, or to consider politics as a subdivision of technology in the instrumental way, with the notion of technocracy playing a key role (1999: 2). On technocracy in Vietnam, there are two main aspects to be outlined. The first aspect to be discussed is doubt about a socialist state becoming a technocratic state. To define the term here, 'technocracy' is typically the replacement of public opinion on certain technical decisions with views or decisions from an appointed technical expert. Vietnam as a single party state ruled by the communist party is nowhere close to being a state that makes a decision based on democratic procedures. However, and regardless of its polity, Vietnam has a hybrid economy - the socialist-market economy, with a mixture of private and state owned enterprises. If the domestic IT industry is taken separately from IT as a whole in Vietnam, it can be seen that the IT industry is largely private, while the IT industry remains state owned. For example, in the telecommunication market, the company that owns the majority of market shares in terms of fixed telephone and Internet services is a state-owned company, the Vietnam Post and Telecommunication Group (VNPT) with 73 per cent and 72 per cent of market shares respectively (MIC 2011a: 51, 107). This point will be returned to later on to discuss in more detail the degree of state control despite decentralisation. Therefore, Vietnam's domestic IT industry does have some degree of free market: for example, the leading IT enterprises are privately owned such as FPT software, JSC, TMAs, CSC Vietnam, and Vina Corp (V.N.G) (MIC 2011a: 111-115). The number of private players suggests that the IT industry has a certain degree of freedom from the central state. Such freedom leads to the question of the extent to which the Vietnamese state is technocratic in IT industrial development.

In order to make the Vietnamese technocratic state discussable, there are several characteristics of Vietnam's IT industry that need to be compared with the conventional concept of technocracy beforehand. The state holds supreme power over the domestic IT industry, which can be considered 'public' in the case of Cloud technology. Combining these features with an actor discussed in detail in this chapter, NISCI, we can bring together all the components required to identify the Vietnamese state as technocratic. As NISCI is the state's institute that functions to carry out higher skilled activities to improve the local software and digital content industry, NISCI's technology of choice should be one that represents the 'public's' demands for technology. However, much of the evidence (from the national technology list and from the original fieldwork for this thesis) shows that Cloud Computing was selected because of foreseeable and unavoidable global technology trends, and for security reasons rather than being demanded by the domestic software and digital content industry. There is no obvious evidence that the domestic industry has required the Cloud. One might argue against this point that NISCI functioned to improve the domestic software and digital content industry; therefore choosing the most cutting-edge technology is logical and legitimates NISCI's functional efficiency without the consent of the 'public'. However, the Cloud being the 'next big thing' does not necessarily translate into its being a key technology that improves the domestic market; indeed, the improvement might not be effective for the majority of the local market. This is the reason why technology is environmentally specific to a certain degree, as no matter how impressively advanced and useful the piece is, if a particular society is not ready to adopt the technology and adapt to a new technical practice that comes with it as a package, then the technology will be redundant. Having said that, however, this chapter does not suggest that the transformation of the state to be an industrial researcher and an innovator is unconstructive. The point of criticism rather falls on an institutional issue that misinterprets its own objectives, as in the case of NISCI. In addition the Cloud Platform appears to be more ‘local-go-global’ rather than *vice versa*, considering the knowledge that was required from NISCI’s foreign partners and the assimilation of an end-user product through the BCC with the Japanese partner. Again, this outcome does not match the objectives and institutional mission of NISCI. In conclusion the Vietnamese state’s choice for its technology push in high-skilled research and development level was determined by the opinion of a set of technical experts - NISCI - rather than the ‘public opinion’ of the domestic industry, given NISCI’s original responsibilities. Thus, regardless of the polity being a single-party state, the characteristics of the Vietnamese state are captured by concept of ‘technocracy’, considering its choice of technology in one of Vietnam’s national technology-upgrading approaches.

Given that Cloud technology is chosen to be the state technological choice not purely due to technological consideration but also from nationalist and political concerns, the domestic market might not be ready for the change brought in by the Cloud. This matter, after all, comes out during the diffusion process of Cloud technology, which calls for an extra push for the wide adoption of the Cloud in the domestic market. A few reports highlight this issue. For example, the need to persuade domestic network providers and digital content providers to employ the Cloud model for providing their services was addressed during the Chief Information Officer (CIO) conference in 2011 (Buu Dien Octerber 11, 2011). The IDC have also suggested that domestic Cloud adoption requires great attention from the government and services providers to encourage domestic IT users to adopt the Cloud, rather than just relying on Cloud investment from the Cloud providers (IDC 2011). Furthermore, since there was no mass domestic demand for the Cloud, there was also no legal ground to regulate Cloud adoption in the country. The government of Vietnam is still at the early stages of debating this issue, as reported by the government media portal, the Vietnamnet online newspaper. Opinion among domestic leading Cloud providers and Cloud users on the legal issues related to the domestic development of Cloud Computing is divided (Buu Dien 9 September 2011). A few stakeholders fear that the specific regulation of the Cloud will impede the economy of the Cloud and might create an unfriendly environment for small Cloud players in the economy, while many others are still sceptical about the implementation of Cloud technology in the public sector and thus demand guidance from the government (Buu Dien 9 September 2011).

The impact of Cloud Computing in a developing economy such as Vietnam has also received a great deal of attention from scholars whose works are on the developmental aspects of Cloud Computing, like Greengard (2010) and Kshetri (2010). Both these authors posit that Cloud Computing will be a powerful tool to bridge the digital divide between developed and developing nations. This is due to the simple fact that Cloud Computing eliminates the requirement of a physical IT infrastructure. In more detail, even though the Cloud still requires a massive infrastructure in order for the Cloud services to be operated, this massive infrastructure is not always the one that Cloud users have to own. This means that economies with a less advanced IT infrastructure to start with can now skip over all the procedures required for constructing their IT infrastructure by just simply being in the position of a Cloud client. As a Cloud client, developing economies now have as equal access to the virtual Cloud infrastructure as advanced economies do (Greengard 2010: 18; Kshetri 2010: 47). This, again, suggests an advance that is becoming a new characteristic of IT, which clearly and automatically involves developing countries in new approaches that bring in domestic technological change.

Transforming from a physical infrastructure-based economy to an infrastructure-less one is unquestionably a part of IT moving forward to a more and more virtual reality. The two different economies surely call for different means of technology procurement. Vietnam has experienced both of them in different phases of its high-tech development and in different sectors; for example, the arrival of the Intel chip assembly and testing facility, and the arrival of the IBM Cloud Lab which both officially opened in 2010. Some may object to the comparison of the two, as they are definitely different sectors of the IT industry: Intel’s plant is for the hardware sector, and IBM’s lab is for the digital content sector; however, the two represent the transformation point in IT development from an infrastructure-based one increasingly to a (physical) infrastructure-less one. Furthermore, this transformation grounds the chapter’s arguments by shedding some light on the new evolutionary traits of IT advancement. Therefore, despite being from different sectors, the two examples combined provide a concrete example of how the relation between the technology-changing characteristics of IT and technology-procurement works, and are compatible with the chapter’s arguments.

With regard to the arrival of Intel's facility, this investment, without doubt, raises Vietnam's IT profile globally. This is especially so in light of the well-known case of Intel in Taiwan, which helped it catch up technologically to such an extent that Taiwan is now at the global IT frontier. However, the investment of Intel in Vietnam is mostly based on the country being a sizeable hub of cheap labour. Vietnam can use Intel to upgrade the country's technological capacity in terms of high-tech infrastructure; local education improvement; increasing demand for local technological suppliers, which increases market competition; and increasing numbers of technology exports.

The case of the technology-upgrading approach that gradually builds up from the foreign direct investment of global technology players, as in the case of Intel's assembly and testing facility, is similar to that of the outsourcing business. In both of these examples, the country is modernised and industrialised based on cheap technical and technological skilled labour. While the inward foreign investment of Intel into Vietnam consists of a physical facility present locally and the export of the final material products out of the location of production, the outsourcing business of Vietnam is connected with the global market through the advancement of the IT infrastructure in order to send out the final service product. However, this type of technology-upgrading path is not always compatible with the new emerging genre of technologies. The case of iDragon speaks cogently to this point.

While the discussion about how the technologically backward nations will benefit from the Cloud is properly contextualized in terms of IT infrastructure equality with the technologically-advanced nations, the economic and socio-technical implications of the Cloud's diffusion for changes in the conventional approach of data management in the context of technologically less advanced economies have not yet been discussed. Since the Cloud reduces the number of physical servers, it reduces the need for technical workers at server administration levels. Even though this issue is an important phenomenon, it is beyond the scope of this thesis; in any case, Cloud adoption in Vietnam is still at a stage where it is too early to investigate such changes in the relationships between Cloud computing facilities and labour.

6.6 Conclusion

This chapter offers an analysis of the technocratic state, which is how the state worked in regard to a top-down technology-upgrading approach with Cloud Computing technology. The Vietnamese state upgraded the nation's technological capacities by undertaking industrial IT research and conducting R&D activities in order to develop local Cloud technology, instead of leaving it to the local IT firms to do it by themselves. This is novel in the Vietnamese economic context, as the state's R&D activities have often been characterised as being state-oriented projects that respond primarily to the state's needs rather than industrial needs.

In terms of the top-down model of technology-upgrading in Cloud Computing as discussed in this chapter, this model was conceptualised from the characteristics of the direction of the three stages where technological upgrade by NISCI were processed. In this model the invention, innovation, and diffusion of iDragon occurred step by step, by ranking from a smaller group of technological producers to a bigger group of technological consumers. As discussed earlier, the Cloud was a product of already existing computing technologies, and therefore it is hard to pinpoint who exactly invented the Cloud. However in the context of iDragon, in the model's invention stage the design's specifications were consulted by NISCI's Japanese partners who acted as an inventor in this case. Then the iDragon's design's specifications were passed down to NISCI to innovate a Cloud platform out of such specifications. Lastly the final product of this technological upgrading process was pushed down to be consumed by Vietnam's IT industry in the diffusional stage of the model. In other words, the model is also top-down with regard to the direction where the state's technological push occurred, considering that the Cloud was the Vietnamese state's technological choice that was selected for upgrading the technological capacity of the domestic IT industry. Against this backdrop, technological upgrading in this chapter is conceptualised as a top-down model.

Cloud Computing in Vietnam has many elements that qualify it to be a core artefact in the hierarchy of emerging information technologies. The human resources model of Cloud Computing is employee-centric, the distribution and monetisation is by-distributors-for-users with a strong dependence on formal capital accumulation and many economic performers and the state recognise the Cloud's importance for economic competitiveness. Moreover, the knowledge employed for technology-upgrading in the Cloud is privately owned, thus the relationship between consumers and the state's Cloud provider is in the black-box mode. More specifically, the Vietnamese state's concern over information surveillance control in regards to Cloud technology shifted the position of the Cloud in the hierarchy of technologies from being peripheral due to lack of visibility back to being in the core category.

The shift from producer-oriented to user-oriented computing in Cloud Computing has created a new set of conditions for how data security and privacy should be handled. This is mainly due to the fact that all data stored in the Cloud is accessible for configuration purposes from the Cloud provider side. On the other hand, this means that certain clandestine information at the state level can be accessed by Cloud providers who have mainly resided outside state control. The Vietnamese state desired to take a technocratic surveillance role and did so by recreating itself as one of the Cloud players. As such, it developed a parallel technology alongside the global Cloud players instead of using other conventional interventions to take control of this situation. With this motive, iDragon thus emerged and the state was institutionalised as a technocratic state that is an innovator as well as a data holder itself. Importantly, the thesis does not suggest that Cloud Computing in Vietnam was by any means the sole state technology of choice that the state selected to allay its national security concerns. Cloud Computing is obviously a powerful IT trend with clear economic benefits. Nonetheless, the conspicuous security concern should not be dismissed as an influential motivation for this state's technology push. With the state's security concern, there is also room for the state's counter-developmentalism as the state still injects some level of control over the choice of industrial technology. As the nature of Cloud Computing decentralises the state's control over national information, the state used its technocratic role to upgrade the technology used in the Cloud as this would justify the state's role back in the management of national information.

Now we shall turn our attentions to the next research findings: the App economy and the irrelevant state.

Chapter 7

The App Economy and the Irrelevant State

7.1. Introduction

This chapter discusses a bottom-up technology-upgrading approach for the App Economy (Figure 4.1: *Four Models of Technology-Upgrading Process*). The Vietnamese state's role in this model is characterised as being irrelevant. The Vietnamese state is irrelevant due to the state failing to benefit from the public-owned–knowledge, which is also non-institutionalised knowledge, used in the innovation of mobile phone application technology. Generally speaking, the essential knowledge for software development can be classified by ownership type into two categories: publicly-owned knowledge and privately-owned knowledge. These two categories should not be confused with Ernst and Lundvall's knowledge taxonomy (1977) that was mentioned in Chapter 3: Literature Review, as the knowledge taxonomy of Ernst and Lundvall emphasises different kinds of knowledge (know-what, know-why, know-how and know-who), while the dichotomy of publicly- and privately-owned knowledge emphasises that different sources of knowledge help determine whether the role of the state is irrelevant or relevant. These two sources of knowledge appear in the software industry as non-proprietary software (software developed from publicly-owned knowledge which is non-institutionalised knowledge) and proprietary software (software developed from privately-owned knowledge which is institutionalised knowledge).

This chapter examines the irrelevance of the state in a situation in which a domestic firm utilised a bottom-up model of technology-upgrading in the App economy for the Android mobile phone operating system. This model of technological upgrading was conducted using publicly-owned knowledge which came in a form of non-proprietary software as a final product. This non-proprietary software is implemented using highly non-institutionalised types of knowledge and modes of innovation. Considering publicly-owned knowledge (as a source of knowledge for technological upgrade) and non-proprietary software (as a final product of technological upgrade) in the context of the hierarchy of emerging information technologies, both publicly-owned knowledge and non-proprietary software fall into the peripheral category of the hierarchy. This explains the state's irrelevant role in the App economy, as the state views non-proprietary software merely as cost-saving software that provides Vietnam with an alternative to high-priced, copyright-protected proprietary software. For this reason, the state fails to realise the technology-upgrading potential of this type of peripheral artefact in its industrial policy.

This chapter begins with a short introduction to the App economy. Next, the chapter examines the different types of knowledge commoditisation that make publicly-owned and privately-owned knowledge distinctively different. Finally, this chapter characterises the irrelevant state in association with the bottom-up model of technology-upgrading in the App economy.

7.1.1 A Short Introduction to the World of the App

The chapter's case study was derived from the App economy for the Android mobile phone operating system. Nonetheless, the chapter's analysis focuses mainly on the App economy, rather than being an analytical account of the technological progression of the Android system. The majority of both the Android system and the App economy have been developed based on uncommodified knowledge, at least in terms of their philosophy. The Android is a Linux-based mobile phone operating system acquired later by Google. The different functions for Android can be obtained by purchasing free downloads, either permanently or for a certain limited time as a trial, through the Android Market Place – which acts as a collective venture for Android users to browse and purchase/free download applications for the Android. This market place is a part of the App economy particularly useful for mobile smart phone applications. The market rival of the Android, and contender for its market share, is Apple Inc. and its App store, that has been developed primarily on commoditised knowledge.

The App economy's profitability cannot be directly calculated, like with the Android's market place. The Android system is a highly creative technological product that is included as part of the formal economy, while its application market place is seen as a part of the informal economy full of amateur or volunteer developers, or an additional service and small revenue source for both professional, amateur, and voluntarily or paid developers. The different treatment of the two aspects of Android may have something to do with how their non-proprietary revenue is monetised – in other words, how their productivity is measured. The Android operating system is owned by a big corporation in the IT industry, Google Inc., despite the fact that the Android was developed upon an open source principle. It was originally Linux-based and still mainly is, whereas Google earns its revenues on Android from several channels. The most obvious revenues to the public are the defaulting of Android users to the Google search engine, the selling of advertisements and the leasing of its market place to App developers to display their applications. The revenues of these are well-documented in Google's revenues, while the revenues of App production cannot be calculated directly. For example, sales taxes on Apps vary by where the developer is based, and their employment status – employee or freelance. Thus it is hard to estimate accurate tax incomes from this information. Furthermore, there are also loopholes in the legislation on tax declaration, such as sales though virtual money which is not real money but royalty credits, as in the case of Microsoft points. I am not going to go into greater detail on this as it is out of the scope of the research; however, these issues are mentioned here to illustrate how difficult it is to measure the App economy's profitability.

Difficulties in finding an accurate measurement of productivity in the App economy are not uncommon in the IT world, regardless of the intellectual property types. There are wider debates on whether IT adoption directly increases the amount of firms' profitability. For the wider debate on this topic, see Carr's (2004) coverage of the debates on the relation between IT and business values.

There is surely more than one explanation for why productivity cannot be calculated. The thesis's analysis, based on the fieldwork, demonstrates that policy makers do not always recognise a great share of the productivity of knowledge goods, when they are commoditized through a non-IPR regime. The measurement of productivity in knowledge goods has not encompassed technologies outside of the IPR protection regime and thus does not represent the true value created by the emergent knowledge-based economy. Actually, the true value created from knowledge goods is hard to capture comprehensively; however, this does not mean that the increasing value of the knowledge economy is immeasurable. One solution, as mentioned in Chapter 4: Technological Upgrade and Research Tool of Analysis, is to measure value though a comparison between a newly-produced value and the originally-created value of a certain unit of production and so illustrate three defined value-added features: innovation, the increasing value of products or services and the expansion into new economic areas. Innovation for its own sake implies an increase in technological knowledge and skills, even if it does not find a market.

7.2. Knowledge Commoditisation for IT Industrial Production

There are two well-developed dominant schemes of knowledge and information exchange in the software industry. The first scheme captures values created from knowledge development and exchanges in market transactions through a commoditization process; it is referred to here as a private ownership scheme. Another scheme captures the value created through a non-commoditization process of such knowledge, which is referred to here as a public ownership scheme. In terms of software as a specific sector, proprietary software is the dominant product of the private ownership scheme, while free software and open source software are the dominant products of the public ownership scheme.

7.2.1 The Private Ownership Scheme

In this scheme, the market value of knowledge and information used for producing software and digitally related works in market transactions is captured through a commodification process whereby prices are assigned through the knowledge and information used in the production.

As mentioned earlier in Chapter 4: Technological Upgrade and Research Tool of Analysis, on the hierarchy of emerging information technologies, knowledge and information naturally belong to the public commons as they are non-rival, unlike material possessions, in that multiple consumptions cannot diminish their quantity and quality. However, this nature makes it impossible to extract a price out of such knowledge and information, and to make them into private property that can be privately owned. However, IPR advocates manage to overcome this nature by creating three ways to extract a price from knowledge, transforming it from a knowledge commons into privately-owned intellectual property. There are three common approaches to commoditise such knowledge within the software realm: patent, trademark and copyright. With these three approaches, intellectual properties are created and assigned to impose scarcity for a set time period.

Historically, the World Intellectual Property Organization (WIPO) started to consider software as intellectual property back in the 1970s and thus needed some provisions for an international standard on the protection of computer programs, establishing a mechanism to do so called a *sui generis* system (WIPO (n.d.)). By that time source code sharing had already been established as a conventional practice in software engineering for over a decade.[32] For example, source code sharing was a common practice among the software engineers engaged in the famous MIT hacker culture in the 1960s.[33] It was also in the 1960s that the software industry started to be distinct from the hardware industry.[34] However, a *sui generis* system had no legislation for enforcement, which led the WIPO to consider other mechanisms to handle this issue. Accordingly the WIPO created a mechanism whereby copyright protection could be applied to computer programs.[35] By the 1990s, the WIPO had proposed two provisional bodies of law – which the WIPO called 'soft law': the

32 Source code is a set of computer commands to operate software, which is written in a programming language (Buckmand and Gay 2002: 3)

33 The term 'computer hackers' during that time referred to those who enjoyed programming regardless of whether it was a profession or hobby (Stallman 2002: 17) The same term nowadays has a completely different meaning as it is associated with an illegal act of accessing someone's source codes or any digital information without the owners' permission.

34 In practice, there are some historical events suggesting the distinction between the two industries. One of these is the infamous court case 'The United States v. IBM' which took place from the second half of 1960s until 1982 (May 2005). IBM had bundled software and related services with its computer machines for customers. The courts considered this to be an act of monopoly which violated antitrust law. As a result, IBM separated the software business from its hardware business.

35 The crude version of computer program components are: object code (code in binary form – one and zero); source code (code computer language that is understandable by humans); and documents (WIPO (n.d.)).

Computer Programs Directive of the European Community (1991) and the more international proposal, the Trade Related Aspects of Intellectual Property Right (TRIPS), which was agreed in 1994 and came into effect in 1995 (WIPO (n.d.)). TRIPS is a multilateral agreement overseen by the World Trade Organization (WTO) to provide a standard provision for the protection of intellectual property in seven combined forms altogether.[36] There are three types of IP protection available in the software industry from these seven forms according to TRIPS: copyright, patent and trademarks. TRIPS considers software as a form of literary work under the scope of the Berne convention (1971) (WIPO (n.d)).

This means that TRIPS considers that the way ideas are expressed in software is of the same type as the way ideas are expressed in language in literary works, and this is the basis underlining copyright in the software industry where copyright is an IP protection for forms in which ideas in software are expressed. The ideas in software are also protected by the patent system. May (2008: 80) suggests that out of the three, patents are the core means by which the market value of information technology innovations is commoditised. This is a strong point as patents are designed to protect the ideas behind the software, while many people can have the same idea but find different ways to express that idea. Notably, out of these three, trademark, which is a protection for names or symbolic identities in relation with particular software as the software's market identity, seems to receive the least criticism that it is against the nature of software engineering from public ownership advocates.

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[36] As stated on the WTO's website, protection afforded by TRIPS covers seven areas: namely copyright and related rights; trademark; geographical indications; industrial designs; patents; the layout-design of integrated circuits; and undisclosed information (WTO (n.d.)).

TRIPS is heavy criticised as having been influenced by giant software corporations and business consortiums in the U.S. It was substantially criticised for being an instrument of MNC influence in the TRIPs negotiation round and for offering little to developing countries who are in a position of being software importers and who pay high prices for IPR-protected software (Sell 2003: 96; May 2006: 128-129) .

TRIPS is referred to by the WIPO as 'soft law' because it has no enforcement at the international level. Nonetheless, TRIPS uses the WTO membership conditions to passively coerce countries that would like to join the WTO to have their national legislation and other mechanisms on intellectual property protections strengthened to meet the standard of TRIPS. Countries that want to join the WTO must alter their national legislation to meet TRIPS' standards. As such, TRIPS as soft law attached to WTO membership conditions attracts criticism that this type of passive enforcement is unfair to developing countries. Such countries who wish to join the WTO face tremendous pressure, even though intellectual property protections contained in TRIPS have already been criticised for, at times, hindering individual innovation because firms own the IPR rather than individual innovators (May 2005).

In terms of software-sector specific critiques, the IP protection provided by TRIPS is the starting point for consequent complexities in the dynamics of development in the software industry. One of the main rationales claimed by IP protection advocates is that TRIPS will protect innovation in the IT industry by moving knowledge-based creation away from its natural origins as a public common good to private property. If knowledge-based creations are left within their original public realm where they are freely accessed and consumed, then inventors will not be rewarded financially for their hard work and creativity. The argument follows that this would discourage people from driving forward the advancement of already existent technological entities. This is the same rationale underlining the design of IP protections in other industries. There are three consequent complexities due to this rationale: the increase in the price of software though temporary monopoly, the incompatibility of the design of the IPR mechanism with the nature of software production and debates over whether the design of IP protection serves its purpose of protecting and fuelling innovation. These three complexities have been thoroughly analysed by advocates of public ownership, who argue that their scheme tackles these complexities more sustainably than private ownership schemes.

I am not going into greater detail on the complexities of the design of IP protection, as this is beyond the research's focus. However, a short introduction to this has underlined circumstances where IP protection takes place as well as its relations with the emergence of public ownership schemes as an alternative design to capture value created from knowledge in the software industry.

7.2.2 The Public Ownership Scheme

The opposite approach to commoditising knowledge in the software industry is the non-privatization of software as a knowledge good in the IT industry. Non-privatized software had long been a traditional practice of software development in the form of source code sharing prior to the emergence of the official software industry in the US, and of course existed before the term proprietary software, which is the result of an IP protection regime for privatized software. The birth of proprietary software had automatically constituted the birth of free software. Those engaged in the conventional practice of source code sharing, had to seek a way to prevent knowledge being privatized into proprietary software, which restricts users from the further distribution of software, including source code sharing. This was the beginning of the emergence of free software. One of the free software developers in the 1980s who managed to develop a socio-economic agenda of free software, which constitutes non-privatized software in the present, is Richard Stallman, a founder of the Free Software Foundation. The Free Software Foundation was established in 1985 but was initiated back in 1984 as free software under the name GNU, which stands for GNU's Not Unix. Stallman's main intentions for the GNU project, including both the GNU system and GNU software, were to provide the public with alternative software that provided the users with the freedom to further redistribute it.

The public ownership scheme is going to be examined based mainly on Stallman's views, as he is an originator of the public ownership scheme which later branched out into many less clear sub theories. Therefore, to avoid confusion, it is best to stick to the original philosophy of the public ownership scheme.

The philosophy behind GNU disagrees with the assignment of private ownership over software and other computer systems (such as operating systems) and seeks to keep the ownership of these technologies, including their further developments, in the public realm. Stallman believes that this will benefit the public as users as well as software developers by limiting the ability of big corporations, which prioritize business profits over the advancement of software and over users' freedom over their purchased software, to promote the privatization of knowledge through the political system. As he explains:

> […] The existence of software inevitably raises the question of how decisions about its use should be made. […] who should decide whether this is done the individuals involved? Or another party, called the owner.
>
> Software developers typically consider these questions on the assumption that the criterion for the answer is to maximize developers' profits. The political power of business has led to the government adoption of both this criterion and the answer proposed by the developers: that the program has an owner, typically a corporation associated with its development. (Stallman 2002a: 121).

As such, Stallman defines types of freedom associated with the Free Software project. Stallman is very clear about what he means by being free; the 'free software' refers to users' freedom to further distributes the software, not 'costless' in terms of price. This means that free software is not always available to the public free of cost. The cost is left to be decided by the individual users, as Stallman puts forward: 'The free software philosophy rejects a specific widespread business practice, but it is not against business. When businesses respect the users' freedom, we wish them success' (Stallman 2002b: 24). In greater detail, software fits Stallman's free software definition when users have the freedom to use, modify or redistribute the original copies, or further distribute modified versions of the software for any purpose and at any price (including remaining costless) (2002b: 20). There are two core issues involved in free software: first of all the users will need to have freedom to access the original software's source codes; and second the users' freedom, as with the original copy of the software, remains the same for the modified version of the software.

Making software and source codes sharable and modifiable means that free software is subject to being developed and maintained only through their users, who are also their further developers and who communicate with each other. This leads later to a great number of emergent communities in relation to free software for various purposes, such as: to provide technical support for particular free software; to act as a forum for trouble shooting, questioning and answering technical or social issues in association with the software and to provide further updates of the software. Against this backdrop, these communities also act as a meeting point for free software users, as well as a pool of technical and technological knowledge of software and software-related technologies. The development of the kernel for the GNU project was finally finished as a complete operating system in 1992 (2002b: 28) through the availability of another free software project, the Linux kernel. Even though the GNU project is a combination of the GNU system and the Linux kernel (2002b:28), as time has progressed the economic basis and philosophies of the two have not stayed the same. Stemming from the original free software philosophy initiated by Stallman, there are other types of software distribution that have roots in the philosophy of free software nowadays, such as ‘open-source software’ and ‘free and open source software’. All of them have different economic, social and political implications and thus are used for different technical (and social and political) purposes rather than technological ones, as is going to be examined in the following section.

7.2.2.1 The Economy of Free Software

Stallman disagrees with the economic advantage argument of private software ownership: that the society will benefit more in terms of technological advantage if software is privately owned. The argument for private software ownership is based on the logic that once software is privately owned, its distribution is not costless and the owners will be rewarded for their creation. When the owners are well rewarded, it is argued, they simply will create more other types of further software developments and society will benefit from the greater availability of variety and further advancement of software. Stallman points out the hole in this argument. He posits that while the economic rewards of privately-owned software might encourage the owners to create more or better versions of the software, this software is still not what the users (the society) need or want (2002d: 49). This comes back to the main philosophy of free software: that the users should have freedom to use, distribute, redistribute and modify the software according to their needs or personal preferences. As such, the economy of free software is based on these types of software users' freedoms.

The three mechanisms previously mentioned through which the ownership right of privately-owned software is exercised- copyright, patent and trademark - must be discussed to understand the economy of free software. To begin with, Stallman does not disagree with the copyright concept in general. He believes that the concept might work well in a certain economic sector, as in the case of the printing industry which is the origin of the copyright system for business practice, but it is unsuitable for some sectors, including software (2002d: 47). The system has a tremendous effect on the future of free software as people can assign a copyright over the free software or the further development of it. This means that the free software developers might not retain freedom over software to whose development they have contributed if someone turns it (or part of it) into proprietary software. In order to deal with this paradox, Stallman introduces a copyleft system, which is a system that has often been mistaken for an anti-copyright system, in the form of a General Public License (GPL). Stallman explains that the copyleft system is rendered from copyright laws but used for the purpose of keeping free software always free. Copyleft is a mechanism for forbidding the assignment of private ownership to free software, its further development and other software that has at the least some free software in it (Lessig 2002: 12).[37]

With regard to the patent system, the economy of open source software is constituted more by a desire for a competitive and technological advantage over proprietary software than the free software economy. This characteristic is reflected clearly in the issue of patents for the free software proponents; as Stallman tells us, the reason behind keeping free software patent free (even though it means in particular areas that features of free software will be in a less advantageous position than proprietary software) is to retain the key values of the free software scheme in maintaining its users' freedom rather than to try always be in a position of technological superiority to proprietary software (Stallman 2002b: 30). Free software advocates object to the patent system in general, but not to copyrights and trademarks, because the patent is a type of monopoly practice and provides fewer benefits to society as a whole. Even worse, the patenting mechanism, which gives a temporary monopoly over ideas and the use of such ideas to some who first invent a product for that patent, is against the fundamental purpose of writing software. Stallman puts this point nicely:

> […] in computer science, [repetitive source codes is] the most obvious way to generalize anything. You did it once, so now you can do it any number of times, you can make a sub routine. (2002a: 103).

[37] A technical term for this is any software that can be counted as derivative work of free software's derivative work (2002).

According to this, society would benefit if subroutines were widely shared among programmers, which is an idea opposed to the patent system.

If a trademark is the commercial identity of a piece of software, free software, according to Stallman, presents its identity more philosophically than legally: *free software, free society*. The software's operating system, GNU, asks clearly on its official site (www.gnu.org) that its developers not apply any trademarks on GNU software and documents and this is to be set as a standard for further development to follow (GNU: (n.d.)). Despite the belief that GNU does not need trademarks, the trademark system does have a huge impact on further progress according to the free software philosophy. One of these advancements which underlines the escalation of the irrelevant state is the ambiguity between the distinction of free and open source software, including the issues surrounding trademark registration.

As the economic mechanisms of free software are based upon the philosophy of software freedom rather than financial benefits, free software developers earn their living through various channels such as selling related services and charging fees for selling copies of the software; however, these are software-related financial channels. There are also knowledge-related financial channels involved in the development of free software, such as teaching the technical knowledge used for free software development or advances in technological knowledge obtained from the development of free software. The chapter's case study, the IVC company, is an example of the latter case: when the company upgrades their technological capacities into an innovation by acquiring the essential knowledge from another rendition of free software, open source software, as will be examined in greater detail later on. The philosophy of free software has more recently given rise to the emergence of open source software, which is not the same as free software, but rather is developed on a competitive advantage of having the source code accessible, either on a full or limited basis.

7.2.2.2 The Economy of Open Source Software

Open source software has its origins in the free software movement. During the 1990s, a few software developers started to doubt the commercial viability of free software, and started to use a new term, as well as a new practice, called open source software. The open source movement became a separate entity from the original free software movement officially in 1998, when it was established as an official community under the trademark, Open Source Initiative (OSI).

The OSI acts as a committee body providing a standard definition for open source software. According to the OSI, open source software means more than just making software source code accessible. From the official definition, making the source code accessible and also enabling it to be used and modified, and further redistributed lies at the heart of open source software (OSI: (n.d.)).[38] The committee board of OSI is the body that approves open source licenses using the criteria of the open source definition, and this license is the main economic mechanism which illustrates the boundary line drawn between open source and free software.

To examine this point in greater detail to avoid any confusion between open source software and free software, an open source license is compared to one of the free software licenses, GPL. While the open source license complies with its definition, a variant of which states that further distributions of open source software do not have to remain as open source (definition no. 9 ‘License Must Not Restrict

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[38] For full details on the open source definition, please refer to Appendix C

Other Software' (OSI: (n.d.))), GPL is an expression of copyleft's will to retain further distributions of free software as free software. This has a huge implication in terms of business practice, as further developments of open source software can be transformed into proprietary software and thus it is more popular in the business world than free software, since free software will always remain free.

To sum up, the difference between free software and open source software is that free source software can be modified by users, but the modifier cannot receive intellectual property rights for the modification; in contrast, with open source software, the modifier can receive intellectual property rights on the modification, although the original open source software remains available for other users to modify. Despite its impact on business practice, open source software is often confused with free software because of its various names and uses in business. This confusion provides the backdrop explaining why non-proprietary software is seen by many (including the irrelevant state) as a peripheral technology in the hierarchy of emerging information technologies.

7.2.2.3 The Economy of Free and Open source Software

Apart from open source software, there is also another type of software that was developed based on the philosophy of free software: free and open source software (FOSS). As the name implies, this type of software is a combination of free software and open source software. Such a combination is done for social purposes rather than technical purposes. FOSS is a term that grew up in the context of development studies, rather than computer science and business studies. There is no clear record of when this term was first introduced, but it has been commonly used by international economic organisations in the development field, mostly referring to both free software and open source software as a costless type of software, an alternative to proprietary software and a means for developing countries to deal with software piracy. These factors amount to a perceived economy of FOSS which would be more precisely called a developmental economy of FOSS. May (2006: 131) puts this point well:

> Despite the philosophical differences between free software […] and open source […], like the United Nations Educational, Scientific and Cultural Organization (UNESCO) and a number of non-government organisations (NGOs) many people in Africa use the combination phrase free and open source software, or FOSS, to encapsulate the distinctiveness of non-proprietary approaches to software development and deployment.

The heavy influence of the developmental economy of FOSS, which underlies the Vietnamese state's roles in nurturing the adoption of free software and open source software for IT industrial development, has actually given rise to the irrelevant state proposed here, particularly in the process of technological upgrading, as examined in the following section.

7.3 Characterising the Irrelevant State

The irrelevant state is one of the features of the counter-developmental state proposed in this thesis as characterising the Vietnamese state. In the irrelevant state, the state's industrial intervention in developing technological skills and capacities to upgrade Vietnam's domestic technological production is irrelevant. This irrelevancy arises when the interventions become disconnected from achieving the developmental target because the state and society incorrectly perceive the potential of emergent technologies, incorrectly viewing some as inferior.

The Vietnamese state's perception of the unequal prospects among technologies is the main reason causing the irrelevant characteristic of the state's role regarding open source software in the development of domestic information technology. In relation to the proposed hierarchy of emergent information technologies, the technological perspective that underlines the birth of the irrelevant state is the application of an IP protocol which determines that open source software is only a peripheral technology (why this is viewed as peripheral will be discussed later on in Section 7.3.2: Policy Analysis). Furthermore, in particular the chapter argues that despite the similar technological capacity between proprietary and free/open source software, the two dominant principles in the philosophy of software are unevenly socially constituted in the proposed hierarchy of emergent information technologies. This unevenness has led to the divergence of the Vietnamese state's roles between the two in technology-upgrading approaches.

Both primary and secondary sources demonstrate how the state's role in regard to the promotion of open source software for industrial usage is irrelevant in Vietnam. With regard to primary sources, the fieldwork research enabled a close examination of the relation between the Vietnamese state's industrial intervention and the domestic technology-upgrading approach based on the procurement of knowledge from an open source community. Supportive evidence came from a domestic software company based in Ho Chi Minh City, IVC, along with other actors in Vietnam's domestic IT industry, such as technological venture capitalists. In addition to this, secondary sources of evidence derived from archived documents and local media accounts were used to analyse government activities in the promotion of aspects of high-tech industry related to the chapter's case study.

7.3.1 The Innovation Story of IVC

The adoption of technological learning from an open source code community for hi-tech industrial usage is rooted in Vietnam's local IT industry and very much associated with the domestic technology-upgrading process. The chapter's case study, IVC, is an example of this. The company has upgraded its IT capacities from being an implementer in an outsourcing business to becoming an innovator in the App economy by using an online open source code community for technological learning for the purpose of radical innovation.

The company's background is that IVC is a local subsidiary in Vietnam of a Japanese mother company, the ISB Corporation.[39] IVC is an offshore and outsourcing unit for software development for ISB. From the Japanese mother company's point of view, IVC takes advantage of Vietnam's cheap, skilled IT workforce.

Since its establishment in Ho Chi Minh City in 2003, IVC has become one of the main outsourcing companies employing young IT graduates and IT workers in Vietnam. This is a successful company that has no connection with the Viet Kieu (Vietnamese overseas), unlike other commonly found outsourcing companies in Vietnam (as discussed in Chapter 5: Software Outsourcing and the Cooperative State). Rather, the company is a beneficial establishment developed from the long bilateral trade connection between Japan and Vietnam.[40] Since its establishment, IVC has expanded into areas of the company's specialty across various areas of the IT market, such as working with various operating platforms, experience in a variety

39 For more details visit http://www.isb.co.jp/

40 More details about the relation between Vietnam's outsourcing business and Vietnam's trade partners and donors was discussed in Chapter 5: *Software Outsourcing and the Cooperative State*.

of database technologies and designing language. Despite the success of the company and its good reputation, IVC faced a tremendous challenge regarding the heavy demands of the work from Japan. Relying on an external IT market's demands as well as the Japanese parent company's decision making power meant that IVC found it difficult to come out of the shadow of ISB, its own mother company in Japan. This limited its economic benefits and technological capacity.

Regardless of IVC's original technological area of business, the company more recently has been involved in the technology-upgrading process as an innovator. The company has shifted between both businesses and levels of technological skill within the IT industry, moving from implementing outsourcing to innovating mobile phone applications. It obtained all the necessary skills and knowledge to do so mainly from an open source-code community, which is located outside the reach of the state's industrial development mechanisms. This is the first indication of the irrelevant state.

Originally, IVC was a start-up only for outsourcing, specialising in the technological areas oriented around the telecommunications industry. However, the company's technological specification was changed in 2009 due to the economic downturn that hit the worldwide economy. The amount of work supplied from external markets such as Japan was decreasing. The drastic decrease in outsourcing work demands from Japan's ISB put the managing board of IVC under pressure to keep up with their pre-recession level of income. Meanwhile the widespread adoption of an open source mobile phone operating system, the Android, in the Vietnamese telecommunication market appeared to be a growing market opportunity that was resisting the recession. This trend was viewed by IVC's senior leader, ILF2, as a great opportunity to escape the recession trap as well as to upgrade IVC's technological skills. With his status as an IT industry veteran with 11 years of experience in Vietnam's IT industry, ILF2 had the idea to turn the crisis into a sustainable opportunity by upgrading the company's technological ability to innovate. IVC was able to take advantage of the fast-growing domestic telecommunications industry because it learned to innovate using external knowledge available at a minimum cost from an online open source code community: The Open Embedded Software Foundation (OESF).[41]

The OESF is an extensive international platform, as it is a free of charge source of technical knowledge, that was initiated in Japan in order to gather people together who had the same interest in the development of an Android-based embedded system in the hope that the result of working together through this platform would eventually standardise the adoption and further development of the Android system across various devices and market environments. To this end, the OESF provides everything from the system architecture to functions through forums for problem solving and sharing know-how, downloadable parts of previous developments and even a business plan. All these features make OESF a good source of learning for first-time innovators or for anyone who wants to get involved in R&D activities for the very first time. ILF2 recognised this as a source of know-how to-innovate; however, the first problem was how to convince the Japanese mother company to grant permission to let IVC get started with R&D activities when the purpose of IVC's establishment was just to be another outsourcing hub for the Japanese mother company. Furthermore, the financial benefits of an R&D investment take longer to return after it has been invested. ILF2 explained:

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41 For more details visit http://www.oesf.biz/

> ILF2: […] Because you know the outsourcing, they can get the money from…
>
> Uer-Aree: Very Quickly?
>
> ILF2: (nodding) outsourcing but for R&D they have to wait for a long time and maybe no profits so the first investment is not a big amount, and the second year we have to persuade them to invest more. (interview with author, ILF2, 2011).

Nonetheless, the promise of getting IVC's technological capacity improved, to benefit the outsourcing business of the company at a minimal cost, was sufficient for ISB to let IVC make an endeavour:

> I made a plan with some students and numbers and persuaded them. I analysed the situation of the company […] at first I have to persuade them […] about the dependency of IVC to ISB Japan. Because if ISB dies, IVC will die too, so we have to reduce the dependency. That why we have to do R&D, so that is the way I persuaded. (interview with author, ILF2, 2011).

After obtaining official permission to conduct R&D activities from ISB, IVC had to focus on R&D processes with a minimum budget allowance. IVC started its R&D project without a budget from the ISB. The support from ISB for IVC's R&D activities came in the form of permission for IVC to use its engineers (ILF2 told me that the number was two engineers) and computing facilities (which started with an Android machine and two PCs). With just these input resources for IVC, innovations were only possible given the availability of free software and open source software that came with a great deal of online community support, such as the OESF, where cutting edge and up-to-date knowledge as well as innovation methodology were presented; prompt, quick responses were given to questions asked by other members; access was provided to customers' point of views and a platform was maintained to share experience and customers' feedback. Using all of these features, ILF2's small team finally upgraded the company's technological capacity two years later in 2011 when the company released its innovation, the Android printing framework that more recently has developed into an application called 'StarPrint'.[42] With the open source software community as a starting point for R&D activities, IVC nowadays encompasses further R&D activities tailoring R&D to customers' requirements.[43]

With its move into R&D, IVC is one of the small domestic firms that is successful in technology upgrading in different business areas within the same industry. It upgraded into this area by using technological learning from a knowledge source that has not been commoditised for private ownership. The Android system's source code is accessible to public and it has an open platform for technological sharing among the open source software community. The Vietnamese developmental state has nothing to do with IVC's achievements. In other words, the state's industrial development roles were irrelevant when dealing with publicly-owned technological knowledge for the domestic technology-upgrading process. Despite the promise of such publicly-owned technological knowledge that is available to be explored in the open source code communities, the case study of IVC unfortunately indicates that the state's industrial development roles, which can be expressed in terms of related policies and activities, are irrelevant in this instance. When asked about the relation between IVC's technological upgrade and

42 For more details see http://www.isb-vietnam.com/index.php/en/products/252-starprint.html

43 For more details see http://www.isb-vietnam.com/index.php/ivc-industry-sectors/97-research-development.html

government policy, ILF2 could not provide any specific details from his experience with IVC's R&D activities:

> ILF2: Actually the government has some kind of special policy for R&D. I'm not clear, but there are some policies.
>
> ILF2: You are not clear because your company hasn't benefited anything from [those policies?].
>
> ILF2: No, we don't have! (interview with author, ILF2, 2011).

In the interview, ILF2 was not asked directly about government policies regarding open source software, but his company R&D activities were all focused upon open source software, thus his statements also indirectly account for the interplay between the Vietnamese government's industrial policy and open source software.

The state's mechanisms for industrial development neglect open source software because they treat open source software and its knowledge communities as merely a cost-saving alternative to proprietary software. This argument is also applicable to the technological production of open source software: the state sees open source software and its communities as initially offering a product for selling product-related services rather than seeing open source software and its communities as a source of technological learning for innovation. As a result of this perception, the state of Vietnam has become irrelevant in this type of technological-upgrading process based on the open source/free software approach.

In addition to the experience of IVC's innovation without the state, uncovered during my fieldwork, there is also supporting evidence from policy analysis. The analysis of government policies shows that the policies aiming to nurture the domestic IT industry in relation to open source software focus on adopting it as an alternative to proprietary software to reduce costs rather than providing incentives for nurturing open source based innovation. This is not to say that the irrelevant state completely fails to support the use of open source software to foster domestic technological capacities among IT firms; however, it seems that, for the time being, the latter mission comes second in comparison with the first one, the adoption of open source software. There are, to date, three industrial policies directly targeting the development of open source software for the sake of modernising and industrialising Vietnam by 2020. The main open source software policy was introduced in 2004: 'The overall project on application and development of open source software in Vietnam from 2004- 2008 (Decision No. 235/QD-TTg)'. This was followed by another two specific, detailed documents on the adoption of open source software products within state agencies and organisations, that were introduced in 2007 and 2009: 'Promulgating the list of open source software products which meet the use requirements of state agencies and organisations (Decision No. 08/2007/QD-BTTTT)' and 'Promulgating a list of open source software products qualified for use by state agencies and organisations (Circular No. 41/2009/TT-BTTTT)' respectively.[44]

7.3.2 Policy Analysis

Out of the three policies, Decision No. 235/QD-TTg, which is the first one to be introduced, is the only one with details on how open source software should be pursued in the context of domestic information technology development, which does

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44 The actual texts of Decision No. 235/QD-TTg, Decision No. 08/2007/QD-BTTTT and Circular No. 41/2009/TT-BTTTT are in Appendix D

not cover only the case of the IT industry, but also domestic information technology consumption. The other two policies, Decision No. 08/2007/QD-BTTTT and Circular No. 41/2009/TT-BTTTT, address specific details of open source software products that are going to be used in state agencies and organisations such as OpenOffice.org and Unikey.

There are three agendas for open source software development in Vietnam which create the irrelevant role of the state as the three agendas do not provide a mechanism to support open source community based products outside the state's realm. The three agendas encompass three areas: firstly, the adoption of open source software within the state's structure in the cause of saving money; secondly, as a method to reduce the amount of pirated software, thus strengthening copyright protection; and finally, the commoditisation of open source software in Vietnam in a state-centric way. [45]

The main criticisms against these three agendas in relation to the irrelevant state are that they do not support an actual dynamic of innovation that could be constituted from knowledge embedded within an open source community. The open source community is community centric and highly integrated in an informal setting rather than state-centric in a formal setting, which is central to the three above-mentioned open source related policies.

Nonetheless, it needs to be made clear before moving on to further discussion that the irrelevant state concept is not a critique of the Vietnamese state's

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[45] The policy's objectives are as follows: '1. To accelerate the application and development of open source software, thus contributing to the protection of copyright and reduction of software procurement expenses. And promoting the development of the information technology industry in general and Vietnam's software industry in particular. 2. To build up the contingent of technicians who are qualified for and master technologies, and promote their creativity in the application and development of open source software. 3. To create a number of special information technology (IT) products suitable to the domestic application conditions and demands and based on open source software.' For more please refer to Appendix C (1).

industrial involvement as a non-industrially oriented one. The proposed irrelevant state characteristics derive from the state's industrial trajectory being implemented in a top-down direction involving industry in a very state-centric way, rather than it not being industrially oriented. The state's strategies for implementing the use of open source software for the development of the local IT industry do not respond directly to the needs of domestic IT firms who have already embedded themselves in the online open-source community. Rather, the state's strategies have been to try to formalise the open source community locally within the state's realm. This is clearly shown in the establishment of the Vietnam Free and Open source Software Association (VFOSSA) at the end of 2011 under the umbrella of the Vietnam Association for Information Processing (VAIP). VFOSSA's main purposes are to initiate an open source community locally in Vietnam and to commercialise open source products domestically in affiliation with the state.

VFOSSA's chair, Dr. Nguyen Hong Quang, is a veteran in open source software as he has been active in the global open source movement since 1996 and initiated the establishment of the community locally in Vietnam from 2000 onward (Vietnam e-Government Symposium (n.d.))' through the NukeViet community which is a community on the technologies of the Content Management System (a set of computer programs for editing and publishing contents). In addition to community building, VFOSSA also affiliates with many local open source software companies, many of which are connected with the state to name but a few VINADES, JSC. which is part of VAIP and the first open source joint-stock company that bases its technological upgrading on a local open source community like NukeViet (VINADES, JSC : 2012), and CngTT&NDS, which is a project of the National Institute of Software and Digital Content Industry (NISCI). These are examples of state strategies within the field of open source software, which are largely irrelevant in supporting firms which are embedded in global open source communities, as in the case of IVC. The absence of state mechanisms in this regard worries Dr. Quang, as he expressed his concerns that the state will need to provide a legal framework for local open source firms to be able to make money. Quoted in the government media portal, the VietnamNet Newspaper, Dr. Quang said:

> In the world, open source software can live well not on the licenses, but on the services. However, in Vietnam, there has been no regulation on the norms of INT services in general and open source software in particular[…] As a result, there is no basis for open source software firms to define and collect service fees […] Firms have to dodge the laws through different ways in order to survive. (VietnamNet 25 February 2012).

Further evidence supporting Dr. Quang's concerns is the exclusion of technology developed based on a philosophy of open source products from the main policy detailing what types of support the state of Vietnam is willing to provide, as in Decision No: 19/2001/QD-TTg (Government of Vietnam 2001).[46] This decision does not act as an impediment to the use of open source knowledge for technological upgrading processes, as it does not specifically exclude the development of open source software for R&D activities: it just does not specifically support it. When looking into further details of the policy, there are three types of government support offered in this policy: taxation, capital for enterprise and land rental. There is nothing that can be applied as government support if the knowledge concerned ultimately originated from open source communities. With regard to the incentive of

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[46] The text of policy Decision No: 19/2001/QD-TTg is in Appendix E

land rental to IT firms, the state provides half-price land rental for selected firms during the infant period of the project's execution (Government of Vietnam: 2001). This does not help firms that have already established and expanded their technological capacity into a different business type, as in the case of IVC.

The last critique of Decision No. 19/2001/QD-TTg's open source exclusions is that the unit of measurement in the policy is the type of computer products rather than the ownership's type of knowledge procurement for IT production. This may explain why it emerged in the fieldwork that this policy had become irrelevant to IVC's technology-upgrading process. For example, the policy states that the supporting capital provided by the state is aimed to support firms with their expenses in the investment of technological production and related matters:

> When there arises the need to invest in building production establishments, the enterprise may borrow the State's development investment credits from the Development Assistance Fund for a period of not more than 10 years for each separate loan. The capital-borrowing enterprise shall not have to mortgage its assets, but must not assign its assets before it has repaid all its debts (both principal and interest) for each loan.

As the investment in open source based technological production is mostly free of cost and is embedded in human resources, this policy becomes irrelevant since it is aimed at computer products not content:

> The enterprise directly producing computers shall be allocated a full per cent of the normal working capital, the deficit shall be covered with the State's development

> investment credit loans from the Development Assistance Fund corresponding to a production cycle.

In addition, the state needs to approve the project, which implies that the project has to be in the formal sector:

> The enterprise shall be supported with the State budget capital source reserves for scientific and technical research in research and development projects after the project is approved.

The final method by which the state attempts to promote open source is by pushing to replace proprietary software by open source software within its own agency and organisations. This movement from the state aims to promote open source software by starting with the state and moving outwards towards society. By doing so, the state not only aims to familiarise local software users with the adoption of open source software, but also to familiarise local software developers with technological features for developing open source software. All of this is done for the cause of IT industrial development, as already mentioned throughout this chapter, and to promote the state’s intention to reduce the amount of software piracy. However, the latter intention is against the free and open source philosophy, as the state’s push for open source software over proprietary software takes the freedom of choice away from software users. This criticism of the Vietnamese state’s roles in IT industrial development has been voiced in the media, and among free and open source software advocates.

Some interesting examples here include ‘The Attack of the Operating System Site’ and ‘ZDNet’, sites registered outside Vietnam where technical people voiced their concerns from a technological point of view, of how Vietnam’s polity has gone too far by mandating the replacement of proprietary software with open source software across the government bodies. This mandate takes away software users’ freedom of choice over software consumption, as well as mistaking the technological benefits of open source software (OS ATTACK: 2009; Blankenhorn: 2009). One example criticism is:

> […] when we talk about open source in the developing world. Mandate open source? Force everyone to use Linux? That's...that's...communist! Can they do that? Yes, they can. If, like Vietnam, they're communist to begin with. Actually you don't have to be communist to do what Vietnam has done. (Blankenhorn: 2009).

Another example comes from the ‘The Attack of the Operating System Site’:

> Many people have criticised Vietnam for this radical implementation of open source software and even calling it “communist”. But really is it communism or actually doing the correct and moral thing. (OS ATTACK: 2009).

However, the criticisms on these two sites further raises the thought-provoking implication that the Vietnamese government’s mandate on this matter may not benefit the country over the long-term and may not benefit the image of open source software.

7.4 Conclusion

This chapter offered an analysis of the irrelevant state, which is the characteristic of the state that arose from the bottom-up technology-upgrading approach in the Android's application technology. The chapter's case study is a domestic IT firm that conducted R&D activities with the use of non-proprietary software that is available to the public via online open-source software sites, where users can exploit knowledge on the site at a minimum cost (free or almost free of charge). As such, these R&D activities have high economic competitiveness potential, as they are produced with a minimum investment cost with regards to the cost of knowledge acquisition for R&D activities. Nevertheless, the irrelevant state fails to utilise such sources of economic competitiveness in its related industrial policies. In other words, the state's industrial developmental instruments are irrelevant, as the failure to capture the non-cost-related potential of publicly-owned knowledge, which is expressed through the production of non-proprietary software.

In terms of the bottom-up model of technology-upgrading of the Android's application technology discussed in this chapter, this model was conceptualised from how essential knowledge of Android's application technology were gathered to be used for technological upgrading. Considering that IVC obtained essential knowledge from publicly-owned sources which were non-institutionalised, technological knowledge in this model thus has a character of being ubiquitously embedded within different segments of society. IVC grounded this public-owned knowledge up into its more institutionalised technology-upgrading process to innovate the company's Android application. Against this backdrop, technological upgrading in this chapter is conceptualised as a bottom-up model.

Android's mobile application technology in Vietnam has many elements that qualify them to be peripheral artefacts in the hierarchy of emerging information technologies. The human resources model of the App economy is people-centric. The innovation model is a ubiquitous model, with a process of improvement that opens up to amateur developers (from Table 4.2, this refers to 'from technical hype to technical reality'). Innovations in the App economy are heavily dependent on informal capital accumulation, thus the App's economic competitiveness is less obvious and less recognised by other economic performers and the state. Moreover, IPRs Protocol of the knowledge employed for technology-upgrading in the App is publicly owned.

A degree of counter-developmentalism also emerged from the state's lack of understanding of the economic development potential of non-proprietary software. The irrelevant state is well behind the curve of the technological trend; the evidence used in this chapter suggests that the Vietnamese state viewed non-proprietary software mainly as a cost saving software alternative to pricey proprietary software that is bound with a package of intellectual property right issues. Even though being cost-saving is one of the potential benefits of non-proprietary software, it is not the only one. With regards to economic competitiveness, non-proprietary software can offer increasingly shared publicly-owned knowledge and the upskilling of the online community, who are behind the construction of non-proprietary software.

Now we shall turn our attention to the next research findings: the counter-developmental state and online games.

Chapter 8

Online games, the Virtual Economy, the Counter-Developmental State and Forward Trends

8.1 Introduction

This chapter discusses a multi-layered model of technological upgrade in the context of online games and the emergence of virtual economies in massively multiplayer online role-playing games (MMORPGs) (Figure 4.1: *Four Models of Technology-Upgrading Process*). The Vietnamese state's role in this model is characterised as being counter-developmental. The state is counter-developmental because it fails to recognise the economic benefits of technological upgrade that come from the emergence of a virtual economy. On the top of this failure to recognise these benefits, the counter-developmental state has also cracked down on many activities in online games (including their consumption) and all activities related to the virtual economy, as the counter-developmental state views these as a form of 'social evil'.

In more specific detail, the state considers the consumption of online games and related activities (especially the MMORPGs) to be a 'social evil' based primarily on a moral panic in society.[47] This moral panic exists especially among generations of Vietnamese who are older than most gamers and is not empirically

[47] According to the government of Vietnam, online games are 'games played on the Internet with the interaction between players and servers of enterprises providing online game services, and among players.' (Government of Vietnam: 2006). However, the government of Vietnam limits the scope of online games through the state's management (2006) by focusing mainly on multiplayer online games: 'Online games defined in this Circular are massively multiplayer online games (MMOGs), including massively multiplayer online role-playing games (MMOPRGs) and casual games.' (2006). This chapter demonstrates that the state is counter-developmental regarding the type of online game referred to collectively as MMORPGs.

well-founded: to date no systematic study has confirmed the relationship between online games and the negative effects reflected in the moral panic. While excessive consumption of everything, including online games, is likely to have negative effects, the most effective way to solve the problem is to deal with the problem of overconsumption rather than to try to control online games.

The multi-layered model of technological upgrade through online games is conducted by its consumers, who are gamers. Online gamers play to obtain certain virtual gains such as digital coins, items, passing game levels and obtaining special powers for game avatars. These virtual gains are the game's artificial scarcities, which gamers seek to overcome. Gamers technologically upgrade to be traders in the virtual economy when they exchange virtual gains with other gamers for economic benefits. These trading activities in the virtual economy are often referred to as 'gold farming', and the gamers who conduct such activities are called 'gold farmers'. This type of technological upgrade is multi-layered because the virtual economy, which is an outcome of the technology-upgrading processes, is tightly connected to its origins in online games.

The consumption of online games leads gamers who are not online game developers to produce goods in the virtual economy. The characteristics of this virtual economy match those of peripheral artefacts in the hierarchy of emerging information technologies. The knowledge and mode of innovation in this type of technological upgrade are not only non-institutionalised, but also blur the distinction between production and consumption, and between skilled and non-skilled workers. Because the Vietnamese state perceives the activities in this virtual economy to be not just peripheral artefacts but even 'social evils', the state's economic developmental role in this type of technology-upgrading process is counter-developmental and Vietnam risks falling behind the curve of the technological trends in this virtual economy.

This chapter starts first with an introduction to the online games industry in Vietnam. Second, the chapter examines the different roles of online games in Vietnam: online games as technological hero versus online games as a ‘social evil’. Finally, the chapter will characterise the counter-developmental state through its attitude towards technology-upgrading processes in online games.

8.2 Introducing Vietnam’s Online Games Industry

In 2009, the government of Vietnam first published an official statistics report, *The White Book on Vietnam ICT 2009*, on the development of Vietnam’s IT Industry. The Minister of Information and Communications, Dr. Le Doan Hop, stated that obtaining accurate statistics on Vietnam’s IT industry is extremely difficult because the industry is growing quickly and very highly socially networked (MIC 2009 : 5). This statement indicates the challenges in obtaining official and trustworthy statistics on Vietnam’s online games industry, although some related statistics provide an indication of the growth and economic contributions of that industry.

In this section, the growth and economic contribution of Vietnam’s online games industry will be viewed through the lens of sector revenue within the context of a digital content industry.

In order to outline the economic benefits of online gaming in the IT industry, the online games sector is merged with the video games sector, and is referred here as computer game. This is due to the advancement of the video games distribution model that increasingly become more digital, thus also creating a share in the online game industry as well (Marchand and Henning-Thurau 2013: 152).

The economic impacts of computer games contribute to many sub-sectors of the IT industry, as the value chain of the game industry encompasses all the three sub-sectors of the IT industry (OECD 2005: 17). For example, computer games sector involved the hardware sector with regard to the production of their game consoles and platforms (2005: 17), the software sector with regard to the production of their middleware (2005: 19), and the digital content sector with regard to their digital online features such as online gamer accounts known as an ‘online pass’ (Marchand and Henning-Thurau 2013: 152).

Statistically, Marchand and Henning-Thurau (2013) provide a clear picture of the economic benefits of the computer game industry by comparing the game industrial revenues with several entertainment industries. In 2012, the global revenues for game hardware and software were around 67 billon US dollars, with an extra 14.8 billion US dollars from virtual economic revenue, and together the revenue of the game industry came five time higher than the global music revenues in 2011 which standed at an estimate of 16.5 billion US dollars, and also came close to the movie industry revenue in 2011 which stood at 69.4 billion US dollars (2013: 141). These numbers lead Marchand and Henning-Thurau to draw a conclusion that the computer game industry has moved from being a niche industry to a highly competitive one (2013: 141).

8.2.1 Industrial Revenue

The government of Vietnam has officially divided its domestic IT industry into three sectors: the hardware, software and digital content industries. Online games form a major business that contributes to the growth of digital content: major leading enterprises in digital content mention online games as a focus. Accordingly, the material on the digital content industry in the aforementioned official report

(MIC 2009: 83; MIC 2010: 37) may be helpful for understanding the online games industry.

Table 8.1 Revenues of Vietnam's IT Industry in Three Sub-Sectors, Year 2008 and 2009 (Million USD)

IT Industry's Sub-Sectors	2008	2009	Growth Rate of 2009 (%)
Hardware	4,100	4,627	12.85
Software	680	850	25.00
Digital Content	440	690	56.81
Total Revenue	5,220	6,167	18.14

Source: Vietnam Information and Communication Technology White Book 2010 (MIC 2010)

According to Table 8.1, digital content accounted for the smallest share in the whole Vietnamese IT industry; however; it possessed the highest growth rate out of the three industries. Digital content was still relatively new to Vietnam and the industry could grow substantially before reaching the saturation point, possibly becoming the biggest part of the Vietnamese IT industry.

8.2.2 Industrial Wages

Table 8.2 Numbers of Workers, Revenue and Wage per Worker in the Vietnamese IT industry, Year 2008 and 2009

IT Industry's Sub-Sectors	Number of Workers (Person)		Revenue per Worker (USD/Person/Year)		Wage per Worker (USD/Person/Year)	
	2008	2009	2008	2009	2008	2009
Hardware	110,000	121,300	37,200	38,145	1,440	1,809

IT Industry's Sub-Sectors	Number of Workers (Person)		Revenue per Worker (USD/Person/Year)		Wage per Worker (USD/Person/Year)	
	2008	2009	2008	2009	2008	2009
Software	57,000	64,000	12,000	13,281	3,600	4,250
Digital Content	33,000	41,000	13,300	16,829	2,820	3,505

Source: Vietnam Information and Communication Technology White Book 2010 (MIC 2010)

Table 8.2 illustrates the numbers and wages of employees in Vietnam's IT industry, and implies the levels of manpower required in the three industries. The hardware sector is the biggest contributor to domestic IT industry revenue. This can be explained by the fact that Vietnam's competitive advantage is in cheap manufacturing labour.[48]

Despite generating the biggest overall revenue out of the three sectors, hardware workers earn the least. There are two interpretations of such wage differentials. Firstly, in digital content work is much more reasonably paid in Vietnam. Secondly, the higher wages of digital content workers may indicate the higher level of skilled work in this sector, as the statistics from the 'Wage per Worker' section of Table 8.2 suggest the positive impact of digital content workers on economic development. Despite being the smallest industry in terms of number of workers, digital content workers brought in the second highest wage per head and individually earned almost twice as much as hardware sector workers. Although these statistics do not break the digital content sector data down, other sources can fill this gap and provide a broad picture of online games' role in the digital content industry.

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48 For more detail on cheap IT-skilled labour as a source of Vietnam's competitiveness, see the thesis's Chapter 5: *Software outsourcing and the cooperative state*.

8.2.3 Online Games Market Revenue

Table 8.3 Vietnam Online Games Market Revenue (Million USD)

	2007	2008	2009
Online Games Revenue	33	67	109

Source: Forbes Asia Magazine (Fannin 2010)

Table 8.3 shows the market revenue of online games in Vietnam. These numbers are crude as, after all, these are still market estimates; nevertheless, they provide a picture of how much online games contribute to the digital content industry. Online games in Vietnam provided 15 per cent and 16 per cent of total digital content market revenue in 2008 and 2009 respectively.[49] Vietnam's emerging online games industry is young and small but powerful in the sense that its economic contributions go beyond the online games business. This industry also generates other types of digital content and services, for example, social networking sites and blogs, so its economic benefits in terms of technological products go beyond the online games themselves. Additionally, online games also generate economic benefits in terms of the high-tech infrastructure that enables local technological consumption in Vietnam, as will be examined in the next section.

8.3 Online games as a Technology Hero and as a Social Evil

8.3.1 Online games as a Technology Hero

To observe the evolution of MMORPGs in Vietnam, the Vinagame Joint Stock Company (now renamed the VNG Corporation, thus hereafter VNG) is employed as a case study. VNG was founded by five hard-core gamers back in 2004 (VNG

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[49] These figures were calculated from statistics on the digital content sector revenues as presented in Table 8.1, and the online games revenue as presented in Table 8.3.

2011), who started their business only by licensing and localising imported MMORPGs from China. In 2005 VNG introduced the first MMPORG in Vietnam, *The Swordsman online* (Vietnamese name *Vo Lam Truyen Ky)*. The game was developed by a Chinese software company, but VNG had a monopoly as its only distributor in Vietnam (VNG 2011). The company started out in the least innovative area, merely customising the online game for the local conditions, which is the smallest possible move from non-innovation to innovation. However, the company later on added areas that nurtured innovation by increasing Internet usage in Vietnam.

Despite starting out only as a licensed local distributor, VNG has thrived in recent years. In 2008, government official statistics showed that VNG's market revenue was 41.0 million USD (Government of Vietnam 2009: 83). Table 8.3 on Vietnam's online games market revenue makes clear the importance of VNG to Vietnam's online games market. The company's revenue constitutes 61 per cent of the total online games revenue in that year, and thus VNG is a valid case to represent the impact of the online games business upon Vietnam's domestic technological development.

Games companies have not only generated prosperity through online games but also improved the conditions for innovation in Vietnam. The online games industry has created favourable conditions for the development of the IT infrastructure. The online games business could not have started if Vietnam did not have a decent broad-band Internet service, but the online games industry has driven this technological development further. The MMORPGs are consumed notably though Internet rooms across Vietnam (Tuo, Wang and Chen 06August 2010) and their popularity has also increased the number of Internet rooms across Vietnam (personal communication, Le Hong Minh, 2010). This has increased the rate of Vietnam's Internet penetration. During the interview with Le Hong Minh, one of VNG's founders and now chairman and chief executive, he mentioned that in 2004 when the company first started, there were about 5,000 Internet rooms in Vietnam. By 2009, there were about 30,000 Internet rooms (personal communication, Le Hong Minh, 2010). He narrates:

> [..] we believed VNG play a very crucial role in terms of Internet growth in Vietnam. Online game became a killer application to attract young people to get into the Internet – and stimulate the growth of Internet rooms (public places to access Internet). Internet rooms are crucial in developing countries and without these public places, China and Vietnam could not have 25%+ Internet penetration. Many other developing countries have lower Internet penetration due to the lack of Internet rooms. Online game is where these Internet rooms are making money and enabling them to expand/invest and attract more people opening up new Internet rooms. (personal communication with author, Le Hong Minh).

The pace of penetration has been skyrocketing, according to the HCMC Computer Association (Internet World Stats site 2010). The association states that the percentage of growth of Internet penetration in Vietnam surpassed the global usage percentage in 2006. Vietnam's Internet penetration rate was 16 per cent of the population, while the global rate was 15.7 per cent of the population (2010). Even though there are other factors that affect the growth rate of internet penetration, this should not conceal the role of online games. Moreover, it was reported by a market research company, Pearl Research, that Vietnamese online gamers spent on average around 31 USD per month in Internet rooms, a claim that matches the author's observation during fieldwork in Internet rooms in several provinces in Vietnam (Ho Chi Minh City, Hanoi, Mui Ne, Da Lat, and Can Tho) (Personal observations 2010; Tuo, Wang and Chen 06August 2010). The rate of Internet penetration can be taken as an indicator of better Internet technology in Vietnam than previously and a growing opportunity for digital commerce that is more accessible given the rate of Internet penetration.

In terms of technological consumption, MMORPGs are consumed mainly by Vietnamese youth, who form the majority of the Vietnamese population. Vietnam is a country with a remarkably young population: among the population of 90,549,390 people, 27.8 years is the median age (Central Intelligence Agency 2011). Furthermore, the young Vietnamese population is a valuable human resource that contributes greatly to Vietnam's new economy, as 70 per cent of population is of working age (age 15-64 years old), with a high rate of literacy at 90.3 per cent of the population. Considering these numbers together, it is undeniable that the country is comprised of a great number of skilled workers, who are young and taking advantage of their country's rapidly growing economy (2011). In relation to the development of the country's IT industry, the large pool of young and skilled workers is often combined with a willingness to work hard for a fraction of the wages of many international IT workers, such as those in China and India (Oxford Analytica 2010).

Online games in Vietnam have also pushed youth over technological boundaries, by connecting them together though virtual communities that emerged alongside the popularity of online games (Tuyen 2010: 185-190). The successes of VNG are not limited only to Vietnam. To date, VNG has also penetrated overseas markets, representing the technological capacity of Vietnamese IT engineers in a global market. In 2012, VNG launched its online game, Sky Garden, in the Chinese online game market. Three months later Sky Garden was granted '*the best game overseas award'* (VNG (n.d.)).

The role of online games as a 'technology hero' can be examined in greater detail in the areas of middleware technology and bandwidth capacity development. However, this chapter focuses mainly on the interplay between the desire of the Vietnamese state to develop the domestic IT industry and its desire to control the dynamic of one of the most vibrant IT sectors, online games. The chapter now moves on to the social challenges that online games in Vietnam have been facing.

8.3.2 Online games as Social Evils and the Government Reaction

The Vietnamese government often portrays online games as having major disadvantages, based on public outcry and negative press stories rather than systematic research. Based on anecdotal evidence, the media has blamed online games for problems including children seeing illicit images, juvenile crime, school violence, school truancy and severe addiction among youth (Thanh 21 May 2010; SGGP 16 December 2010; Vietnamnet 01 July 2011; GamePolitics 09 December 2010). These accusations are highly contentious since they may reflect the moral panic of older non-gamers worried about the younger generation rather than the negative effects of such games. Despite the lack of systematic, sound evidence linking online games with the negative effects claimed by media, the government has expressed concerns about the effects of online games on youth though several channels: constantly expressing concerns though government media such as the news site Vietnamenet, coordinating with local government to forbid online games that are considered to contain violent scenes (SGGP 16 December 2010) and coordinating with games provider not to provide services in any Internet rooms located near educational institutions (2010).

The government of Vietnam has implemented several restrictions related to online games activities at different levels, both in banning game playing activities and limiting game content. The earliest concerns regarding online games date back to the time when the online games business in Vietnam started. In 2007, the Ministry of Information and Communications issued Circular 60 specifying time restriction rules for online game playing (PV 16 November 2007). Under Circular 60, game providers have to put a limit on playing time that varies by each game. For example, very few games can be played continuously for three hours or five hours. The most difficult part of this restriction was implementing it effectively (2007). The most recent and controversial restriction saw the government shift pressure from online game providers to Internet service providers (ISPs). From March 2011 ISPs were requested by the Ministry of Information and Communications to restrict access to online games from 10.00pm to 08.00am. Failure to adhere to these regulations results in businesses being shut down.

The government's crackdowns on online games and related activities have been conducted on somewhat groundless evidence. Most justifications given for the crackdown are based on public outcries and moral panic as expressed through media which are mostly owned by the Vietnamese state. This moral panic is well explained by the notion of 'social evils' in Vietnam, which the state has historically associated with certain economic phenomena.

The term 'social evils' expresses a conflict between old and new values in Vietnam. The definitions of what are old and new are not systematic, but what is old is what is considered to reflect traditional Vietnamese values (McNally 2003: 114).

Online games are not the first socio-economic activity to be branded as a social evil in Vietnam. The Vietnamese government has similarly classified many other activities as social evils in the past including foreign-style advertising and Western music (Higgs 2003: 84-85; McNally 2003: 114), pornography (Soucy 2003: 129), prostitution and drugs, the latter of which have been blamed as a cause of another social evil, HIV, in Vietnam (McNally 2003: 113). While most of these proclaimed social evils seemed to result from economic liberalisation, they also are political as well as social or economic issues. McNally reflects this point: ‘Vietnam continues to be controlled by a one-party state that often remains intolerant of freedom and difference, and ambivalent towards change.’(2003: 113).

8.4 Characterising the Counter-Developmental State from Online Games and its Technology-Upgrading Process

Technological upgrade in an online games industry can be done in many technological areas that determine the quality of the games, such as with real-time technology or middleware technologies.[50] Technological upgrade for these two types of technologies comes in various forms and serves various purposes. These purposes include increasing the effectiveness or skills needed to implement currently used technology. These are a few examples of how technological upgrade can occur in the online games sector; nonetheless, the research pays attention to other types of technological upgrade that are not focussed on the technology used in providing online games. Rather, this chapter appears examines the technological upgrade that occurs in the form of the emergence of a new economy out of the consumption of

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[50] In brief, real time technology is the technology or technologies which enable interactions between players concurrently, and middleware technology is a type of software technology that connects online game applications with the computer’s operating systems.

online games. This new economy lives within the economy of online games, from which it arose.

There are two major phenomena that characterise the new economy, which are also results of technological upgrade. First of all, the new economy is also a new line of production that does not yield common upgrades in a line of production, (such as an upgrade to produce additional services or additional applications that are provided by the same producers to the same users or in short, an upgrade to a line of production by producers for users). Rather, technological upgrading in online games is a case of an upgrade in a line of production by users for users. Secondly, such upgrading in a line of production is not in order to support the technological capacity used in the original economy, but rather to exploit artificial scarcities that are produced while the original economy is consumed.

This is a new type of IT economy called a virtual economy, one based on transactions involving the scarce digital commodities that are produced during the consumption of the digital economy (Lehdonvirta and Ernkvist 2011: 6). In other words, the virtual economy exists inside the consumption process of the digital economy.

8.4.1 From Online Gamers to Gold Farmers: A Technology-Upgrading Approach in a Leisure Digital Economy

In the world of digital technologies, gold farming is an economic phenomenon in which people derive income from playing online games. MMORPG gamers become gold farmers when they play games not just for entertainment but for economic gain, for example, when they trade the virtual gains that they earn as they play the games. The aforementioned virtual gains can range from an avatar, through to platinum items or an avatar's capacities, levels of game achievement and numbers of challenges unlocked. Trading a few of these virtual gains involves the trade of a game account.

The demands of the gold farming business arise from the default setting of game challenges. The entertainment value of games is subject to the abilities of each gamer to overcome different types of challenges that she has to face throughout the game. In the world of MMORPGS, these challenges can vary greatly. For example, gamers play their MMORPGs though an avatar. Commonly, the avatars' characters and abilities are defined and constrained through default settings; for example, a particular avatar might come with an ability to fight faster but with less power than other types of avatars. Furthermore, the levels of the MMORPGs are also set so that gamers have to overcome challenges in the game to progress. For example, winning a fight with monsters in a game allows a gamer to obtain virtual items which will unlock the next levels of the game later on. Another example is when gamers gain virtual items by completing default achievements. The gamers then exchange these virtual items with an in-game merchant for coins or special avatar abilities. These game challenges in the form of different types of constraints lead to the creation of *'virtual scarcities'*. These scarcities also create a market niche for gamers who have more time than money to play the games to overcome these challenges, then sell their accounts or virtual items to other players who have more money but less time (Heeks 2008: 19). This constitutes the gold farming business. [51]

These virtual gains derived from playing MMORPGs can be traded directly from a gold farmer to other gamers, or traded in a collective manner when the gold farmers get together and sell their virtual gains though other institutions, such as a middle man who does the marketing and advertising in the MMORPGs for other

[51] Of course, the details and characteristics of the gold farming business vary from game to game. However, despite such variations, the nature of gold farming has the common, shared characteristics described above.

gold farmers. Trading through a middle man is an in-game method to do gold farming; however, it is not the only method to organise the trade transactions of gold farming. For example, gold farming businesses retail their business though gold farming websites, such as MyMMOShop.com that sells gold for the War of Worldcraft game, or selling virtual gains on online auction sites or in game forums.[52]

The payments for these virtual gains, which are essential to the gold farming phenomenon, can be digitalised both in terms of trading venues and trading currency. The trading venues have to be involved, as these virtual items only exist in the digital world; however, the trade agreement and items transfers could occur online and the payment be made in person. Castronova (2001: 30-31) refers to this as a trade in a virtual world and a payment in the real world society.[53] It has also been reported that there are other types of payments used in the trade of gold farming, such as an exchange of the virtual items of other digital goods in which both sides of the trade agree on values, or other methods of compensation.

Since, as Heeks notes, gold farmers are those who have more time than money, and their clients are those who have more money than time (2008: 19), it makes sense that gold farmers are in a lower socio-economic position than their clients. In terms of global chain analysis, many of these gold farmers are from developing countries such as Vietnam and China (Lehdonvirta and Ernkvist 2011: xi). As such, people who have more time than money can be understood as people who are from a less technological advanced society or situation than their clients. In

[52] The third party gold farming sites have major problems concerning their reliability. A small number are known in game forums for conducting fraud after gaining the trust of the gamers. These sites have then closed down. Some have been forced to close by official game distributors.

[53] The methods of payment are one of the aspects of gold farming that has created a public outcry. Sites for exchanging such payments can have a poor reputation and the media often report security concerns in relation to the youth who play games.

this case, the emergence of gold farming presents not only the emergence of entrepreneurial opportunities but also technological opportunities for people in less technological advanced circumstances to become part of a technological production chain.

How these Vietnamese gold farmers get paid is still largely shrouded in myth. It is very difficult to pinpoint exact numbers of gold farmers in Vietnam or how much they earn out of this business. Most information about the Vietnamese gold farmers comes from discussions from game forums (MMOSITE 7 August 2008) and media reports (BBC 22 August 2008; BBC 8 April 2011). Research about gold farming is at an infant stage and unfocused since it is a grey area of economic activity. As such, measuring and understanding how Vietnamese gold farmers earn from their farms and their net values in this global chain of gold farming are uncharted waters.

Moreover, many view gold farming as a grey area economy, so most analytical research accounts are based on media reports, the researchers' own in-game experiences and online observations. This limits the scope of the research to a few aspects of gold farming such as the organisation of gold farming in terms of its in-game organisation and global value chain production, the industrial sociology of gold farmers and gold farming as part of the virtual economy (Castronova 2001; Heeks 2008; Lehdonvirta and Ernkvist 2011; and Keegan et. al 2011).

However in characterising the counter-developmental state in high-tech economic development, gold farming will be examined in the scholarly context of a virtual economy, one of the newest phenomena of techno-economic evolutionary progress within information technology.

8.4.2 The Virtual Economy and Beyond

Gold farming, which Lehdonvirta and Ernkvist refer to as a third party online games service (2011: 7-8), is an increasingly popular economic activity forming part of the virtual economy, but it is not the only one. Since the beginning of the 21st century, more and more diverse virtual economic activities have come to be known such as *microwork* including crowdsourcing, *cherry blossoming* and *user-created virtual goods production* (Lehdonvirta and Ernkvist 2011: 7-8). *Microwork* and *cherry blossoming* are economic activities that use human effort to conduct small digital tasks that computers cannot do, for example, to recognise user-uploaded pictures that match a description, a *microwork* task. *'Cherry blossoming'* involves clicking a 'like' button on a new Facebook page to improve how it is perceived (2011: 7-8) to achieve marketing tasks for products that have a Facebook page. *User-created virtual goods production* is an economic activity in which IT workers produce virtual commodities for virtual environments, such as Second Life (2011: 7-8).[54] There are some similarities between the four types of virtual economies. The *third party games service* and *the user-created virtual goods* echo each other very closely; however, there is a major difference between the two. While the *third party online games service* is a virtual production to overcome *digital scarcities*, the *user-created virtual goods* are a virtual production to overcome *virtual scarcities*. Furthermore, not all four types of virtual economy are meant to overcome artificial scarcities. This is a distinction, for example, between *microwork* and *cherry blossoming*. While both of the two use human effort to accomplish small digital tasks that computers cannot do, or can only do with higher cost and more time than by human efforts, *microwork*

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54 Second Life is a virtual world where people can live, as they would do in real life, through an avatar. Second Life is a huge virtual community that is famous for its online chat community, and its huge virtual market place for its users to produce and trade their virtual goods, such as designing and selling avatars' clothes.

is not a type of work to overcome virtual scarcity, as is the case of *cherry blossoming* (2001: 7-8).

However, when comparing gold farming businesses with other types of the virtual economy, the gold farming business appears to be in a less formal economic sector than the others. Gold farming businesses have been closed down or are illegal in many countries; thus they often are found as an underground market activity and not just in Vietnam. The economic formality of gold farming is constrained largely because gold farming services degrade and disturb the original challenge setting of the MMORPGs (Lehdonvirta and Ernkvist 2011: xi; Castronova 2001: 28). Gold farmers produce their commodities by playing the MMORPGs, and then trade them outside of the original games where the commodities were produced. Most game distributors disapprove of gamers engaging in gold farming economic transactions outside of the official MMORPGs. A few games distributors regard gold farming as an activity that violates the original copyright of the MMORPGs. From this perspective all of the accounts, avatars and items of the games are the MMORPGs' intellectual property, despite the fees and the time that the gamers spend.

The size of the virtual economy is promising. Lehdonvirta and Ernkvist (2011: xi) state that gross revenues from third party online games services were around 3.0 billion USD in 2009. Beyond the impressive figures, it enables technological entrepreneurship for less developed economies as they enter the global production of this virtual economy, which has potential implications for development. Many less technologically advanced economies have become a substantial part of the virtual economy, such as Vietnam and China in the gold farming business and India and Kenya in the *microwork* business (2011: xi). Unfortunately, the future of such entrepreneurial opportunity appears to be endangered since authorities and official game distributors seek to remove virtual economic workers from the production chains. Gold farming remains profitable because the design of games constantly creates demand to overcome digital scarcities that are part of the games' challenges. In response, MMORPGs distributors have come up with strategies to fill the gamers' demand for gold farming. For example, NeverWinter, a MMORPG, offers its own official gold farming service. This is an attempt by the game distributor to combat the unofficial gold farming business that flourishes around games. Additionally, Vietnamese authorities have clamped down on gold farming, reducing the entrepreneurial opportunities for the workers who have thrived as part of the knowledge economy and overcome their socio-technological constraints.

Furthermore, if we consider how information technologies have evolved since the birth of the commercial computing machine, we can see that the virtual economy is part of how information technologies evolve within economic mechanisms. Generally speaking, at the beginning of the computer industry, when the term IT was used rather than the term IT when referring to the computer industry, the hardware sector occupied most of the market share. At the time, hardware was initially a computing technology. Then as time and technologies progressed, hardware – while remained a computing technology - became a utility technology that enabled the production of software. This process was also repeated with software. After originally starting off as a computing technology only, it became a utility technology which enabled the production of the digital economy and is now subservient to the on-going economic life of the digital economy. The digital economy was only a computing technology (which is now often referred to as an information technology), but has now turned itself into a utility technology that enables the production of the virtual economy to take place. However, unlike the other information technologies, a big part of the virtual economy has been the casual technological production that blurs the line between the consumption of leisure technologies and their production. This, in turn, has also blurred the line between technological entrepreneurial opportunities and moral panic, as well as work and play.

8.4.3 Characterising the Counter-Developmental State from Technological Upgrading in an Online Games Business

The counter-developmental state derives from a structural contradiction between the state's industrial policies on the one hand and state culture and public security policies on the other hand. It is a characteristic form of the state that it undermines its own economic developmental trajectory due to its objectives in other areas. Online games is a prominent contributor to a domestic digital content industry, not only in its industrial share but also in terms of spinoff benefits for other digital content productions, especially in the entertainment business, as well as in terms of technology-upgrading capacity. However, all of these competitive advantages of the online games business do not guarantee support from the state, even though the online games business helps the state to reach its economic goal to industrialise and modernise Vietnam by 2020. The prosperity of the Vietnam domestic online games business is undermined by the state's restrictions because the state considers the development of online games in the context of culture and social morals. This contradiction behind the rise of the counter-developmental state is analysed in this chapter on the basis of the main industrial policy relating to the management of online games, Joint Circular No. 60/2006/TTLT-BVHTT-BBCVT-BCA (Government of Vietnam 2006**)**.[55]

The Vietnamese state's industrial interventions in the online games business place the technological development of online games in a socio-cultural context by authorising the management of this sector conjointly between three ministries: the Ministry of Culture and Information, the Ministry of Post and Telematics and the Ministry of Public Security. In general, the Circular focuses mainly upon providing guidelines to online games providers about how they are managed under the state's supervision. These guidelines evoke a sense of the state controlling and regulating rather supporting or being cooperative. The Circular contains six topics of how to manage online games including general provisions; provision of online games services; responsibilities of organisations and individuals providing and using online game services; inspection, examination, and handling of violations; organisation of implementation; and implementation provisions. The circular mostly addresses what businesses should not do. The first Chapter on the general provisions emphasises the type of technological and technical activities that are governed by the Circular, definitions of online games and their providers; prohibited games; and limits on publishing and advertising for online games. Importantly, the first Chapter of the Circular advocates for the state protection of domestic technology products, as long as their content is not against Vietnam's history and traditional cultures, by prioritising support for games that are researched and produced domestically rather than being imported into Vietnam (2006).

Chapter two of the Circular expresses generally the state's requirements for the games' documentation and state procedures to obtain the state's permission for

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55 Appendix F of this thesis is a full policy statement

online games' production and the provision of services. Online games enterprises are required to submit their applications to the Ministry of Post and Telematics and the Ministry of Public Security for their co-ordinated approval. This can be analysed in the way that the Ministry of Post and Telematics, and the Ministry of Public Security are the Vietnamese state's tools to manage online games at the approval stage, prior to the state's granting of permission. Nevertheless, the Ministry of Culture and Information jointly manages online games with the first two ministries, assuming the state's management of online games after the games have been approved.

Chapter three of the Circular details the types of information that online games have to provide to the state's management agencies after the online games have been approved to operate in Vietnam. All the three ministries are empowered by the state to acquire all this information. Chapter three, all required information, is referred to as the 'responsibilities' of all the parties involved in an operation of online games. This required information is a sign of the state's control beyond purely online games information as the online gamers' information must also be stored by online games' providers, who are obliged to pass it to the state if requested. As such the Circular states:

> [a/] Request service users to supply enterprises with personal information such as names, addresses, 10 numbers or other details necessary for identifying service users; […] 3. Enterprises shall have to store information on service users and supply such information to competent state management agencies when so requested. […] To send reports to the Culture and Information Ministry, the Post and Telematics Ministry and the Public Security Ministry biannually or in unexpected cases, when so requested. (2006).

Additionally, the Circular also requires that users will be informed fully about the rules of games, the negative effects of excessive playing, the storage of their information, the possibility that this information could be passed to third parties. Users are also to be informed that online game providers are not allowed to make profits from items like in-game valuable assets: ‘Enterprises providing online game services must neither create valuable assets in games for profit seeking purposes nor alter information on players’ assets or value’ (2006).

The notion that state agencies managing online games can request information from online game services on online games users suggests strongly the proposed counter-developmental state model where the state’s economic interests conflict with social concerns. There are high levels of social concern expressed in association with the state’s requirements for approving online games. For example, Chapter three of the circular expresses the state’s concerns about school truancy, requiring online game services ‘To provide online game services at places which are at least 200 m far from the entrance gates of schools (from pre-schools to secondary education schools) in any locality’ (2006).

The controlling side of Vietnam’s counter-developmental state continues to be represented in Chapter four of the Circular. This chapter express the state’s rights to inspect and examine all involved parties and their activities as stated in the Circular’s Article 1. These invited parties are ‘[…]enterprises providing online game services, Internet access service providers (ISP), Internet agents and users of online game services’ (2006). The article also expresses the state’s rights to act upon any violations via examination and sanctions.

The state's control over online games activities is also expressed in Chapter five of the Circular. This chapter states a list of responsibilities of line ministries and the related state management agency in order to manage online games. In addition to the three ministerial-level agencies, the provincial or municipal People's Committees also hold responsibility for the state's management of online games. The responsibilities of these agencies are stated in order to provide guidelines for these agencies to implement the Circular. All the parties subject to the Circular, as stated in Article 1, have a relationship with the state involving being directed, regulated and controlled rather than one involving partnership or co-ordination. The related online games parties coordinate with the state only in the sense that they are obliged to provide online games and their gamers' information as required by the state; nevertheless, these parties do not coordinate with the state in terms of the development of the domestic online games industry.

Chapter six, the last chapter, concerns the implementation of the circular. It states the length of time during which the Circular becomes effective. It also states that all parties involved in the online games business are required to report problems to the state's management agencies.

To sum up, the state's management of online games as expressed in Circular 60 considers online games through the lens of negative social effects on users rather through the provision of the sector-specific developmental roles of the state. Even though no specific information about online games' ill effects on users are stated in the Circular, the Circular treats the activities and functionalities of the online games business as something that needs to be approved, regulated and controlled by the state. This model of the state's view towards online games in association with a moral panic in Vietnam has been translated into the global context of Internet safety;

it was voiced at APEC-OECD Joint Symposium on Initiatives among Member Economies Promoting a Safer Internet Environment for Children in 2009, where Ngo Quang Huy, an information security expert from Vietnam Computer Emergency Response Team: Ministry of Information and Communications, represented online games in the context of risks to children alongside ones such as pornography and gambling (Ngo Quang Huy 2009). Furthermore, Huy acknowledged in his presentation that Circular 60 attempts to provide solutions to the dangers to which children may be exposed from playing games by limiting the time spent on games for each gamer's account and by controlling the content of online games, as has been explained earlier in this chapter.

Moreover, the state's control over online activities is now moving to another area of online games: the virtual asset. The World Bank reports that China and Vietnam are key suppliers of online game virtual resources for the global gold farming business (Lehdonvirta and Ernkvist 2011: 7). While the World Bank views this as a virtual economy, the Ho Chi Minh City People's Committee has asked the prime minister to ban the trade of online game virtual assets (Tuoi Tre 13 April 2011). This raises the question whether excessive game addiction actually causes problems or whether there is a gap in perception between gamers and non-gamers which could result in the suppression of one of the most vibrant contemporary economic and technology sectors, namely online games in Vietnam. Furthermore, the grey area of gold farming may particularly affect the government of Vietnam's attitude towards the IT business's virtual economic potential, even though this potential has been recognised differently and positively by the Wold Bank.

The banning of late-night online games in Vietnam is a step further for the intervention in Internet usage. The Vietnamese government is known for its strict monitoring of online activities (Lehdonvirta and Ernkvist 2011: 19), and once blocked access to the Facebook site though a DNS-level barrier (Banyan 04 January 2011). Now the government has implemented a late-night ban, which without a doubt has created extra economic costs, especially for the ISPs that have to find efficient ways to implement the blocking. Furthermore, the ban will always leave further questions about its effectiveness, especially in view of the enormous size of the Internet and the high Internet literacy of Vietnamese youth.

Furthermore, this ban calls into question the credibility of Vietnamese state's economic intervention. There have been concerns expressed by Chinese technology investors about the credibility and stability of Vietnam's technology market especially related to the new regulations of the government of Vietnam on controlling online games (Tuo, Wang and Chen 6 August 2010). These regulations create uncertainty in the business environment. Alternatively they could further affect technology transfers and spillovers from foreign technology enterprises if they withdraw their technology investment plans from Vietnam or lose trust in their Vietnamese partners.

8.5 Conclusion

This chapter offers an analysis of the counter-developmental state, which is the state that arose from a multi-layered technology-upgrading approach in the online games industry. An increase in the Internet penetration rate in less technologically advanced countries aids the advancement of digital technology, which is able to impersonate real world environments. This results in the construction of a few lines of production in the digital world that are non-institutionalised in many respects. Gold farming activities are one example of technological expansions in the digital world that count as informal digital production. Non-institutionalised technological production refers to the production of technologies that blur the line between the consumption of leisure technologies and the production of such technologies, and the line between technological producers and technological users. As a result of the blurring of these lines, technological upgrade in online industry has resulted in an emergence of a new form of economy – the virtual economy – that is under-institutionalised. The unconventional characteristics of the techno-economic activities in the gold farming business are viewed by the Vietnamese state to be a social issue (social evils), rather than an economic one. The Vietnamese state's perceiving of technological products, which primarily come in the form of technological consumption, through the lens of social problems led the state's economic roles to be counter-developmental in this multi-layered technology-upgrading approach.

In terms of the technology-upgrading approach in the online games industry discussed in this chapter, technological upgrading in this model occurred in a multi-layered manner, considering that the invention and innovation stage were processed within a digital economy (by the digital consumption of online gamers), but the diffusion stage of technological upgrading in this model occurred in a virtual economy which lingers inside the digital economy. Technological upgrade in this model creates an overlap in the three stages of technological upgrade between the digital sector and the virtual economy. Based on these findings, the technology-upgrading approach in this chapter was identified as a multi-layered model.

The virtual economy in Vietnam has many elements that qualify it to be a peripheral artefact in the hierarchy of emerging information technologies. The human resources model of the virtual economy is people-centric, who are the main source of un-codified knowledge for technological production in Virtual economy. The distribution and monetisation is by-users-for-users with a strong dependence on informal capital accumulation, and the virtual economy's economic competitiveness is less obvious to many economic performers, as well as to the state. Moreover, the knowledge employed for technological upgrade in the virtual economy is publicly owned. Finally, the resource scarcity in the virtual economy is artificial scarcity; with economic activities that rely on the producers in the virtual economy to make use of already created digital content.

In this chapter, the Vietnamese state worked mostly in a counter-developmental manner, especially when compared with the cooperative, technocratic and irrelevant approaches from the previous chapters. The counter-developmental state in the case of managing online gamers and their other roles as gold farmers displays structural contradictions between the social and techno-economic structure. The characteristics of the Vietnamese state in this chapter are similar to the previous chapter – the irrelevant state – in the sense that in both of the cases the state falls behind the curve in keeping up with the techno-economic potential of IT that has already been cultivated in Vietnam. Nonetheless, the difference between the irrelevant state with a degree of counter-developmentalism and the counter-developmental state, as proposed in this chapter, lies in the state understanding the required technology to a lesser degree and the state viewing the technology as a form of social evil. This has crucial implications in terms of state developmentalism, as it means that the prosperity of certain types of IT production appears as 'social evil' to the state, thus these activities were clamped down on by the state. By doing so, the Vietnamese state was ultimately counter-developmental, as the way the state governs the nation's social structure undermines the state's own economic development trajectory.

Up to this point the four research's case studies have been discussed, we shall now turn our attention to the research's conclusions where we will discuss how the four case studies construct the research's arguments and how these arguments contribute to the wider set of literatures that are discussed on Chapter 3: *Literature Review*.

Chapter 9

Conclusions

9.1 An Introduction to the Conclusions of the Thesis

A detailed summary of how this thesis has answered the two research questions has been provided already in Chapter 4: Technological Upgrade and Research Tool of Analysis, in the form of an overview of the research findings. Chapter 4, Section 4.3: Technology-Upgrading Approaches: Fieldwork Evidence, summarised the answers to research question 1, 'How should we characterise the nature of the technology-upgrading approaches that are employed domestically in Vietnam, and how these approaches are processed within the context of Vietnam's IT industry?'. Section 4.4: Characterising Vietnam's Counter-Developmental State answered research question 2, 'How to characterise the state's roles regarding technological upgrade in Vietnam's IT industry, and to what extent and in which way do these different state roles affect the domestic technology-upgrading approaches?'. Therefore, in order to avoid repetition, this section will not recap the previous summaries. Rather, a short synopsis is provided in this chapter, before it moves on to discuss why the answers to the two research questions matter. This chapter will address the significance of the research questions by concluding the arguments, theoretical contributions, and further implications of the thesis. These are summed up in four sections: the first three sections are conclusions derived from the research's empirical findings (one finding per section); and the last section consists of the research's implications for future work as well as its policy implications.

Before dealing with these final four sections, we will turn briefly to discuss research rationale and provide a summary of the thesis.

9.1.1 Research Rationale

The research was motivated by two main theoretical discourses when it began. The first discourse is on the changing nature of industrial production. Work in this body of literature suggests the transformation of industrial structures from mass production, with vertical lines of production (often referred to as Fordist production), towards post-industrial structures. The latter is often teamed with horizontal, multi-line production, which has no single controller over the whole process of production, as the production chain has been broken down into small procedures. The latter is often known as post-Fordist production. This theoretical discourse is often linked with a second discourse which motivated this research, the theory of state industrial developmentalism. There are many sub-disciplines within the second theoretical group and this research was specifically motivated by work concerning how state developmentalism is associated with evolving industrial technologies as a state's economy moves from being the industrial to the post-industrial.

These two discourses together create a research terrain for examining how being a state with a highly centralised political system, like Vietnam, affects the state's role in the post industrialised economy. Within this terrain, I narrowed the research scope by studying the state's role in the specific field of technological upgrade in Vietnam's IT industry. Coming from these two theoretical perspectives, the research has specifically explored what technological upgrade in Vietnam's IT industry looks like, considering that such an upgrade occurred amidst the transformations of the post-industrial era (addressing research question 1).

Furthermore, the research analysed the role of the Vietnamese state in facilitating the technological upgrade captured in the first research question, as well as how these state roles affect technological upgrade (addressing research question 2).

9.1.2 Research Synopsis

Summarising the answer to the first research question of how the nature of technology-upgrading approaches employed domestically in Vietnam should be characterised and how they are processed within the context of Vietnam's IT industry, the research posited that technological upgrade in Vietnam's IT industry after Directive 58 has not been done in the conventional ways, as represented by the market-led model, the state-led model and the network knowledge-led model of the literature review in Chapter 3. The reason for the unconventional nature of the models is that the conditions facing technology production in the information age are more complicated than the theories suggest, as we will discuss below. The research frames technology-upgrading approaches from the fieldwork findings into four conceptual models, representative of the four different types of technologies available in Vietnam's IT industry, namely: a top-down model of technological upgrade in Cloud Computing; a perpendicular model of technological upgrade in the local outsourcing business; a bottom-up model of technological upgrade in the App economy; and a multi-layered model of technological upgrade in the virtual economy. Importantly, the research found that in the latter two models there was a large portion of non-institutionalised knowledge and modes of learning employed by many economic actors in Vietnam's IT industry.

Summarising the answer to the second of our research questions on how to characterise the state's roles regarding technological upgrade in Vietnam's IT industry, and the extent and ways in which these different state roles affect the domestic technology-upgrading approaches, the research proposed four roles of state-developmentalism. All four roles are more or less indicative of what the research calls a counter-developmental state. These four roles arose from the different technologies in Vietnam's IT industry, namely a technocratic state from the top-down model of technological upgrade in 'Cloud Computing'; a cooperative state from the perpendicular model of technological upgrade in a local outsourcing business; an irrelevant state from the bottom-up model of technological upgrade in an App economy; and a counter-developmental state from the multi-layered model of technological upgrade in a virtual economy.

The thesis posits three arguments, drawing from the research findings in Chapters 5-8, to be presented in this final chapter.

1. The first argument is that the technology-upgrading approach of Vietnam's IT industry challenges the conventional approach to technological upgrade. This challenge comes in the form of different approaches, processes, actors and the types of knowledge and skills involved.

2. The second argument is that technology is not just an instrument of the state to be used for economic development. Rather, technology is also a structure shaping the role of the state in economic development.

3. The last argument claims that there can be more than one role for the state in the IT industry. These varied roles happen at the same time, which can undermine state economic developmentalism. We will refer to this phenomenon as the 'counter-developmental state'

9.2 Argument 1: Technology-Upgrading Approaches in the Information Technology Industry

The first finding in this research is that the technology-upgrading approach for the IT industry in post-industrial economic settings has gone beyond the conventional, institutionalised approaches that were reviewed in our literature review chapter.

In more detail, technological upgrading approaches from our research case studies were initially set to be investigated through the lens of technology-learning for the economic catch-up of late developing economies. As discussed in Chapter 3: Literature Review, this lens implied three categories of technology-learning, namely a market-led, a state-led, and an network knowledge-led model. In reality, technological upgrades, the specific focus of our research, are more complicated and take place beyond these technology-learning processes.

The first conventional model that was examined was the market-led model. The case of the outsourcing business and a cooperative state, as discussed in Chapter 5: Software Outsourcing and the Cooperative State, fits well with this model. The market-led model suggests that technological-learning is transmitted from more technologically advanced economies to less technological advanced economies through a neo-liberal economic regime (Kojima 2000; Saxenian 2001; Görg and Strobl 2004). Technology-upgrading approaches in Vietnam’s outsourcing sector were demonstrated to possess characteristics that match the descriptions from this model. The fieldwork evidence suggests that technology-upgrading approaches in Vietnam’s outsourcing sector have benefitted from trade liberalisation that enabled trade and financial flows between Vietnam and countries advanced in IT, such as Japan, which is a traditional aid donor to Vietnam, and the US, which lifted is trade embargo on Vietnam in 1994.

Trade liberalisation was combined with another two factors: the rise of local IT entrepreneurs and connections to overseas Vietnamese, who are embedded in more-advanced IT economies. These two factors have also established the flow of global technological capital, in the form of the outsourcing business, in Vietnam. This flow of capital later created a spillover effect in the form of labour mobility; the skills of IT labour in the outsourcing business were upgraded and became ready to move into a higher skill-level of IT production. The difference between the technology-upgrading approach derived from the fieldwork and the one that was depicted in the literature on the market-led model, is that with the outsourcing business, the advancement in Vietnam's IT infrastructure did not require the presence of foreign MNCs in Vietnam. This is explained by the fragmented nature of global IT production, which is little accounted for in the literature. This also implies that technological upgrade though labour mobility in the outsourcing business does not follow the exact blueprint of the spillover effects depicted in the literatures.

The state-led model of technological learning was demonstrated by the case of Cloud Computing and the technocratic state in Chapter 6: The Cloud, the iDragon, and the Technocratic state. The technological upgrade led by the Vietnamese state as it innovates Cloud Computing technologies, sits well with the notion of national innovation system theory (NIS), which lies at the heart of this model. Nonetheless, the state's role in nurturing technological learning demonstrated through the fieldwork, did not come from the state being a domineering broker that created linkages between other actors in a national setting, as is suggested by the literature. Technological upgrading in Cloud Computing is state-led in that the state itself took on the innovator's role in Cloud technologies, rather than acting a broker assisting other industrial innovators to conduct R&D activities relating to Cloud technologies, as the theory suggests.

The last model of technological learning discussed in the literature review chapter, the network knowledge-led model, was analysed through the technological upgrading for an App economy and online games in Chapter 7: The App Economy and the Irrelevant State, and in Chapter 8: Online games, the Virtual Economy, Counter-Developmental State, and the Trend Forward, respectively, which illustrated the functioning of this model. These two case studies illustrate how tacit knowledge was mobilised into the process of technological upgrade by informal R&D actors, such as online open-source software communities and gamers who are involved in technological change through digital content consumption. Considering the technology-upgrading approaches in the context of the DUI mode of innovation of Jensen et al. (2007), the two technology-upgrading approaches discussed in Chapters 7 and 8 (the bottom-up and multi-layered technology-upgrading approaches respectively) sync well with the DUI mode. The DUI mode advocates innovation that used tacit knowledge though the doing, using, and interaction mode, which was demonstrated in Chapters 7 and 8.

Despite representing technological upgrade from the network knowledge-led model, the two case studies also present a few differences from the model. Technological upgrade conducted by IVC in the App Economy might not move beyond the conventional approach in terms of the approach which use the DUI mode using network knowledge of production; however, the major difference arises from the fact that IVC's bottom-up approach appears to be un-connected from other actors in its national economy. In more detail, the technology-upgrading approach from the network knowledge-led model illustrates the connection with the state (as another actor in the national economy) by asking for a change in the state's industrial roles to become a more suitable state - a network state. Unlike the theory, IVC's bottom-up approach falls off the state's industrial radar. The Vietnamese state was not able to have any industrial role with IVC's innovative activities, due to the state's misunderstanding of economic benefit from non-proprietary software. Nonetheless, the approach of IVC's technological upgrade by using publicly-owned knowledge to produce non-proprietary software, was successfully conducted without any state involvement.

With regards to the technology-upgrading approach from the case study in Chapter 8 which was conducted by the gold farmers, this multi-layered approach moved beyond the network knowledge-led model in terms of the mode of technological upgrade. The multi-layered model employed the types of knowledge and skills which match with the theory of the DUI by Jensen et al. (2007); however, the mode of production is different from the DUI mode as technological upgrade occurred through technological consumption, rather than technological production. In more detail, the multi-layered technological upgrade occurred when the online gamers play the online game (consuming the game) for economic purposes rather than for original purposes of entertaining. Once this happens, these online gamers have upgraded themselves to be technological producers –known as gold farmers – as well as produced a new economy – known as the virtual economy. This mode has made a major move beyond the theory, which posits the mode of production will be operated by technological producers not consumers.

Furthermore, the case studies in Chapters 7 and 8 support another research sub-argument, that as IT progresses the less institutionalised technological elements and actors (for example *bricoleurs*, tinkers, amateur developers, improvisers, public-owned knowledge, and informal organisation of technological production) have become more and more important sources of innovation in the IT industry. The tool of analysis proposed in Chapter 4: Technological Upgrade and the Research Tool of Analysis, the hierarchy of emerging information technologies, frames how the less institutionalised technological elements and actors are ‘othered’, marginalising their role in innovation in the IT industry.

The technology-upgrading approaches employed by NSICI, and by FPT and TMAs to innovate Cloud technologies and software, outlined in Chapter 6: The Cloud, the iDragon, and the Technocratic State and Chapter 7: The App Economy, and the Irrelevant State, respectively, were conducted by using institutionalised technological elements. In contrast, the technology-upgrading approach employed by IVC to innovate in the App technology, outlined in Chapter 7: The App Economy and the Irrelevant State, illustrated the rise of amateurs and tinkers who employ publicly-owned knowledge (which is considered to be a less institutionalised type of knowledge when compared with privately-owned knowledge) for institutionalised technological production (at the firm level). Additionally, the technology-upgrading approach employed by the gold farmers as discussed in Chapter 8:Online Gaming, the Virtual Economy, the Counter-Developmental State, and Forward Trend, illustrates the rise of improvisers in technology-upgrading approaches. Improvisers who have fewer technical skills may actually be consumers who have turned into producers.

Since technology-upgrading approaches in the global IT industry increasingly involve less-institutionalised sources of technological production, this leads to the second broad argument of our research, that information technology in the age of the post-industrial economy should be considered as an economic structure as well as an economic instrument in the literature on state developmentalism.

Having concluded that the technology-upgrading approach of Vietnam’s IT industry challenges the conventional approach to technological upgrade in the form of different approaches, processes, actors and the types of knowledge and skills involved, we will move onto discussing the roles of technology as a structure, rather than a state instrument as often is found in the study of state developmentalism. The findings in Chapter 6: The Cloud, the iDragon, and the Technocratic State, offer an obvious example to consider whether technocratic state roles are shaped by the advancement of Cloud technology (instrumentative), or whether the advancement of Cloud technology is determined by the technocratic state (substantive), which we will discuss now.

9.3 Argument 2: Information Technology as a Structure or as an Instrument for Economic Development

The second research findings argue that technology does not act as a black box when it comes to interaction with economic development. This argument questions the validity of how technologies are considered in the context of the wider literature. Considering that the characteristics of industrialisation have been transforming, the roles of technologies in industrialising processes have also changed accordingly. Generally speaking, literatures on the state’s industrial/economic developmentalism were shaped heavily by Fordist industrial structures. The use of technology for industrialisation during this period was captured mostly as industrial engineering, where the developments of technology were highly and formally institutionalised. Within this industrial setting, technologies were often treated as a black box in the study of state developmentalism, in that technologies were treated as passive objects, to be economically shaped by the active state. This ‘black box’ appraisal occurred because the idea behind the classic developmental state is for the state to be a catch-up state that was not interested in advancing technologies further, but rather picked up older technological products for the country’s economic catching-up.

The arrival of industrial transformation from the industrial to a post-industrial economy, often known as the information industry, heralded the beginning of post-Fordist production. The post-industrial economy is also characterised as including industries with high levels of information-based or knowledge-based production, rather than heavy manufacturing-based production. Being a knowledge-based industry also means that the use of technology for industrial production is constantly being reconstructed and also becoming less institutionalised, as we saw in the conclusion of argument one, presented above. We saw that technologies change in unconventional ways with an increasing share of un-institutionalised elements of technological production. This means that in the post-industrial economy, not only have technologies become both a core mechanism and main product for industrial production, but also technological production has involved informal and less institutionalised areas that allow non-professional engineers or tinkers to be major contributors in many parts of technological production. Technologies in this post-industrial age have become more than an instrumentative industrial piece, but also is a substantive force that conditions and shapes the state’s developmental roles. Nonetheless, when relating this argument about technologies’ industrial role to the works on state developmentalism in the post-industrial economy, recent work on the developmental state still considers technology as a passive (instrumentative) object even when a country has developed a more technologically intensive economy, and has passed the catching-up period. This broad argument will be substantiated by a more thorough review of the literature on state developmentalism below. This review will highlight the gaps in that literature, especially regarding the treatment of technology as passive and ‘black-boxed’, and show how this thesis addresses those gaps.

9.3.1 The Role of Technology in State Developmentalism Theories

To begin this discussion we shall start with the ‘classic developmental state’ model that was coined by Johnson (1982). In this model, technological dimensions were not taken into account when characterising the state’s role in economic development. Johnson instead placed the state’s economic institutions at the heart of his model. This therefore leads us to conclude that Johnson’s developmental state model was originally not designed to be inclusive of technological dimensions, as the model arose from the belief that economic catch-up could be achieved with already existing technology. Furthermore, Johnson’s developmental state was captured in the period of heavy manufacturing, when technological production was still characterised as its competitive advantage, represented by economies of scale.

After Johnson’s initiative on the developmental state model, the subject spun off in many directions: a few scholars like Amyx 2004 and Jayasuriya 2005 suggest the end of the era of the developmental state (Kim 2012: 293); while scholars like O’Riain (2004) or Evans (1995, cited in Breznitz (2007: 16)) advocate other forms of state developmentalism, such as developmental network states, or network polities. However, these post-developmental state models are often critiqued on their originality. For example, Breznitz (2007: 16) posits that despite the variety in these new models, for example the ‘flexible developmental state’, the ‘neo-developmental state’, the ‘network polity’, the ‘developmental networked state’, or the ‘embedded autonomy industrial bureaucracy’, they all share one thing in common in that they all subscribe to the idea that the state possesses one developmental role. A similar argument is offered by Kim (2012: 294), who contends that works on the post-developmental state model do not offer many changes from the original developmental state model.

However, unlike Jonhson's developmental state model, many of these works based their arguments on the transformative characteristics of technology developments during the transition into a post-industrial economy, whereby technologies are both a means of production and contribute to industrial products in both instrumentative and substantive ways. This means that there is a greater appreciation of the technological dimensions in these 'spin off' models, than in the original developmental state model. An example of such a 'spin off' model is that of the developmental network state as proposed by O'Riain (2004). O'Riain accounts for technology in the way he uses it to break down the Fordist production chain. He explains that in the post-Fordist era less developed countries can catch up technologically not by climbing up Fordist value chain, as in the post-Fordist era this value chain has been broken down and is now based upon specialised production, not mass production (2004: 224-227). As such, O'Riain illustrates his account of the specialised production of less developed countries in international IT production, by discussing the appearance of Indian and Chinese high-tech entrepreneurs in Silicon Valley (2004: 226).

Johnson's 'classic developmental state' which O'Riain builds upon in his work, becomes for him a 'developmental network state'. The 'developmental network state' appears to undermine the 'classical developmental state' by the nature of its IT production. The nature of IT production requires more internationalised functions of the state, beyond the developmentalism offered by the developmental state model. Against this deficiency of state developmentalism, O'Riain characterises a new form of state developmentalism from Ireland's IT industry from 1995-2002 (2004: 244-245). He advocates this new form as a 'developmental network state', where the state's developmental structures become highly networked to overcome the limitations of national borders, allowing the state's economic developmental functions to be embedded in a cross-national institution, like the EU (2004: 205-206).

The nature of IT production, with its increasingly borderless characteristics in O'Riain's work, is a sign of how technological dimensions are included in a characterisation of state developmental models. However, O'Riain still focuses mainly on the network state developmental structures rather than going into greater detail on how technological changes in IT interplay in a substantive way with the state's network structures that eventually constitute the 'network developmental state'.

While there is an emergence of state developmental models that describes a state's economic role in the post-industrial economic era, like those of O'Riain and Breznitz, there are still contemporary advocates of the 'classic developmental state'. Hence, work on 'bringing back the developmental state' involves a greater appreciation of technological dynamics than had done previously. An example of work in this group is Kim (2012), which was reviewed in Chapter 3: Literature Review.

Kim examines the relationship between the state and technological upgrade of wireless telecommunication technology in South Korea. However, technological features have conditioned the role of the South Korean state in Kim's works in a static way. To elaborate, the role of the South Korean state was shaped not by the specific features of the wireless telecommunication technology in Kim's model. In actuality, the South Korean's wireless telecommunication technology market conditions the role of the state in a sense of being sector-specific, which requires the state to understand the players and the nature of knowledge accumulation in this specific technological market.

In comparison with how technological features are considered to interplay with the state in this thesis, Kim's analysis still takes technology as an instrument for the state to help, with the state aiding local wireless technology firms that were competing with foreign firms in the South Korean market.

Having demonstrated the problems with the way state developmentalism theories deal with technology, we will move to discuss how the thesis addresses the shortcomings in these theories. As evident from this study, industrial technology is both the state's developmental instrument and a structure conditioning state developmentalism. The research argues that newly emerging features of IT structurally condition the motivation behind why certain types of technologies are selected, particularly for technological upgrade by Vietnam's local firms and government agencies. These newly emerging features of IT also structurally condition the approach for technology-upgrading processes for each technology in a unique way. Specifically, we discussed how technologies are not selected for technological upgrade due to 'economies of scale', even though this is a commonly found justification in the literature of the 'classic developmental state'. This thesis found multiple motivations driving technological upgrades in Vietnam's IT industry. To start with the case of NISCI – an innovator of Vietnam's Cloud technology – we note that the NISCI represents the technocratic side of the state, which is driven by its urge to follow global technological trends as well as its concern over national security, as the Cloud technology decentralises the state's central control over the country's information surveillance. In the case of the App economy, IVC's upgrade of technological production was driven by an economic downturn and the availability as well as an accessibility of non- commoditised knowledge at a minimal cost. With regards to the motivations behind technological upgrade in an outsourcing business, FPT was driven by the successful connection of Vietnam's IT industry to the global market, and the maturing of the local software industry that required growth in software demand from the domestic market. These changes have led FPT to computerise other non-IT sectors by introducing innovations in software into those sectors. Lastly, in the case of online games, online gamers have induced technological change by transforming themselves into gold farming businesses that are driven by an emergence of artificial scarcities. These scarcities can be overcome by online gamers playing the game and then trading their achievements to other players.

These various motivations illustrate one thing in common: that different technologies lead to different motivations for firms to employ them for technology-upgrading purposes. This idea suggests that the structural nature of technologies acts to shape the state's developmental roles associated with each technology. In the examples drawn from the field work of this thesis, the four case studies illustrate how IT structurally shapes the developmental roles of the state, as will be explained below, starting with the first case study of an outsourcing business. The advancement of computer technologies in general, such as Internet and real time technologies, have made a global software outsourcing business possible even in a once technological backward economy like Vietnam, without requiring the existence of Vietnam's IT industry. This advancement of computer technologies in concurrence with the Vietnamese state's first IT industrial policy's failure, led the state to seek more help from IT entrepreneurs when establishing the second policy, resulting in shaping the state's industrial role to transform from being a controlling state to a cooperative state.

With regard to the second case of Cloud Computing, the technologically advanced nature of the Cloud has transformed major computing activities including data management. These transformations have allowed these computing activities to be able to be done with minimal work from customers (also without any physical presence from the customer sides), and has decentralised the Vietnamese state's power over data management as well as posed a strong national security concern regarding information technology. This structurally led the Vietnamese state to be technocratic (as an innovator in Cloud Computing technology), in order to gain back some control over national data management with the Cloud Computing.

In terms of the third case of the App economy, the progression in knowledge used for non-proprietary software production which came in the form of non-institutionalised public-ownership, structurally caused the state to fall behind the technological curve in understanding the actual economic potential of non-proprietary software. This led the state to be irrelevant in the case of the App economy, that is, the state does not possess any key role.

Lastly in the case of online games, the advancement of digital technology created a complex set of artificial scarcities. When such digital technology is consumed, it blurred the conventional line of work and play as well as creating a by-product known as virtual economy. The state failed to keep up with this new form of economy, whose productions are produced by consuming digital leisure activities. Furthermore, such technological advancement also contributed to the counter-developmental characteristic of the Vietnamese state; the complication and unusual mode of technological production by consumption, led the state to associate online gaming with the notion of social evils, and hence tried to suppress it regardless of its economic benefits.

We shall discuss the ramifications of the state's roles in these different scenarios in the next section.

9.4 Argument 3: From Developmental to Counter-Developmental: Jeopardising State's Developmentalism

Lastly, the research findings showed that there is more than one type of state developmentalism within the same industry: the state role differed depending on the type of technology in question. Furthermore, state developmentalism can turn out to be counter-developmental, indicating that the state has acted based on non-economic interests that might interfere with state developmentalism, resulting in less than optimum economic benefits.

This third argument contributes to the set of literature on state developmentalism by questioning works that provide a single label to state developmental models, as the thesis questions how just one model can be comprehensive enough to represent all the different state roles. Referring back to the work of O'Riain (2004) to illustrate this argument, overall his model still applies one type of state developmentalism to explain a variety of industry sub-sectors, despite a great effort to consider the nature of technology in his formulation of the 'network developmental state'.

Kim's analysis provides an important supporting point to the argument we are making here. Kim uses the context of the famous developmental state of South Korea to outline the literature, which shows different views on the debates on whether the developmental state model has ended or is still a valid model (Kim 2012: 293-294). To this end, Kim questions the theoretical value of a discourse that tries to classify a singular model of state developmentalism, as well as the validity of the way the developmental model has been created. Here Kim refers to Crouch (2005) to point out that there is more than one form of capitalism in a single national setting. Thus, assigning a single label to the state would require a systematic and holistic study of every role of the state in every industry in the hopes that one structure can explain them all (2012: 294). O'Riain's study (2004) falls into this method of analysis; his 'development network state' takes the IT industry as a 'black box', failing to appreciate the varied sub-sectors within it. When we acknowledge the different sub-sectors under the very general term 'IT industry', we can see that the state interacts differently with each technological industry within IT, as this research has demonstrated in Vietnam's IT industry.

Similar views can also be seen from Breznitz's analyses (2007), of state roles in the development of the IT industry in Ireland, Israel, and Taiwan. Breznitz does not directly challenge the way that the models in the literature attribute a singular role to the state, regarding the state's interaction with different industrial sub-sectors. Nonetheless, he contests the way main schools in such literatures, such as the developmental state and a neo-developmental state, are so specific about associating particular political and institutional structures with the success of high-tech economic catching-up, as there are in fact multiple successful hi-tech industrial developmental choices. Breznitz argues that different state structures and behaviours led to different industrial developmental paths in the three countries (2007: 191). In order to do so, Breznitz offers a few analytical domains to demonstrate the differences in their IT industrial development, such as the state's actions in obtaining necessary skills and finance for R&D activities (2007: 192). In his analyses of these domains we can also see how the nature of specific information technologies used in his work are considered. Breznitz considers technologies not as a black-box; thus he highlights how technologies condition the state's actions in the development of IT industries.

While Breznitz appreciates that a state's role might be different in specific national conditions, for example the state's role in Israel is different from the state's role in Ireland, he still attributes a singular role to the state within these different, specific national conditions. The position of Breznitz is somewhat similar to the position of our thesis, as he avoids a singular conception of state developmentalism, recognising that different states possess different roles. However, this thesis has gone beyond Breznitz's account as it breaks down the IT industry into several different technologies and finds different state roles corresponding to each technology. These different state roles have something important to say when taken together as each of them illustrates state counter-developmentalism in different ways and to varying degrees.

9.4.1 Explaining Counter-Developmentalism

Building on this argument we can make a secondary claim that some of the processes that are often understood as representative of the developmental state may be a 'mis-diagnosis'. In fact, these processes can be indicative of a counter-developmental state. This happens when the state emphasises non-economic factors, which result in less than optimal economic benefits. This claim is made by synthesising the research findings with literature on the decline of the state's role in the post-industrial economy, as discussed in Chapter 3: Literature Review. We will conclude that amidst this decline of the state's role in the post-industrial economy, the Vietnamese state sought to use a developmental role in the IT industry to firm up its position and resist decline.

An example from this chapter would be the case of the network knowledge-led model, where we noted that many scholars of that model addressed the declining importance of the nation state in economic development as information economy progresses globally. This is due to two main reasons, which we discuss below.

The first reason is the increase in the employment of tacit knowledge as an actual source for technological upgrade. This tacit knowledge is transmitted through people's experiences and cannot be codified, and thus is stored and shared in an institutionalised learning environment such as learning through problem-solving in online forums, or experiencing a shared environment (Boulanger 2005, Jendsen et al. 2007).

The second reason leads on from Ohmae (1993), who envisaged that the natural economic zone would be redefined in the era of post-Fordist industrial production, with international or regional economic zones replacing national ones. Many scholars have suggested a new role for the state in post-Fordist industry. For example Ansell (2000) suggests that the state needs to decentralise its command structure, while O'Riain proposes his 'developmental network state'.

Coming from the angle of the network knowledge-led model, the proposed counter-developmental state argues that both the increase of tacit knowledge and the fragmentation of post-Fordist industrial production do not diminish the state's command role in industrial development. Rather, these two factors shape a new form of state leadership. The case of the cooperative state, from the outsourcing example, and the technocratic state, from the Cloud Computing case, both illustrate this argument well and will be discussed below. What both examples show is that in securing its leadership position, the state concerns itself with non-economic factors and the result was sub-optimal economic growth, with the state becoming a counter-developmental state.

In terms of the cooperative state, the decline of the state is demonstrated in that the state did not have enough expertise when it came to the establishment of the local IT industry. Instead of changing its role in the economy and surrendering its command position to other industrial experts, the Vietnamese state strategically adopted a cooperative role which let industrial experts in the outsourcing business take part in the drafting of industrial policy. That measure secured its command position in the face of decline. The cooperative state, while it may seem beneficial, is in fact indicative of the counter-developmental state as it hinders growth in the long term, as was discussed in depth in Section 5.3.3: Limitations of the Cooperative State.

Another example of how what looks like a developmental state turns out to be a counter-developmental state, is the case of the technocratic state in the development of Cloud Computing. The advancement of Cloud Computing threatened to decentralise the state's power over national information surveillance, but instead of accepting a minimalised state role, the Vietnamese state, remained committed to its information security concerns, implemented industrial R&D on Cloud Computing, thereby again securing its role in the face of decline. This also contradicts what the theory suggests, as Freeman (1995) posits that high security concerns will drive the state to commit to military R&D, when in this example the state committed to industrial R&D to justify its role in the economy. Even though the state security concerns are not the sole reason for the Vietnamese state to commit to R&D in Cloud Computing,[56] the technocratic state is still indicative of the counter-developmental state as it allows non-economic factors to influence its economic actions. Unlike the example of outsourcing and the cooperative state discussed above, we cannot state that the technocratic state will lead to sub-optimal growth as we do not have field work data to support that claim. The example of the technocratic state does support our claim that the state allowed non-economic reasons to affect its decisions on the economy.

9.5 Beyond the Counter-Developmental State

We will finish this concluding chapter by outlining further research opportunities and policy implications. The significant originality of this research is that the research has paid attention to the technological areas in which the state does not claim to have economic benefits, like in the case of an App economy and the virtual economy. By doing so, the research has captured the high degree of state counter-developmentalism that occurs when the state falls behind technological curves. The irrelevant state and the counter-developmental state from Chapters 7 and 8 respectively, open up further debates in relation to economic benefits, developmental impacts, the governance of non-proprietary software, and the virtual economy. In the tools of analysis of the thesis (the hierarchy of merging information technologies), the case studies from Chapters 7 and 8 fall into the peripheral categories of the hierarchy due to the technological upgrade of these two chapters employing a high level of tacit knowledge through ‘bricolage’ rather than using codified knowledge implemented by engineers or scientists, which is currently

[56] Cloud Computing is also an up and coming global technology trend.

considered conventional in both academic research and policy. An analysis offered by Jensen et al. mirrors this point well:

> Despite the broad acceptance of this literature, there remains a bias among scholars and policy makers to consider innovation processes largely as aspects connected to formal processes of R&D, especially in the science based industries (2007: 681).

As such, these issues are worth of study in their own right.

In reference to the main questions of how to characterise the nature of the technology-upgrading approaches that are employed domestically in Vietnam's IT industry, and how to characterise the state's roles regarding these captured technology-upgrading approaches, we have found that technological upgrade in Vietnam's IT industry after Directive 58 has been done using four models in four different IT technologies. These models are namely: the perpendicular model of technological upgrade in the outsourcing business; the top-down model of technological upgrade in Cloud Computing; the bottom-up model of technological upgrade in App economy; and the multi-layered of technological upgrade in online games. Furthermore, we found that there was more than one state role regarding the four models of technological upgrade, specifically: the cooperative state for the perpendicular model; the technocratic state for the top-up model; the irrelevant state for the bottom-up model; and the counter-developmental state for the multi-layered model.

In answering the main questions, we have also been able to comment on three secondary research arguments. The first argument was that the technology-upgrading approach of Vietnam's IT industry challenges the conventional approach to technological upgrade. This challenge comes in the form of different approaches, processes, actors and the types of knowledge and skills involved. The second argument was that technology is not just an instrument of the state to be used for economic development. Rather, technology is also a structure shaping the role of the state in economic development. The last argument claimed that there can be more than one role for the state in the IT industry. These varied roles may be performed at the same time, and overall may actually undermine state economic developmentalism. We referred to this phenomenon as the ‘counter-developmental state’.

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List of Abbreviations

APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
BCC	Business Cooperation Contract
BITCO	Business Information Technology Co., Ltd
CCC	Computer Communication Company
CDMA	American Code Division Multiple Access
CIO	Chief Information Officer
CPE	Culture Political Economy
DFJ	Draper Fisher Jurvetson network
DNS	Domain Name System
DUI	Doing, Using and Interaction mode of Innovation
EC2	Amazon Elastic Computing Cloud
FDI	Foreign Direct Investment
FOSS	Free and Open Source Software
FPT	Corporation for Financing and Promoting Technology
GOV	Government of Vietnam
GATS	General Agreement on Trade in Services
GPTs	General Purpose Technologies
GOV	Government of Vietnam

GNU	GNU’s Not Unix
GPL	General Public License
GATT	General Agreement on Tariffs and Trade
GES	Global Equipment Company Services
HCA	Ho Chi Minh City Computer Association
HCMC	Ho Chi Minh City
HoSE	Ho Chi Minh Stock Exchange
HPT	High Performance Technology
IaaS	Infrastructure-as-a-Service
ICT	Information and Communications Technology
IDG	International Data Group
IOIT	Institute of Information Technology
IP	Intellectual property
IPO	India-Plus-One model
IPR	Intellectual Property Right
ISO	International Organisation for Standardisation
ISPs	Internet service providers
IT	Information Technology
IVC	ISB Vietnam Cooperation
MIC	Ministry of Information and Communications
MMOGs	Massively Multiplayer Online Games

MMORPGs	Massively Multiplayer Online Role-Playing Game
MNCs	Multinational Corporations
MOET	Ministry of Education and Training
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trading
MONRE	Ministry of Natural Resource and Environment
MOPT	Ministry of Post and Telecommunications
MOST	Ministry of Science and Technology
MoU	Memorandum of Understanding
MPIP	Ministry of Planning and Investment Portal
MPT	Ministry of Post and Telematics
NA	National Assembly
NDS	Network Developmental State
NGOs	Non-Government Organisations
NICs	Newly Industrialised Countries
NIS	National Innovation System
NISCI	National Institute of software and Digital Content Industry
NIST	the U.S. National Institute of Standards and Technology
ODA	Overseas Development Aid
OECD	Organisation of Economic-Cooperation and Development
OEM	Original Equipment Manufacture

OESF	Open Embedded Software Foundation
OSI	Open Source Initiative
PaaS	Platform-as-a-Service
R&D	Research and Development
SaaS	Software-as-a-Service
SAVVI	Strategic Alliance Vietnamese Ventures International
SBT	Software Business Incubator
SBV	State Bank of Vietnam
SMEs	Small and Medium-Sized Enterprises
SOCBs	State-Owned Commercial Banks
SOEs	State-Owned Enterprises
S&T	Science and Technology
STI	Science, Technology, and Innovation mode of Innovation
TMAs	TMA Solutions
TQM	Total Quality Management
TRIMS	Agreement on Trade Related Investment Measure
TRIPS	Trade Related Aspects of Intellectual Property Right
T-SS	Trinity Security Systems Incorporated
VNPT	Vietnam Post and Telecommunication Group
VTS	Vina Technology Solutions
HoSE	Ho Chi Minh Stock Exchange

VNPT	Vietnam Post and Telecommunications Corporation
OESF	Open Embedded Software Foundation
GPTs	General Purpose Technologies
UNESCO	United Nations Educational, Scientific and Cultural Organization
VAIP	Vietnam Association for Information Processing
VAST	Vietnamese Academy of Science and Technology
VDC	Vietnam Data Communication Company
VFOSSA	Vietnam Free and Open source Software Association
VINASA	Vietnam Software Association
VIP	Vietnam Information for Science and Technology Advance Innovation Portal
VISIT	Vietnam's Agency of Science and Technology
VNG	Cooperation Vinagame Joint Stock Company
VNPT	Vietnam Post and Telecommunications Corporation
VNTT	Vietnam Technology and Telecommunications Joint Stock Company
WIPI	Wireless Internet Platform for Interoperability
WIPO	World Intellectual Property Organization
WTO	World Trade Organisation
Y2K	Year 2000 problem

APPENDICES

Appendix A

Revenues of Vietnam's IT industry

Table A.1 Revenues of Vietnam's IT Industry by sector, 2008-2011 (Million USD)

Vietnam's IT Industry	2008	2009	2010	2011	Growth[57]
Hardware Sector	4,100	4,627	5,631	11,326	101%
Software Sector	680	850	1,064	1,172	10%
Digital Content Sector	440	690	934	1165	25%
Total Revenue of IT Industry	5,220	6,167	7,629	13,663	79%

Source: Ministry of Information and Communications (2012: 45)

57 The growth rate refers to the increase in revenue between 2010 and 2011.

Appendix B

Letter of Affiliation

School of Industrial Management
Ho Chi Minh City University of Technology
268 Ly Thuong Kiet Street, District 10, HCMC
Room 103, Building B10

To Whom It May Concern,

I, Dr Cao Hao Thi, am pleased to introduce Miss Uer-Aree Phothiyarom as a Research Affiliate while she is working on her doctoral thesis, *Technology-Upgrading Approach for Late Industrialised Economy: The Case of Vietnam's Information Technology Industrial Policy*, for the University of Leeds, England during the period of July 2010 – January 2011.

I wish to express my appreciation for Miss Phothiyarom to conduct research with your permission. This means that, as a research student, Miss Phothiyarom will require access to data or/and contact a person at your organization with she is to communicate with in necessary to conduct research for a project entitled.

Although Miss Phothiyarom will not be a paid employee of the Ho Chi Minh City University of Technology, please be advised that the University of Leeds' rules and policies regarding the conduct of research apply to this affiliation. Miss Phothiyarom has been instructed and agreed to protect confidentiality of data collected so that no subject will be individually identifiable. She will also share a copy of a final report with your organization upon request.

If any problems and/or concerns arise regarding this project, I would appreciate your notifying me by writing to me at School of Industrial Management, Ho Chi MInh City University of Technology, 268 Ly Thuong Kiet Street, District 10, HCMC, Room 103, Building B10; or by mailing thicaohao@yahoo.com.

Please sign a copy of this letter to acknowledge receipt and your understanding of the scope of Miss Phothiyarom's proposed activity.

Thank you indeed for your cooperation.

Sincerely

(...)
Dr Cao Hao Thi

I wish to participate in the proposed activity

(...)

Appendix C

Open Source Software Definition

Introduction

Open source does not simply mean open access to the source code. The distribution terms of open source software must comply with the following criteria:

1. Free Redistribution

The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programmes from several different sources. The license shall not require a royalty or other fee for such sale.

2. Source Code

The programme must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, downloading via the Internet without charge. The source code must be the preferred form in which a programmemer would modify the programme. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a pre-processor or translator are not allowed.

3. Derived Works

The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.

4. Integrity of The Author's Source Code

The license may restrict source-code from being distributed in modified form *only* if the license allows the distribution of "patch files" with the source code for the purpose of modifying the programme at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

5. No Discrimination Against Persons or Groups

The license must not discriminate against any person or group of persons.

6. No Discrimination Against Fields of Endeavour

The license must not restrict anyone from making use of the programme in a specific field of endeavour. For example, it may not restrict the programme from being used in a business, or from being used for genetic research.

7. Distribution of License

The rights attached to the programme must apply to all to whom the programme is redistributed without the need for execution of an additional license by those parties.

8. License Must Not Be Specific to a Product

The rights attached to the programme must not depend on the programme's being part of a particular software distribution. If the programme is extracted from that distribution and used or distributed within the terms of the programme's license, all parties to whom the programme is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.

9. License Must Not Restrict Other Software

The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programmes distributed on the same medium must be open source software.

10. License Must Be Technology-Neutral

No provision of the license may be predicated on any individual technology or style of interface.

Source: OPEN SOURCE INITIATIVE (OSI) [no date] *The Open source Definition* [online]. [Accessed 13 January 2013]. Available from http://opensource.org/docs/osd.

Appendix D

Open Source Software Policies in Vietnam

D.1 Decision No.235/QD-TTg

DECISION No. 235/QD-TTg OF MARCH 2, 2004 APPROVING THE OVERALL PROJECT ON APPLICATION AND DEVELOPMENT OF OPEN SOURCE SOFTWARE IN VIETNAM IN THE 2004-2008 PERIOD

THE PRIME MINISTER

Pursuant to the Law on Organization of the Government of December 25, 2001;

Pursuant to the Government's Resolution No. 0712000IND-CP of June 5, 2000 on building and development of software industry in the 2000-2005 period;

Pursuant to the Prime Minister's Decision No. 81/2001/OD-TTg of May 24, 2001 approving the action programme for implementation of the Political Bureau's Directive No. 58-CTITW of October 17, 2000 on stepping up the application and development of information technology in the cause of industrialization and modernization in the 2001 - 2005 period;

At the proposal of the Minister of Science and Technology,

DECIDES:

Article 1. - To approve the overall project on application and development of open source software in Vietnam in the 2004-2008 period with the following contents:

I. OBJECTIVES

1. To accelerate the application and development of open source software, thus contributing to the protection of copyright and reduction of software procurement expenses, and promoting the development of the information technology industry in general and Vietnam's software industry in particular.

2. To build up the contingent of technicians who are qualified for and master technologies, and promote their creativity in the application and development of open source software.

3. To create a number of special information technology (IT) products suitable to the domestic application conditions and demands and based on open source software.

II. PRINCIPAL CONTENTS OF THE PROJECT

1. Main tasks:

a/ To formulate policies to promote the application and development of open source software.

-To formulate and promulgate mechanisms and policies to encourage the application and development of open source software to attract educational, training and scientific research establishments to participate in the open source software training, development and research; to encourage and create favorable conditions for overseas Vietnamese and foreign specialists as well as foreign companies and international organizations to invest in open source software trading, development, technology transfer and training in Vietnam.

- To promulgate policies to use some open source software in the State sector.

b/ To organize the application of open source software

-To organize the experimental application of open source software, first of all the application of open source software in a number of ministries, agencies and localities, then expand it throughout the country.

- To organize the application of open source software to some professional utilities as well as to security and defense. To establish and put into use high-performance and network-computation computer systems based on open source software to solve application problems which require a strong computation capacity in ministries, branches and localities nationwide.

c/ To train human resources for application and development of open source software

- To organize the training of the contingent of open source software teachers in universities, colleges, vocational and job-training intermediate schools; teachers for training of State officials and employees.

- To build up the contingent of cadres fully capable of organizing the application and development of open source software in ministries, branches and localities.

- To support the training of technicians in service of the work of organizing and instructing the contingent of open source software professional cadres in ministries, branches and localities, and work out programmes on training and maintaining this contingent.

- To work out and implement programmes on training in the use of open source software for State officials and employees as well as students in universities, colleges, vocational and job-training intermediate schools and pupils of senior-secondary schools. To develop software tools, utilities and applications in service of teaching and learning activities.

- To attract domestic and foreign organizations and individuals as well as overseas Vietnamese to take part in activities of training in open source software in Vietnam.

- To send brilliant teachers, lecturers and students to foreign countries for short-term and long-term open source software training.

d/ To develop a number of core software, formulate standards and system of certificates, and train high-level specialists

- To organize research into, proposition and development of a number of core software of Vietnam, select and localize some software to meet Vietnam's basic application demands.

- To establish the system for evaluating and inspecting the quality of open source software products and give use cautions to the community.

- To research, elaborate and promulgate open source software technical standards and skill standards, and establish the system for testing open source software skills and granting open source software certificates.

- To encourage the establishment of enterprises trading in and developing open source software, companies, scientific agencies and educational establishments providing open source software application support services. To build open source software development centers and laboratories.

e/ To enter into international cooperation in open source software

- To join the regional and international open source software organizations and associations to enhance the cooperation and experience exchange among members of such organizations.

- To organize the cooperation in open source software development research and trading with foreign partners.

2. Mini-projects:

a/ Formulation of mechanisms and policies on open source software application and development, with the Ministry of Post and Telematics assuming the prime responsibility therefor.

b/Open source software application and training in universities, colleges and vocational intermediate schools with the Ministry of Education and Training assuming the prime responsibility therefor.

c/ Open source software application and training in job-training schools with the Ministry of Labor, War Invalids and Social Affairs assuming the prime responsibility therefor.

d/ Training in open source software use for public servants, State officials and employees with the Ministry of Home Affairs assuming the prime responsibility therefor.

e/ Experimental application and development of open source software in Hanoi City and Ho Chi Minh City with the People's Committees of Hanoi city and Ho Chi Minh City assuming the prime responsibility therefor.

f/ Experimental application and development of open source software for defense purpose with the Ministry of Defense assuming the prime responsibility therefor.

g/ Experimental application and development of open source software for security purpose with the Ministry of Public Security assuming the prime responsibility therefor.

h/ Development of a number of core software, formulation of standards and system of certificates, and training of high-level specialists with the Ministry Science and Technology assuming the prime responsibility therefor.

III. SOLUTIONS

1. To raise the community's awareness about the protection of software copyright and benefits from the open source software for the information technology development in our country in general and the software industry in particular.

2. To stringently enforce the software copyright. 3. To organize the assessment of impacts of and solutions related to the switch to use open source software in the State sector as well as the compatibility of open source software applications with commercial software products. To organize research into, experimentation and multiplication of a number of applied open source software.

4. To provide open source software training in the educational system and the training establishments. 5. To develop and maintain core open source software which can bring about common benefits for the community, and formulate the national standards on open source software.

6. To develop open source software trading models, especially professional open source software support service.

7. Funding in service of the open source software application and development in general and mini-projects in particular shall be mobilized from different sources of enterprises, individuals and international organizations, ODA and the State budget.

Article 2. - Organization of implementation

1. The Ministry of Science and Technology shall assume the prime responsibility for, and coordinate with the ministries, the ministerial-level agencies, the Government-attached agencies and the People's Committees of the provinces and centrally-run cities in, organizing the execution of the Project.

2. The Ministry of Planning and Investment shall assume the prime responsibility for, and coordinate with the Ministry of Finance and the Ministry of Science and Technology in, balancing and synthesizing resources in the State's annual plans for projects, mini-projects and plans on open source software application of the ministries, ministerial-level agencies, Government-attached agencies, and the concerned provinces and centrally-run cities.

3. The Ministry of Finance shall assume the prime responsibility for, and coordinate with the Ministry of Post and Telematics and the Ministry of Science and Technology in, formulating financial mechanisms and policies for open source software application and development.

4. The Ministry of Science and Technology, the Ministry of Education and Training, the Ministry of Labor, War Invalids and Social Affairs, the Ministry of Home Affairs, the Ministry of Defense, the Ministry of Post and Telematics and the People's Committees of Hanoi City and Ho Chi Minh City,

which are assigned to assume the prime responsibility for mini-projects, shall direct the formulation and execution of mink projects according to current regulations.

The execution of the above-said mini-projects must ensure the efficient coordination and integration with other programmes and projects on information technology.

5. The ministries, the ministerial-level agencies, the Government-attached agencies, the People's Committees of the provinces and centrally-run cities shall work out plans on rational use of open source software in their respective professional operations, and build up the contingent of technicians knowledgeable about open source software.

Article 3. - This Decision takes effect after its signing.

Article 4. - The ministers, the heads of the ministerial-level agencies, the heads of the Government-attached agencies and the presidents of the People's Committees of the provinces and centrally-run cities shall have to implement this Decision.

For the Prime Minister

Deputy Prime Minister

PHAM GIA KHIEM

D.2 Decision No. 08/2007/QD-BTTTT

THE MINISTRY OF INFORMATION AND COMMUNICATION

SOCIALIST REPUBLIC OF VIET NAM

Independence - Freedom - Happiness

No. 08/2007/QD-BTTTT *Hanoi, December 24, 2007*

DECISION

PROMULGATING THE LIST OF OPEN SOURCE SOFTWARE PRODUCTS WHICH MEET THE USE REQUIREMENTS OF STATE AGENCIES AND ORGANIZATIONS

THE MINISTER OF INFORMATION AND COMMUNICATION

Pursuant to the Governments Decree No. 178/2007/ND-CP of December 3, 2007, defining the functions, tasks, powers and organizational structures of ministries and ministerial-level agencies;

Pursuant to the Prime Ministers Decision No. 169/2006/QD-TTg of July 17, 2006, providing for investment in and procurement of information technology (IT) products by agencies and organizations using state budget capital and the Prime Ministers Decision No. 223/2006/QD-TTg of October 4, 2006, amending a number of articles of Decision No. 169/2006/QD-TTg;

Pursuant to Circular No. 02/2007/TT-BBCVT of August 2, 2007, of the Ministry Post and Telematics (now the Ministry of Information and Communication), detailing a number of contents of the Prime Ministers Decision No. 169/2006/QD-TTg of July 17, 2006, and Decision No. 223/2006/QD-TTg of October 4, 2006;

At the proposal of the director of the IT Industry Department,

DECIDES:

Article 1. To promulgate together with this Decision the List of open source software products which meet the use requirements of state agencies and organizations for use as a basis of implementation for Circular No. 02/2007/TT-BBCVTof August 2, 2007, of the Ministry of Post and Telematics (now the Ministry of Information and Communication) and the Prime Ministers Decision No. 169/2006/QD-TTg of July 17, 2006, and Decision No. 223/2006/QD-TTg of October 4, 2006. Agencies or organizations that use state budget funds or state budget-originated funds for investment in, procurement of IT and execution of IT application and development projects shall prioritize investment in, procurement of IT and use of products on the List enclosed with this Decision.

Article 2. The List of open source software products which meet the use requirements of state agencies and organizations may be amended and supplemented to suit reality.

Any problems arising in the course of application of the List shall be considered and settled by the Ministry of Information and Communication.

Article 3. This Decision takes effect 15 days after its publication in CONG BAO.

Article 4. The director of the Office, the chief inspector, the director of the IT Industry Department, heads of agencies and units under the Ministry of Information and Communication, and concerned agencies and organizations shall implement this Decision.

FOR THE MINISTER OF INFORMATION AND COMMUNICATION
VICE MINISTER

Nguyen Minh Hong

LIST OF OPEN SOURCE SOFTWARE PRODUCTS WHICH MEET THE USE REQUIREMENTS OF STATE AGENCIES AND ORGANIZATIONS

(Promulgated together with Decision No. 08/2007/QD-BTTTT of December 24, 2007)

No.	Types	Products
1	Office software	a/ OpenOffice.org 2.0 b/ OpenOffice.org 2.1 c/ OpenOffice.org 2.2 d. OpenOffice.org 2.3
2	Email server software	Mozilla Thunderbird
3	Web browser software	Mozilla Firefox
4	Vietnamese keyboard software	Unikey

D.3 Circular No. 41/2009/TT-BTTTT

THE MINISTRY OF INFORMATION AND COMMUNICATIONS SOCIALIST REPUBLIC OF VIET NAM

Independence - Freedom - Happiness

No. 41/2009/TTBTTTT Hanoi, December 30, 2009

CIRCULAR

PROMULGATING A LIST OF OPEN SOURCE SOFTWARE PRODUCTS QUALIFIED FOR USE BY STATE AGENCIES AND ORGANIZATIONS

THE MINISTER OF INFORMATION AND COMMUNICATIONS

Pursuant to the Government's Decree No.187/2007/ND-CP of December 25, 2007, defining the functions, tasks, powers and organizational structure of the Ministry of Information and Communications;

Pursuant to the Prime Minister's Decision No. 169/2006/QD-TTg of July 17, 2006, providing for the investment in and procurement of information technology products by agencies and organizations using state budget funds and the Prime Minister's Decision No. 223/2006/QD-TTg of October 4, 2006, amending a number of articles of Decision No. 169/2006/QD-TTg;

At the proposal of the director of the Information Technology Department,

STIPULATES:

Article 1. To promulgate together with this Circular a list of open source software products qualified for use in state agencies and organizations (below referred to as the list of open source software) for use as a basis for the implementation of the Prime Minister's Decision No. 169/2006/QD-TTg and Decision No. 223/ 2006/QD-TTg.

Article 2. State agencies and organizations that use state budget funds or state budget-originated funds for investment in or procurement of software of types specified in the list of open source software shall prioritize the investment in, and use of, corresponding software products on this list.

State agencies and organizations are encouraged to invest in, procure and use software which is upgraded, modified, perfected or Vietnamized from software products on the list.

Article 3. The above-said list of open source software may be adjusted or supplemented so as to suit reality.

Article 4. This Circular takes effect on February 15, 2010, and replaces the Information and Communications Minister's Decision No. 08/2007/QD-BTTTT of December 24, 2007, promulgating a list of open source software products qualified for use in state agencies and organizations.

Any problems and difficulties arising in the process of implementation should be reported to the Ministry of Information and Communications for study and settlement.-

FOR THE MINISTER OF INFORMATION AND COMMUNICATION

DEPUTY MINISTER

NGUYEN MINH HONG

LIST OF OPEN SOURCE SOFTWARE PRODUCTS QUALIFIED FOR USE IN STATE

AGENCIES AND ORGANIZATIONS

(Promulgated together with Circular No. 41/2009/TT-BTTTT of December 30, 2009)

No.	Type	Products
1	Office software	- OpenOffice version 2.4 and or later versions.
2	Email software	- Mozilla Thunderbird
3	Web browser software	- Mozilla Firefox
4	Vietnamese keyboard software	- Unikey
5	Operating system software	- Ubuntu server operating system version 8.10 or later versions
6	Database management system	a/ PostgreSQL database management system, version 8.3 or later versions -
		b/ MySQL database management system, version 5.1 or later versions
7	Messaging server software	a/ SendMail messaging server software, version 5.1 or later versions
		b/ Postfix messaging server software, version 23 or later versions *t*
8	Content management system	a/ Alfresco content management system, version 3.0 or later versions
		b/ Drupal content management system, version 6.10 or later versions
		c/ Joomla content management system, version 1.5.9 or later versions
9	ePortal	- Liferay, version 4.0 or later versions

Appendix E

Key Industrial Products, and their Support Policies in Vietnam

E.1 Decision No: 19/2001/QD-TTg

THE PRIME MINISTER OF GOVERNMENT SOCIALIST REPUBLIC OF VIET NAM

Independence - Freedom - Happiness

No: 19/2001/QD-TTg *Hanoi, February 20, 2001*

DECISION

ADDING THE COMPUTER PRODUCTS TO THE LIST OF KEY INDUSTRIAL PRODUCTS ENJOYING SUPPORT UNDER THE PRIME MINISTER'S DECISION NO. 37/2000/QD-TTG OF MARCH 24, 2000

THE PRIME MINISTER

Pursuant to the Law on Organization of the Government of September 30, 1992;

Pursuant to Article 3 of the Prime Minister's Decision No. 37/2000/QD-TTg of March 24, 2000 adding other products to the list of key industrial products;

At the proposal of the Minister of Industry,

DECIDES:

Article 1.- To add the computer products to the list of key industrial products prescribed in the Prime Minister's Decision No. 37/2000/QD-TTg of March 24, 2000.

Article 2.- The preferential tax policies and other financial policies for the computer products shall uniformly comply with the provisions in the Prime Minister's Decision No. 37/2000/QD-TTg of March 24, 2000 (enclosed appendix).

Article 3.- This Decision takes effect after its signing.

Article 4.- The Ministers of Planning and Investment; Industry; Finance; Science, Technology and Environment; Trade; Defense; Agriculture and Rural Development; Aquatic Resources, the Minister-Chairman of the Committee for Ethnic Minorities and Mountainous Areas, the Governor of Vietnam State Bank, the General Director of Land Administration, the General Director of Customs, the General Director of Post and Telecommunications, the Director of the Government Pricing Committee, the Director of Radio Voice of Vietnam, the Chairman of the Management Board of Investment Development Support Fund, the General Director of Vietnam Electronics and Informatics Corporation, and the heads of concerned agencies shall have to implement this Decision.

FOR THE PRIME MINISTER

DEPUTY PRIME MINISTER

Nguyen Tan Dung

E.2 An Appendix of Decision No: 19/2001/QD-TTg

APPENDIX

POLICY OF SUPPORT FOR THE DEVELOPMENT OF KEY INDUSTRIAL PRODUCTS APPLICABLE TO COMPUTER PRODUCTS

(Issued together with the Prime Ministers Decision No. 19/2001/QD-TTg of February 20, 2001)

I. ENTERPRISE ASSUMING THE PRIME RESPONSIBILITY FOR THE EXECUTION OF THE PROJECT:

Vietnam Electronics and Informatics Corporation

II. SUPPORT POLICY:

1. On taxation:

- To exempt import tax up to the end of December 31, 2003 for equipment, machinery and special-use transport means, which are included in the technological lines to create fixed assets of the enterprise

- Incomes earned from the production of computers by the enterprises which execute the project shall be entitled to the enterprise income tax rate of 25%, be tax-free for the first two years after the taxable income is generated, and entitled to 50% reduction of the payable income tax for the two subsequent years.

- The enterprise shall be entitled to preferential index with the regulating coefficient of 0.5 to calculate import tax according to the localization rate prescribed in Joint-Circular No. 176/1998/TTLT of December 25, 1998 of the Ministry of Finance, the Ministry of Industry and the General Department of Customs.

2. On capital for the enterprise:

- When there arises the need to invest in building production establishments, the enterprise may borrow the States development investment credits from the Development Assistance Fund for a period of not more than 10 years for each separate loan. The capital-borrowing enterprise shall not have to mortgage its assets, but must not assign its assets before its has repaid all its debts (both principal and interest) for each loan.

- The enterprise directly producing computers shall be allocated full 30% of the norm working capital, the deficit shall be covered with the States development investment credit loans from the Development Assistance Fund corresponding to a production cycle.

- The enterprise shall be supported with the State budget capital source reserves for scientific and technical research in research and development projects after the project is approved.

3. Other preferences:

50% reduction of land rent for the enterprise during the period of project execution.-

Appendix F

Policy on the Management of Online Games in Vietnam

JOINT CIRCULAR No. 60/2006/TTLT-BVHTT-¬BBCVT-BCA of June 1, 2006, on management of online games

Pursuant to the Government's Decree No. 55/2001/ ND-CP of August 23, 2001, on the management, provision and use of Internet services;

Pursuant to the Government's Decree No. 90/2002/ ND-CP of November 11, 2002, defining the functions, tasks, powers and organizational structure of the Ministry of Post and Telematics;

Pursuant to the Government's Decree No. 63/2003/ ND-Cpof June 11, 2003, defining the functions, tasks, powers and organizational structure of the Ministry of Culture and Information;

Pursuant to the Government's Decree No. 136/ 2003/ND-CP of November 14, 2003, defining the functions, tasks, powers and organizational structure of the Ministry of Public Security;

The Ministry of Culture and Information, the Ministry of Post and Telematics and the Ministry of Public Security hereby jointly guide the management of online games as follows

Chapter I

GENERAL PROVISIONS

Article 1.- Governing scope and application subjects

This Circular governs the production, provision and use of online game services in Vietnam.

Subject to the application of this Circular are enterprises and individuals producing online games, enterprises providing online game services, Internet access service providers (ISP), Internet agents and users of online game services.

Article 2.- Interpretation of terms

1. Online games mean games played on the Internet with the interaction between players and servers of enterprises providing online game services, and among players.

Online games defined in this Circular are massively multiplayer online games (MMOG), including massively multiplayer online role-playing games (MMOPRG) and casual games.

2. Enterprises providing online game services are enterprises that install equipment systems and directly provide online game services.

Article 3.- Prohibited acts

1. Importing, producing and providing online games with the following contents:

a/ Inciting the people to oppose against the State of the Socialist Republic of Vietnam, undermining the national solidarity bloc;

b/ Provoking violence, spreading propaganda about wars of aggression, sowing hatred among nations and peoples, arousing obscenity, debauchery and crime;

c/ Disclosing state secrets, defense, security, economic and foreign relations secrets and other secrets provided for by law;

d/ Supplying untrue information, distorting, slandering and infringing upon the prestige of organizations as well as honor and dignity of citizens.

2. Providing online game services or acting as online game service-providing agents in Vietnam without permission of competent state management agencies.

3. Advertising and introducing online games which have not yet been permitted for circulation in Vietnam.

Article 4.- Production and processing of online games

Game-producing enterprises and individuals shall satisfy conditions and abide by the provisions of law on software production. The State encourages and supports domestic enterprises and individuals to research and produce online games. Priority shall be given to the distribution of online games which are produced at home and have contents appropriate to national history and cultural traditions.

Chapter II

PROVISION OF ONLINE GAME SERVICES

Article 5.- Conditions for provision of online game services

3. Having obtained written certification by the Post and Telematics Ministry with the agreement of the Public Security Ministry of satisfaction of technical and professional conditions prescribed for enterprises providing online game services in order to ensure information safety and security, service quality and legitimate interests of service users.

Article 6.- Dossiers and procedures for approval of contents and scenarios of online games

1. Dossiers of application for approval of game contents and scenarios

An application dossier addressed to the Culture and Information Ministry comprises:

al An application of the enterprise;

bl Lawful copy of the enterprise's business registration certificate, covering the provision of online game or video game services (at places other than its head-office).

c/lnformation on the game, including:

- The name of the online game;

- The origin of the game (imported or produced at home);

- The game owner's certificate of game software copyright and documents permitting the enterprise to distribute such game in Vietnam;

- The type of the game (MMOPRG or casual game);

- Summary of main contents and scenario of the game;

- Languages used in the game;

- Other necessary information.

2. Procedures for assessing contents and scenarios of online games

The Culture and Information Ministry shall receive dossiers, assess and approve contents and scenarios of online games.

Within 15 working days after receiving valid dossiers, the Culture and Information Ministry shall issue a written reply, notifying its approval or disapproval of the contents and scenarios of the games and the reason therefore.

Article 7.- Technical and professional conditions and procedures for evaluation thereof

1. Technical and professional conditions

After completing the installation of equipment systems and the formulation of technical and professional plans, enterprises shall send reports thereon to the Post and Telematics Ministry. Within 15 working days after receiving the reports, the Post and Telematics Ministry shall assume the prime responsibility for, and coordinate with the Public Security Ministry in, conducting field inspection at enterprises. If enterprises meet all the conditions for service provision stated in Clause 1 of this Article, the Post and Telematics Ministry shall issue written certifications of satisfaction of technical and professional conditions. In case of refusal, the Post and Telematics Ministry shall issue a written reply, clearly stating the reasons therefor so that enterprises can resolve existing problems.

For any change resulting from the provision of new games in technical and professional plans already reported by enterprises to competent state management agencies, the Post and Telematics Ministry shall consider and issue written replies within 15 working days after receiving enterprises' reports thereon. Past this time limit, if the Post and Telematics Ministry issues no written reply, enterprises shall be entitled to provide games already reported.

Chapter III

RESPONSIBILITIES OF ORGANIZATIONS AND INDIVIDUALS PROVIDING AND USING ONLINE GAME SERVICES

a/ Request service users to supply enterprises with personal information such as names, addresses, 10 numbers or other details necessary for identifying service users;

b/ Warn service users about undesirable impacts such as physical and mental complications caused by excessive playing, the rights to disposal of property accruing in games;

These regulations shall be concurrently sent to the Culture and Information Ministry, the Post and Telematics Ministry and the Public Security Ministry.

3. Enterprises shall have to store information on service users and supply such information to competent state management agencies when so requested.

4. Enterprises providing online game services shall register for establishment of websites and manage information posted on websites as well as information exchanged by service users in game forums in strict accordance with current provisions of law.

A game home page shall fully contain the following information:

- Rules of the game;

- Regulations on management of online games and

regulations on assurance of the fairness of games.

5. To apply appropriate measures to ensure legitimate interests of service users and settle disputes between service users; and to take responsibility before service users for service quality, information safety and security, and charges.

Enterprises providing online game services must neither create valuable assets in games for profit¬seeking purposes nor alter information on players' assets or value.

6. To send reports to the Culture and Information Ministry, the Post and Telematics Ministry and the Public Security Ministry biannually or in unexpected cases, when so requested.

7. To be submit to the inspection and examination by competent state management agencies according to current provisions of law.

8. If wishing to terminate the provision of online game services, enterprises providing online game services shall report such in writing to the Culture and Information Ministry, the Post and Telematics Ministry and the Public Security Ministry, make announcements on game home pages at least 3 months before the intended time of termination of service provision, and have to ensure interests of service users.

To have plans to ensure the quality of Internet access services in strict accordance with current standards when they lease channels to enterprises providing online game services or provide Internet connection services or when network congestion occurs.

3. To provide online game services at places which are at least 200 m far from entrance gates of schools (from pre-schools to secondary education schools) in any locality.

Article 12.- Responsibilities of service users

1. To strictly abide by relevant provisions of this Circular.

2. Not to post on game forums information in violation of the provisions of Clause 1, Article 3 of this Circular.

3. To supply adequate and accurate personal information such as names, addresses, 10 number as well as other details necessary for their identification at the request of enterprises providing online game services.

Chapter IV

INSPECTION, EXAMINATION, AND HANDLING OF VIOLATIONS

Article 13.- Inspection and examination

Inspection agencies specialized in culture and information as well as post and telematics shall, within the scope of their state management, inspect and examine activities of producing, providing and using online game services by subjects defined in Article 1 of this Circular.

Article 14.- Handling of violations

Enterprises and individuals producing and/or providing online games, Internet agents and users of online game services that violate regulations on the management of online games shall, depending on the nature and seriousness of their violations, be administratively sanctioned or examined for penal liability according to the provisions of law.

Chapter V

ORGANIZATION OF IMPLEMENTATION

Article 15.- Responsibilities of ministries and branches

1. The Culture and Information Ministry:

a/ To direct and guide enterprises providing online game services to observe state regulations on management and provision of information applicable to online games.

b/ To coordinate with concerned state agencies in guiding the mass media in disseminating information on online games and the state management of this service.

c/ To inspect, examine and handle violations of regulations on the management of online games falling within its state management competence.

2. The Post and Telematics Ministry:

a/ To direct Internet service-providing enterprises to work out plans so as to ensure the quality of transmission lines and Internet access services up to the set standards.

b/ To direct provincial/municipal Post and Telematics Services to assume the prime responsibility for, and coordinate with concerned units in, enhancing inspection of Internet agents' activities.

c/ To inspect, examine and handle violations of regulations on management of online games falling within its state management competence.

3. The Public Security Ministry:

a/ To direct and realize the prevention and combat of offenses related to online game activities.

b/ To direct professional units, provincial/municipal polices to coordinate with post and telematics inspectorate and culture and information inspectorate in examining, inspecting and handling violations in the provision of online game services in their respective localities according to current provisions of law.

4. Provincial/municipal People's Committees:

a/ To direct authorities of various levels to manage, inspect and examine activities of enterprises and individuals that produce and/or provide online game services and Internet agents providing online game services.

b/ To direct provincial/municipal Post and Telematics Services, Culture and Information Services and Police Departments in organizing periodical and unexpected inspections at enterprises and individuals that produce and/or provide online game services and Internet agents providing online game services in the localities and in handling violations according to their tasks and powers prescribed by law.

c/ To coordinate with ministries and ministerial-level agencies in managing activities of enterprises and Internet agents providing online game services in their localities.

Chapter VI

IMPLEMENTATION PROVISIONS

Article 16.- This Circular takes effect 15 days after its publication in "CONG BAO"

The Culture and Information Ministry, the Post and Telematics Ministry and the Public Security Ministry shall, within the scope oftheir tasks and powers, guide agencies, organizations and units to implement the provisions of this Circular.

Agencies, organizations and individuals are requested to report any problems arising in the course of implementation to the Ministry of Culture and Information, the Ministry of Post and Telematics and the Ministry of Public Security for guidance and settlement.

For the Post and Telematics Minister Vice Minister

LE NAM THANG

For the Public Security Minister Vice Minister

NGUYEN VAN HUONG

For the Culture and Information Minister Vice Minister

DO QUY DOAN