# KNOWLEDGE SPILLOVERS & ITS RELATION WITH INNOVATION AT FIRM LEVEL WITHIN A KNOWLEDGE-INTENSIVE CLUSTER IN DEVELOPING COUNTRIES: A CASE STUDY OF QTSC, VIETNAM

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## ABSTRACT

This thesis has been motivated by existing theoretical and empirical gaps about the relationship between local knowledge spillovers (LKS) and innovation in the context of knowledge-intensive clusters in developing countries. So far, few efforts have been devoted toward synthesizing factors moderating the effects of LKS to innovation according to its channels. Previous studies present mixed evidence on the effects of LKS on innovation of clustered firms. In addition, contextual differences between low-cost manufacturing clusters and knowledge-intensive clusters in developing countries raise concerns about the significance of LKS to innovation of co-located firms, since these clusters often rely on knowledge rooted from abroad for their production. Likewise, while the consensus from past studies holds that global linkages play a major role for firms in developing countries to innovate, how the global connections could further diffuse knowledge, especially tacit knowledge in the form of LKS, to local communities remains unknown.

The purpose of this study is to yield a comprehensive picture of the LKS phenomenon, by addressing factors influencing the channels of LKS on the one hand, and explore how LKS via these channels may influence innovation at firm level on the other hand. This research aims to unravel the complex interactions amongst determining factors of LKS at different levels, namely intra-organisation (inside firm), intra cluster (amongst firms, and between firms and other institutions within the same cluster), and external linkages outside clusters, typically global linkages.

A case study research design with mixed-method methodology under the guidance of critical realism was conducted. Due to the scarcity of secondary data, the researcher has collected primary data, including 46 network surveys, 42 innovation surveys and 28 semi-structured interviews, from a total cluster population of 97 firms inside the largest software cluster in Vietnam named Quang Trung Software City (QTSC), during a fieldwork trip in 2018. Each type of data is analysed separately at first, then their findings are complementarily integrated to generate meta-inferences for the whole population of firms inside the cluster.

In the findings, not all channels of LKS exert equal effect on innovation at firm level. Only LKS via social interaction is beneficial for innovation, while LKS via labour mobility and spin-off do not obtain statistically significant results. The social network of firms inside the cluster is evidently sparser than that of other software clusters in developing countries. The current localised institutional setting, i.e. the presence and efficiency of available actors and institutions within the cluster, has not supported the dissemination of LKS useful for innovation.

The contributions of this study are three-fold. First, it demonstrates hierarchical levels of influences on the LKS phenomenon within a cluster from macro, industry to cluster and individual firm levels. Second, empirical findings from this research deepen and extend our understanding about factors moderating the relationship between the LKS channels and innovation of co-located firms in a knowledge-intensive cluster in developing countries. Third, the present study presents two novel points to the existing empirical literature of local-global dynamism. On the one hand, it elaborates the benefits of global linkages according to business activities of firms. On the other hand, it traces how knowledge flows from global connections could transfer to LKS via local connections.

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## DEDICATION

**I wish to dedicate this thesis to my beloved family and my husband, Thinh Kien Ngo for their love and endless support**

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**List of Abbreviation**

| | |
|---|---|
| CE | Collective Efficiency |
| CEO | Chief Executive Officer |
| CTO | Chief Technical Officer |
| EG | Economic Geography |
| FDI | Foreign Direct Investment |
| GDP | Gross Domestic Production |
| GSO | General Statistics Office of Vietnam |
| GVC | Global Value Chain |
| ICT | Information Communication Technology |
| IPRs | Intellectual Property Rights |
| IT | Information Technology |
| KPF | Knowledge Production Function |
| KS | Knowledge spillovers |
| KSC | Knowledge Services Cluster |
| LKS | Localised knowledge spillovers |
| MIC | Ministry of Information and Communication |
| MNCs | Multi-national Corporations |
| MMR | Mixed-method research |
| QTSC | Quang Trung Software City |
| QTSC Development Company | Quang Trung Software City Development Company Limited |
| R&D | Research and Development |
| RQ | Research question |
| SBI | QTSC Incubator |
| SMEs | Small and Medium Enterprises |
| SNA | Social Network Analysis |
| SOEs | State-owned Enterprises |
| VINASA | Vietnam Software and IT Service Association |
| VNITO | Vietnam Information Technology Outsourcing Alliance |

# CHAPTER 1: INTRODUCTION & KEY CONCEPTS

## 1.1. Chapter overview

We, as human beings, always want to learn from the best, so do our governments. This statement applies to the cluster initiatives at the behest of governments in developing countries. The formation of these clusters aims to replicate successful clusters and regions across the world, from the Third Italy Industrial District to modern Silicon Valley. It is believed that in practice the popularity of cluster initiatives has been highly influenced by the cluster theory of Michael Porter (Martin & Sunley, 2003; Nathan & Overman, 2013). Accordingly, cluster is the unit of national competitiveness which positively contributes to innovation and economic development. However, within these clusters, knowledge spillovers (KS) are often taken for granted (Breschi & Lissoni, 2001). In other words, the mechanisms of this local or localised knowledge spillovers (LKS) phenomenon have not been fully examined.

The phenomenon of LKS and its influence upon innovation at firm level is not a trivial matter. Towards a knowledge-based economy, economic growth needs less reliance upon traditional production inputs such as capital and labour, but more upon knowledge, innovation and technology (OECD, 1996). It is no longer physical capital accumulation but knowledge accumulation embedded either in labour or technology or machinery which plays the key role for improving living standards; an ultimate goal of economic development (Stiglitz & Greenwald, 2014). This statement is significantly meaningful for those developing countries which desire to catch-up with developed countries. In particular, by purposely establishing knowledge-intensive clusters, developing countries could tap into the wealth of knowledge generation within a cluster and simultaneously accelerate the level of LKS. However, spatial proximity acts as an enabling element for LKS only; co-location within the same cluster is not sufficient to trigger LKS (Dankbaar, 2013), neither does it guarantee that LKS would contribute significantly to innovation (Huber, 2012).

This chapter aims to provide an overview of the whole thesis. Section 1.2 seeks to explain the key concepts used throughout this thesis. Section 1.3 introduces the research aims and objectives, and research questions. Then, section 1.4 outlines the thesis structure prior to concluding with a summary of this chapter in section 1.5.

## 1.2. Key concepts

This section provides the definitions of the key concepts used throughout this thesis. These concepts include local or localised knowledge spillovers, innovation at firm level, knowledge-intensive cluster and software outsourcing industry. Understanding the key concepts is important

to avoid either any confusion about the terms in use or mistaken generalisations to a wider population, such as clusters in other sectors or in other countries.

### *1.2.1. Localised knowledge spillovers (LKS)*

The term "localised knowledge spillovers" or "local knowledge spillovers" (LKS) implies a spatial dimension of knowledge spillovers (KS). There is extensive extant literature about KS (Cerver-Romero, Ferreira, & Fernandes, 2018). Hence, it is important to highlight that the focus of this thesis is within LKS, rather than any other types of KS. In this study, the term LKS refers to KS restricted within an identified geographical area, such as a cluster or region, due to the agglomeration of firms.

The conception of KS, followed by an explanation of why KS occurs in the first place, the spatial dimension of KS and the channels of LKS in reference to this study is articulated below.

#### *The conception of knowledge spillovers (KS)*

The origin of KS is derived from Marshallian agglomeration externalities (Marshall, 2013 [1890]). In particular, the rationales for geographical clustering of industrial activities are known as Marshallian agglomeration externalities, including (i) a pool of skilled workers, (ii) linkages with suppliers and consumers, and (ii) KS – "the mysteries of the trade … in the air" (ibid, p.225). In this regard, KS according to Marshall is largely unintentional (Schmitz, 1995, 1998, 1999a).

The conception of KS is later developed by other scholars. For example, Breschi and Lissoni (2001, p. 975) define KS as "*knowledge externalities bounded in space that provide an advantage for closely located firms in accessing critical knowledge sources needed to create innovations at a faster rate than competitors located in other areas*". For Ibrahim, Fallah, and Reilly (2009, p. 412), KS is "*useful local sources of knowledge found in a region, that were obtained beyond the recipients' organisation, and that affected the innovation of the recipient"*. Meanwhile, according to (Grossman & Helpman, 1992, p. 16) KS, is referred to as the information flow which satisfies two conditions, namely "*(1) firms can acquire information created by others without paying for that information in a market transaction, and (2) the creators (or current owners) of the information have no effective recourse, under prevailing laws, if other firms utilise information so acquired"*.

#### *The occurrence of knowledge spillovers (KS)*

KS is a type of positive economic externalities. It occurs owning to the properties of knowledge itself, namely as a type of public goods, its indivisibility and inappropriability.

Knowledge has characteristics of a public goods, i.e. non-rival, non-excludable and non-exhaustive (Acemoglu, 2008; Romer, 1990; Samuelson, 1954; Stiglitz, 2005; Stiglitz & Greenwald, 2014). Accordingly, the non-rivalrous feature of public goods or 'collective consumption goods' means that the use of a goods by one person does not affect the amount of that goods consumed by latter individuals (Samuelson, 1954). There is a low or zero marginal cost for sharing knowledge. Regarding non-excludability or imperfect excludability, "*there are high costs to exclusion … to additional individuals enjoying the benefits*" of public goods (Stiglitz, 2005, p. 26). It is difficult to exclude others from using the public goods. Certain types of knowledge, such as trade secrets, could be excludable or at least temporarily excludable.

As a special type of information, knowledge is indivisible and inappropriable (Arrow, 1962; Stiglitz & Greenwald, 2014). Information is an indivisible commodity. In this regard, the transmitting cost of information is close to zero. However, firms are resistant to disclose their strategic knowledge to others, especially to their competitors, because some of their knowledge support firms to retain their market power. For this reason a legal framework, such as via the intellectual property rights (IPRs), is established to protect the intangible assets of individuals and organisations. On the one hand, the IPRs regimes incentivise creative activities, especially innovation. Being granted exclusive rights on patents, inventors are required to disclose descriptions of their inventions into the public domain. This requirement aims to enable the free flow of advanced knowledge leading to further innovations. However, in practice, the IPRs tools such as patenting are criticised for engendering social inefficiencies due to the underutilisation of knowledge (ibid):

> *Market responses to the appropriability problem can impede learning, it leads to more extensive patenting and greater secrecy… impediments in the transmission of knowledge*. (Stiglitz & Greenwald, 2014, p.73)

Regarding the inappropriability property of information, legal protection is unlikely to be sufficient to make information appropriable; therefrom social returns tend to exceed private returns (Stiglitz & Greenwald, 2014, p.76). For example, the dissemination of knowledge could happen via labour mobility. Nowadays, employers prevent such dissemination by using nondisclosure and confidentiality agreements with their employees. These contracts legally force employees not to disclose certain types of intellectual property (IP) assets owned by their employers in any forms. Nevertheless, this form of legal protection does not fully eliminate the inappropriability of knowledge. As a result, firms generally cannot internalise or appropriate all economic returns from their innovative activities and knowledge (Kaiser, 2002; Samaniego, 2013; Stiglitz & Greenwald, 2014). This probably reduces the propensity of firms to invest in innovation, which could damage their learning process (Arrow, 1962).

***Knowledge spillovers (KS) has a spatial dimension***

The consensus amongst researchers holds that KS decays with geographical distance. Admittedly, nowadays, the advancement of communication technology specifically the use of Internet enables information to be circulated easier, wider and faster. Notwithstanding, in the words of von Hippel (1994), some 'sticky information' is embedded within specific individuals and organisations, and would be perhaps diffused only through personal communication and frequent contacts. Similarly, according to Feldman (1993, p. 455), pieces of tacit knowledge "*cannot be completely codified and transferred through blueprints and instructions*". Besides, some new economic knowledge could be more valuable to firms if the knowledge is absorbed in a timely manner through regular and personal contacts due to the firms' physical closeness to the original sources of knowledge (Shearmur & Doloreux, 2016). Spatial proximity therefore plays an important role in diffusing information and knowledge (Jaffe, Trajtenberg, & Henderson, 1993). However, it rather acts as an enabling factor, rather than a sufficient one to KS (Dankbaar, 2013; Torre, 2008).

***Channels of local knowledge spillovers (LKS)***

To detect channels of LKS it is important to note that KS could be both intentional and unintentional. For those studies which interpret the KS process to be accidental and unintentional, the channels of KS are restricted within the bounds of attendance of fairs, seminars, workshops, reading publications within their field, observing other firms and high-skilled labour mobility (Grillitsch & Trippl, 2014; Trippl, Tödtling, & Lengauer, 2009). Nevertheless, other intentional channels of KS are equally important to firm's economic growth and innovation as outlined in the literature of economic development studies (Schmitz, 1995, 1998, 1999a) and of economic geography of innovation (Kesidou, 2007).

The intentional channel of KS or 'quasi KS' (Kesidou, 2007) is nested within the formal transactions based upon supplier-buyer networks (Antonelli, 2006). In this regard, there are both horizontal and vertical spillovers. Typically, for developing countries, major attention has been drawn on spillovers from foreign direct investment (FDI) (Blomstrom, 1992; Finn, Juliane, Carol, & John, 2011). Accordingly, horizontal spillovers refer to the benefits due to the presence of multi-national corporations (MNCs). The relevant spillover channels include observation and imitation of products, labour mobility and competitive pressure from MNCs. Vertical spillovers could be classified into forward and backward linkages. Backward linkages represent the from-buyer-to-supplier relationship. Firms could benefit from their backward linkages with MNCs due to direct technology transfer. In addition, similar to horizontal spillovers, the mobility of skilled-labour, e.g. managers and senior technicians from MNCs to domestic firms is another conduit to

KS. By working with MNCs, pressure to achieve higher product quality standards theoretically forces domestic firms to improve their productivity and efficiency. FDI or MNCs might be the crucial source of knowledge including KS, but horizontal and vertical spillovers channels could be applicable to any sources of knowledge and KS.

In particular, as tacit knowledge is carried within human beings, the mobility of labour within a geographical area facilitates the circulation and dissemination of knowledge (Breschi, Malerba, & Montobbio, 2007). Notably, valuable economic knowledge is likely to be embedded within highly skilled labour rather than low-skilled labour (Glaeser, Kallal, Scheinkman, & Shleifer, 1992). For instance, the geographical proximity to specialised universities and training centres could provide firms with skilled labour, thereby increasing the firm's competitive advantage (Griliches, 1979).

In addition, Allen (1984) and Von Hippel (1987) (as cited in Dahl & Pedersen (2004)) regard some forms of KS as 'information trading' occurring through informal exchange of knowledge between employees in different firms. Such informal exchange represents the social interaction channel of KS (Breschi et al., 2007). The exchange is based upon mutual reciprocity; one party reveals the required information in return for a future favour from the other. In this sense, LKS is immersed within "*the socialised processes of local knowledge creation*" (Capello & Faggian, 2005, p. 75).

Finally, in entrepreneurship literature 'spin-off' is considered an important channel of KS (Audretsch & Lehmann, 2005); especially spin-offs from universities, research laboratories or incumbent firms. Spin-off refers to the situation when an individual or individuals leave their old workplace to form a new business. Spin-offs tend to co-locate with their parent firms or institutions (Audretsch & Keilbach, 2008), or within a dense concentration of related firms in order to learn from incumbent firms; to enjoy localisation externalities such as LKS. However, subject to the life cycle of firm (Glaeser et al., 1992), spin-offs may relocate away from their parent organisations later (Torre, 2008). Hence, geographical proximity likely influences a spin-off more during its early stages.

To consider all the aforementioned channels of KS, this thesis will pay particularly attention to those channels restricted by geographical proximity and more relevant to the research context - a knowledge-intensive cluster (Ter Wal & Boschma, 2011). Imitation, reverse engineering, and reading scientific publications are likely to be associated with manufacturing activities given their scientific and technological nature, rather than software services (Malerba, 2006; Pavitt, 1984; Pietrobelli & Rabellotti, 2006). Meanwhile, the attending of seminars, conferences, trade fairs and other networking events channel of KS is not necessarily confined within a cluster.

Taking all the above into consideration, this study seeks to capture LKS within a cluster via three major channels, namely network (mainly social interaction), labour mobility and spin-off.

### *1.2.2. Innovation at firm level*

Innovations are new creations of economic significance (Edquist, 1997a) which contribute to economic growth (Nelson, 2008). Innovation at firm level refers to "*the process by which firms master and put into practice product designs and manufacturing processes that are new to them*" (Nelson, 1993, p. 4).

Classical economists do not directly discuss innovation as major source of economic growth. For them, innovations are largely embedded in machinery and due to the division of labour. For example, in the Wealth of Nations by Adam Smith ([1776], 2015), innovations are limited within the inventions of machinery owing to the division of labour, that "*facilitate and abridge labour, and enable one man to do the work of many*" (p.10). The division of labour leads to changes in the organisation of work, productivity and ultimately economic growth and wealth creation (Mazzucato, 2018). According to classical and neo-classical economists, microeconomic theories are mostly about profit-maximization behaviour and equilibrium conditions. This presumption has little to say about how firms evolve and innovate (Nelson & Winter, 2002).

The evolutionary economics ideas, typically Schumpeterian ideas about "creative destruction" and entrepreneurial force as the source of competitive advantage (Schumpeter, [1934], 1983, [1942], 2003)[i] did not gain much attention until the second half of the 20$^{th}$ century (Nelson & Winter, 2002). Then in the 1980s, inspired by Darwinian evolution theory and Schumpeterian theory Nelson and Winter (1982) founded evolutionary economics, which has become the dominant theoretical guidance for innovation studies. The evolutionary school challenges the view of the neo-classical school regarding technical change and innovation (Dosi, Freeman, Nelson, Silverberg, & Soete, 1990; Nelson & Winter, 2002). Unlike the presumptions that profit-maximisation behaviour of firms is the micro-foundations of economic theory, evolutionary scholars stress the role of institutions and organisational routines; especially how effective routines develop and change over time to generate technical changes and therefrom, result in economic growth. Evolutionary economics also acknowledges the importance of technological changes, knowledge and learning for the catching-up progress in developing countries. In fact, evolutionary economists warn that the term "innovation" in developing and developed countries should be perceived differently, both the direction and level of innovation (Nelson, 1993, 2008). For example, innovation in developing countries "*may largely involve learning to produce a product or employ technology that has been employed for sometimes by firms in the highly industrialised economies*" (Nelson, 1993, p.11); hence for indigenous firms, innovation

associates with newness for themselves, not necessarily new to the world. Also, investment in machinery and technology importation does not automatically lead to innovation in developing countries, they need "*to develop technologies suited to their own conditions*" (Nelson, 2008, p.18). Regarding economic development the evolutionary school promotes the integral role of indigenous actors and institutions, and call for public and private investment in basic research, educational and training programs in order to upgrade indigenous labour skills (Nelson, 2008).

Two types of innovation models dominate the conceptualisation of knowledge utilisation, and knowledge transfer (Havelock, 1969) including process and system models. Process models focus upon sequential steps or changes involved in decision making leading to innovation. One of the well-known process models is the chain linked model of Kline-Rosenberg (Edler & Fagerberg, 2017). The process of innovation starts with a market research or idealisation stage followed by design, production, marketing and distribution, concluding with the commercialisation stage. Innovation may occur at any or several points in this chain. Hence, the process model might be more likely to be associated with a particular product or technology. Yet, it is crucial to note that innovation is not a linear, but an interactive and cumulative learning process (Edquist, 1997a; Freeman, 1995; Lundvall, 1992; Nelson, 1993).

> Innovation is an interactive process- between firms and the basic science infrastructure, between the different functions within the firm, between producers and users at the inter-firm level and between firms and the wider institutional milieu – and that this process should be conceived as a process of interactive learning in which a wide array of institutional mechanisms can play a role. (Morgan, 1997, p. 493)

Meanwhile, system models such as systems of innovation exert considerable influence in the innovation policy domain. System models particularly pay attention to the flow, pattern and structure of knowledge usage. The model contains innovation networks of organisations, capabilities and actors.

For a long time, empirical studies, especially quantitative ones, had focused upon technological innovation; thereby, measuring innovation mainly via research and development (R&D) - relevant variables, such as the number of registered patents and other scientific publications. Until the end of the 1980s and during the early 1990s, the need for novel indicators to encapsulate non-R&D forms of innovation and incremental changes emerged. In 1992, the first Oslo Manual was introduced jointly by OECD & Eurostat to harmonise the surveying efforts to capture innovation both as an activity (such as, R&D, acquisition of machinery, etc.) and as an output (such as, introduction of product and process innovation). This Manual has become the dominant guidance for data collection in innovation studies in both developed and developing

countries. Typically, learning from the experience of Latin American innovation survey collection practice (Bogotá Manual), the Oslo Manual 2005 also includes annexes for innovation surveys in developing countries.

The Oslo Manual aims "*to provide guidelines for the collection and interpretation of data on innovation*" (OECD, 2005, p. 14) especially at firm level concerning the organisational level of decision-making on innovation activities. Since 2005, the Oslo Manual started to treat the organisational innovation as important as technological innovation, i.e. product and process innovation. According to this Manual, there are four types of innovation: product innovation, process innovation, organisational innovation, and marketing innovation (Table 1.1).

> An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. (Extracted from the Oslo Manual 2005, p.46)

In this regard, innovation is associated with newness, i.e. product, process, organisational method and marketing practice must at least be new to firms.

**Table 1.1: Types of innovation**

| Type of innovation | Definition |
|---|---|
| Product innovation | The introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. |
| Process innovation | The implementation of a new or significantly improved production or delivery method. |
| Organisational innovation | The implementation of a new organisational method in the firm's business practices, workplace organisation or external relations. |
| Marketing innovation | The implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. |

Source: Oslo Manual 2005 (OECD, 2005, pp. 48-51)

In the context of firms within a cluster, especially in developing countries, the concept of innovation also connects to 'upgrading'. Particularly, "*upgrading refers to the capacity of a firm to innovate to increase the value added of its products and processes"* (Giuliani, Pietrobelli, & Rabellotti, 2005, p. 550). 'Upgrading' at firm level is associated with an increase in '"*he skill content of their activities and/or (their) move into market niches which have entry barriers and*

*... therefore (they are) insulated to some extent from (competitive) pressure*" (Humphrey & Schmitz, 2002, p. 1018). At the cluster level, upgrading is subject to the relevant global value chain (GVC). Hence, studies regarding innovation in clusters in developing economies should be aware of the position of the concerned cluster in its relevant GVC.

### *1.2.3. Knowledge-intensive cluster*

This study applies the cluster definition by Michael Porter due to its prominence in both academia and corporate world (Martin & Sunley, 2003; Nathan & Overman, 2013). Accordingly, cluster refers to "*geographic concentrations of interconnected companies and institutions in a particular field"* (Porter, 1998, p. 2). This term might be confused with other terms in literature, such as spatial agglomeration of firms. However, the latter refers to a "*geographical concentration of firms whose mutual linkages may or may not exist"* (Wang, Lin, & Li, 2010, p. 1991).

To elaborate on the term 'knowledge-intensive', a brief explanation about sectoral classification is required. The sectoral differences are relevant to the level of technological intensity, the sources of knowledge for innovation and the nature and channels of KS. Based upon a dataset from British manufacturing firms, Pavitt (1984) provides a taxonomy of sectoral innovations. These innovations are divided into three categorisations; namely supplier-dominated firms, production intensive firms (sub-divided into scale intensive and specialised suppliers), and science-based firms. According to the level of technological intensity, Lall (2000) dictates four types of exporting manufactured goods organisations; namely resource-based, low-technology (such as textile, pottery and furniture), medium-technology (automotive, process and engineering industries) and high-technology (e.g. electronics and electrical, pharmaceuticals, optical instruments). Focusing upon Latin American countries, Giuliani et al. (2005) propose another taxonomy for sectoral innovation consisting of traditional manufacturing, natural resource-based sectors, complex products industries (such as automobiles and computers), and specialised suppliers (especially software). Knowledge-intensive industries fall into the last categorisation, i.e. specialised suppliers sector (Kesidou, 2007).

Each sector may rely upon a few dominant sources of knowledge for their innovation. For example, within the traditional manufacturing sector new technologies embedded in capital goods, i.e. machinery and equipment, are the main sources of knowledge. In this sector, the process of knowledge or technological accumulation is largely embodied in the production methods and design. Meanwhile, in the software sector, user-producer interaction, or distance to users is important for innovation. Unlike the complex product sector, which is both scale-and-technology- intensive, the software sector has a low barrier to entry.

Sector-wise factors, namely knowledge accessibility, opportunity and cumulativeness would affect the amount of KS (Malerba, 2006). Greater accessibility to external knowledge reduces the necessity for industrial concentration or clustering. This increased accessibility, in turn results in lower levels of KS. The extent and source of scientific and technological opportunities is attributable to the level of knowledge accessibility which differs from sector to sector as explained above. Finally, the degree of knowledge accumulation at local level could influence the appropriability condition of innovation. Particularly, locally high cumulativeness leads to low appropriability conditions and high level of LKS.

#### *1.2.4. Software outsourcing industry*

Software outsourcing is a type of knowledge-intensive business service. This sub-section initially addresses the concept of business services before moving on to briefly explain the GVC of offshore services. At the end of this section the definitions of software and software outsourcing according to literature and following the legal regulation in Vietnam are provided.

##### *1.2.4.1. Business services*

The definition and taxonomy of service is important when identifying innovation in the service industry. In this section, the researcher will address the blurred line between goods and services.

The line between goods and services is disappearing due to the advancement of information, communication and technology (ICT) revolution. Conventionally, goods, which are often alternatively described as "product" are "*physical objects that can be appropriated and therefore are transferrable between economic units*" (Rubalcaba & Kox, 2007, p. 4); meanwhile services are defined by what are not "goods". However, nowadays, services are no longer required to be consumed at the place of its production. Similar to manufacturing, services can now be standardised, modularised and provided from a distance.

> *Information today can be standardised, built to order, assembled from components, picked, packed, stored, and shipped.* (Karmarkar, 2004, p. 4)

The above observation is especially valid in the case of business services. Business services are "*intermediate inputs for other industries*" (Rubalcaba & Kox, 2007, p. 33) and mainly refer to services in business-to-business transactions. Business services differ from network-intensive services which "*in most cases can be produced in-house only*" (ibid). Table 1.2 presents some examples of knowledge-intensive and operational business services.

**Table 1.2: Two types of business services**

| Knowledge-intensive business services | Operational business services |
|---|---|
| • Software and computer services<br>• Strategy and management consultancy<br>• Auditing, accountancy, tax and legal advise<br>• Marketing services, opinion polling<br>• Technical services, engineering<br>• Personnel training, headhunting | •Security services<br>•Equipment renting<br>•Facility management, cleaning<br>•Administration, bookkeeping<br>•Temporary labour recruitment<br>•Other operational services (e.g. catering, translation, call centres) |

Source: (Rubalcaba & Kox, 2007, p. 5)

Due to its vertical disintegration nature from other industries, business services could be outsourced or produced offshore (also known as offshore outsourcing). In the context of this study, the software clusters in developing countries like Quang Trung Software City (QTSC) are primarily the destination of offshore services for clients in developed countries.

The next section will explain the GVC of offshore services.

#### *1.2.4.2. The global value chain (GVC) of offshore services*

Initiated in the mid-1980s, the offshoring phenomenon was associated with the process of manufacturing between developed and developing countries. In the beginning, the offshore services are inter-connected with the production and process of manufacturing (Sturgeon, 2002). Gradually, powered by the ICT revolution, the offshoring of services has increasingly gained momentum. In general, the clients are mainly from developed countries. Whereas, the suppliers of offshore services tend to come (i) from developing and emerging countries for low-value added services and/or low costs, and (ii) from more advanced countries for higher value-added services (Manning, 2013). There is evidence that some emerging countries such as India are engaging into more higher value added activities (Chaminade & Vang, 2008).

Business services could be categorised based on two dimensions, i.e. by geographical location and by corporate boundary (Sako, 2006) as illustrated in Table 1.3.

**Table 1.3: Offshoring and Outsourcing**

| | | Geographical location | |
|---|---|---|---|
| | | **Domestic (Inshore)** | **Oversea (Offshore)** |
| **Corporate boundary** | **Insource** | Domestic Divisions/Affiliates | Establishing Foreign Affiliates (FDI & Trade) **- Captive offshoring -** |
| | **Outsource** | Source from domestic suppliers **- Inshore outsourcing -** | Source from foreign suppliers (International Trade) **- Offshore outsourcing-** |

Source: Adapted from (Sako, 2006)

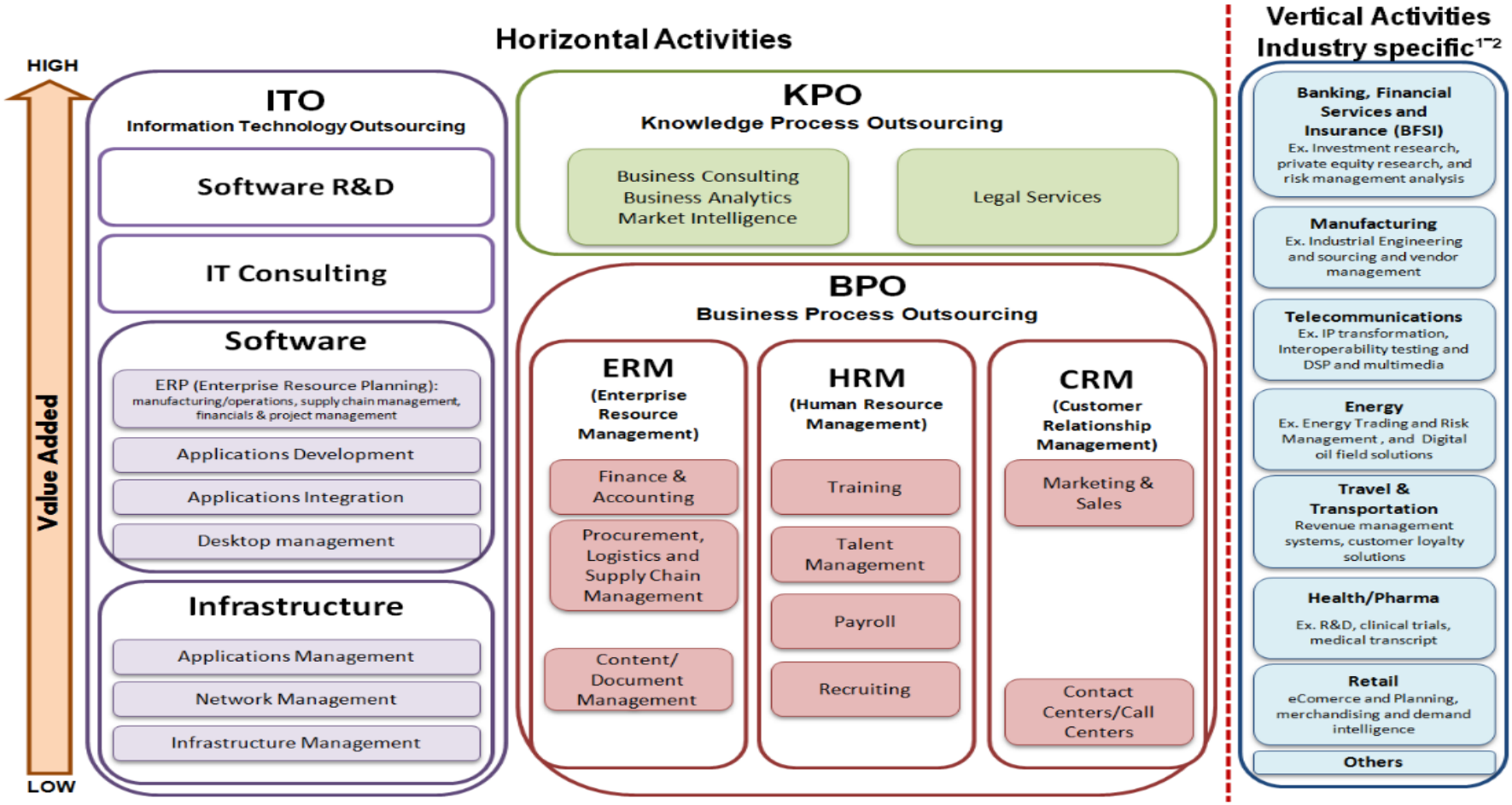
Accordingly, there are four scenarios to consider when developing the sourcing strategy of a firm. Apart from keeping the production in-house and within domestic divisions or affiliates, firms could either apply the models of 'inshore outsourcing', 'captive offshoring' and 'offshore outsourcing'. Another useful approach to define outsourcing is analysing the 'make-or-buy' decisions of a firm; within this scenario outsourcing refers to the decisions of buying rather than making things in-house. However, offshoring does not necessarily combine with outsourcing. A multinational corporation may shift their production activities offshore, but maintaining ownership, which is the "captive offshoring" model. Conversely, they may opt for "offshore outsourcing" via international trade; buying things produced by a separate owner.

From the demand side, MNCs search for offshoring services in developing countries for cost reduction, "*technological skills, language proficiency, similar time zones, and geographic and cultural proximity to major market"* (Gereffi and Fernandez-Stark, 2010, p.3). From the supply side, offshoring services evidently are beneficial to developing countries at least in terms of job and income creation (Sako, 2006). Offshoring outsourcing could enhance the productivity of suppliers due to the specialisation, standardisation and migration into a higher value-added segment (ibid). Moreover, for developing countries, offshoring lures technology transfer; therefrom helps these countries to develop its knowledge-based economy (Hirakawa & Nguyen, 2017).

At firm-level analysis, Gereffi and Fernandez-Stark (2010) have traced the GVC of offshore services (see Figure 1.1). There are three categories regarding general business activities or horizontal services supplied to all industries. First is Information Technology Outsourcing (ITO)

which covers activities from low to high value-added. Activities range from infrastructure, software outsourcing to IT Consulting and Software R&D. The second category is Business Process Outsourcing (BPO). This category includes low-to-medium value-added activities with three main business processes; namely Enterprise Resource Management (ERM), Human Resource Management (HRM), and Customer Relationship Management (CRM). The third category is the segment with the highest value-added activities described as Knowledge Process Outsourcing (KPO). The measurement of value in each activity is correlated with the level of education. The right panel of Figure 1.1 represents vertical services which are industry-specific. It lists some of the most popular industries regardless of the order of value-added.

**Figure 1.1: The Offshore Services Global Value Chain**




[1] *Industry specific: Each industry has its own value chain. Within each of these chains, there are associated services that can be offshored. This diagram captures the industries with the highest demand for offshore services.*

[2] *This graphical depiction of industry specific services does not imply value levels. Each industry may include ITO, BPO and advanced activities.*

Source: (Gereffi and Fernandez-Stark, 2010, p.14)

The GVC of the offshore services could either be producer-driven or buyer-driven. The institutional context at multiple levels (local, national and regional levels) shapes the value chain segment and its upgrading trajectory of a specific industry. In addition, the GVC of the offshore services is more likely to follow a non-linear trajectory; meaning that a country could upgrade its position and change its development paths in the value chain at different rates (Gereffi and Fernandez-Stark, 2011).

#### *1.2.4.3. Software and software outsourcing*

Software is an 'immaterial good' (Messerschmitt & Szyperski, 2004). It shares some commonalities with both material goods and services but maintains some unique features when compared with these two categories (ibid). Particularly, "*similar to many material goods and to services … its value is in the behaviours and actions it performs*" (ibid, p.4). However, software differs from material goods because its production is based upon "*logical rather than physical manifestation*" (ibid). Also, the production of software could achieve the economies of scale to a greater extent than the production of material goods, subject to the network effects or the adoption rate of software. Likewise, from a supplier perspective, software may entail "*large creation costs but miniscule reproduction and distribution costs*" (ibid). Software could be in the form of service in the sense that "*it requires a provider (mechanical and human) to convey its content*" (ibid).

Software outsourcing occurs when parts of software development are outsourced to vendor(s):

> a single software application and its supporting infrastructure are decomposed into many internal units (later called modules), often supplied by different vendors and with distinct ownership. (Messerschmitt & Szyperski, 2004, p. 5)

The length of outsourcing period and the point at which the outsourcing starts are varied and subject to discussions and agreements between the client/buyer and the vendor/supplier/subcontractor (Hätönen, 2008). However, a certain level of collaboration or exchange of information and knowledge exists between the buyer and the supplier of software outsourcing services.

In the national legal system of Vietnam, the highest legal documents relevant to software are the Law on Information Technology and Decree 71/2007/ND-CP. According to these regulations, the Vietnamese IT industry consists of three sectors; software, hardware and digital content. The software sector is subsequently divided into software products, software services and software outsourcing. The following paragraphs are definitions of software, software products, software services and software outsourcing extracted from the Vietnamese regulations.

Software is "*a computer program which is described by a system of signs, codes or languages for controlling digital equipment to perform certain functions*" (Article 4, Law on Information Technology).

Software product refers to "*software and accompanying documentation which are produced and displayed or stored in any forms and to be purchased, sold or transferred to other subjects for exploitation or use"* (Article 3, Decree 71/2007/ND-CP).

Software service refers to "*activities in directly supporting the production, installation, exploitation, use, upgrading, warranty and maintenance of software and other similar activities related to software*" (ibid).

Software outsourcing refers to "*activities whereby outsourcing vendors are specialised in producing and supplying software products or services or in performing certain stages to complete software products or services upon the request of the outsourcing clients*" (ibid).

### 1.3. Significance of study

In the existing literature of LKS, there exist both theoretical and empirical gaps in the context of knowledge-intensive clusters within developing countries. The available theoretical and analytical frameworks, particularly relating to the LKS phenomenon within a cluster is mostly outdated (Caniëls & Romijn, 2003). Also, the empirical literature fails to provide a systematic framework to explain the existence of LKS according to its channels. It suggests that the cluster initiatives within developing economies often presume the automatic presence of LKS (Breschi & Lissoni, 2001). Furthermore, there is a lack of empirical studies investigating the importance of LKS to innovation at firm level within a knowledge-intensive cluster in developing countries. This is problematical given the distinctions between low-cost manufacturing clusters and knowledge-intensive clusters (Manning, 2013) and the mixed evidence found in previous studies (Huber, 2012; Kesidou, 2007; Tsang, 2005). Finally, despite the blooming literature about local buzz versus global pipeline (Bathelt et al., 2004), there remains a scarcity of research into how global connections may further diffuse knowledge to local communities.

This study will address these gaps and contribute to the literature in economic development and economic geography of innovation.

## 1.4. Research Aims, Objectives and Questions

### *1.4.1. Research Aims and Objectives*

This study aims to investigate the LKS phenomenon and its relationship with innovation at firm level within a knowledge-intensive cluster under government initiatives within developing countries. To gain insights into the LKS phenomenon this research will use a case study research design based upon the largest software cluster in Vietnam; namely Quang Trung Software City (QTSC).

Overall, and as will be discussed in the literature review, chapter 2, the economic development studies about clusters in developing countries fail to address what happens inside a firm or organisation. This research domain tends to crowd out linkages beyond the boundary of a cluster. The economic geography of innovation literature has largely addressed the cases of Western clusters (Huber, 2012; Tsang, 2005) and a few successful clusters within developing countries (Caniëls & Romijn, 2003). Hence, to contribute to economic development and economic geography of innovation literature, this study will unravel the complex interactions amongst determining factors of LKS at different levels, namely intra-organisation (inside firm), intra cluster (amongst firms, and between firms and other institutions within the same cluster), and external linkages outside clusters, typically global linkages. Furthermore, it seeks to yield a comprehensive picture of the LKS phenomenon, by addressing factors influencing the channels of LKS on the one hand and explore how LKS via these channels may influence innovation at firm level on the other hand.

### *1.4.2. Research Questions*

Through a meticulous process of proposing, discussing and refining, the researcher decided to focus upon the following research questions. Each research question will be partly addressed in the respective individual chapters indicated in brackets. The research questions are:

1. How does the institutional setting affect LKS within QTSC? (Chapter 4 & 6)
2. How do the structure and composition of social network within QTSC influence the nature and patterns of LKS? (Chapter 5 & 6)
3. How significant LKS via different mechanisms are to innovation at firm level within QTSC? (Chapter 5 & 6)
4. How do idiosyncratic characteristics inside a firm affect LKS within QTSC? (Chapter 5 & 6)
5. How does the local-global dynamism influence LKS amongst firms inside QTSC? (Chapter 6)

To yield a comprehensive picture of LKS, research questions (RQ) numbered 1, 2 & 4 respectively deal with external learning environment, network dimension, and internal learning aspects of LKS. Meanwhile, RQ3, RQ4 and RQ5 address influencing factors on LKS at multiple levels, including the intra-organisational, intra-cluster (local linkages) and external linkages outside the cluster.

### 1.5. Thesis structure

This thesis consists of eight (8) chapters.

Chapter 1 provides a holistic overview of the thesis by explaining the research concerns. The research aims, objectives and questions are outlined. It also introduces and defines key concepts including LKS, innovation at firm level, knowledge-intensive cluster and software outsourcing.

Chapter 2 critically and systematically reviews the theoretical and empirical literature with respect to LKS and its influence upon innovation at firm level within a cluster in developing economies. As a result, it demonstrates some gaps that this PhD thesis seeks to contribute towards closing.

Chapter 3 articulates the research methodology and design used in this research to address the research questions and objectives. It elaborates upon the rationales for the chosen case study design and mixed-method methodology under in light of the research questions.

Chapter 4 illustrates the research context, particularly the country and cluster context in order to gain background knowledge about the institutional conditions. It covers some key macroeconomics information through different time-periods in Vietnam and some important industrial information about the Vietnamese software industry and the research cluster – the largest software cluster in Vietnam named QTSC.

Chapter 5 is the first of the analysis and results chapters. It responds to the quantitative strand in mixed-method methodology. The overall aim of this chapter is two-faceted, namely (i) to understand the network structure and characteristics – which address the channels of LKS via social interaction, and (ii) to testify the quantitative significance of different channels of LKS upon innovation at firm level.

Chapter 6 is complementary to chapter 5 in order to yield a complete picture about the LKS phenomenon within QTSC. This chapter seeks to obtain insights into which factors and how these identified factors interact to influence LKS and as a result influence innovation at firm level within QTSC.

Chapter 7 provides meta-inferences based upon the previous chapters. This chapter will integrate the findings from individual chapters and generalise them to the whole cluster.

Chapter 8 closes this thesis with conclusions about the theoretical, empirical and practical contributions of this PhD study. This chapter also acknowledges some limitations of this research and suggests opportunities for further studies.

# Chapter 2: LITERATURE REVIEW

## 2.1. Chapter overview

This chapter offers a systematic and critical review of both theoretical and empirical literature on the research topic. In the end, it identifies the existing gaps for which driving the formation of research questions.

The chapter is structured as follows. Section 2.2 provides a systematic summary of most relevant theoretical approaches relevant to clustering. By doing so, it examines how LKS and its relation with innovation at firm level have been addressed. Based on this summary, section 2.3 proposes a simplistic conceptual framework of three determinants of LKS, namely institutional setting, internal learning and external learning. Section 2.4 follows by addressing the literature of empirical studies. At last, section 2.5 summarises the theoretical and empirical gaps, and re-introduce the research questions.

## 2.2. Theoretical approaches regarding industrial cluster in developing countries

Most of the theoretical approaches regarding industrial clusters in developing countries are rooted from the work of Alfred Marshall (2013 [1890]). He identified three forms of agglomeration economies or external economies intensifying the clustering of firms. They are (i) the availability of skilled labour market, (ii) the linkages with customers and suppliers, and (iii) unintentional knowledge spillovers. While sharing the theoretical root, each theoretical approach focuses on a few distinctive areas. Table 2.1 encapsulates the individual theoretical approaches about clustering in literature, followed by discussion at length.

**Table 2.1: Summary of key theoretical approaches about clustering**

| Theoretical approach | Key studies | Discussion about LKS | Focus | Limitations |
|---|---|---|---|---|
| ***Collective efficiency (CE)*** | (Schmitz, 1995, 1998, 1999a) | Do not discuss explicitly about LKS. It is embedded within external economies and joint action | External economies and joint action are the conditions to promote the growth of industrial clusters in developing countries.<br>Upgrading is attributable for local factors and linkages (amongst firms, and between firms with local institutions) | The context is often low-cost manufacturing clusters originated from traditional, small-scale industries.<br>It crowds out both external linkages and intra-organisational aspects (what happens inside firms). |
| ***Knowledge system*** | (Bell & Albu, 1999; Bell & Pavitt, 1993) | Same like the collective efficiency | Technology and technological changes in industrial cluster in developing countries. Investment by firms to improve and acquire new capabilities is required. | Its context is large-scale manufacturing industry. |

| | | | | |
|---|---|---|---|---|
| ***Global value chain (GVC)*** | (Gereffi, 1999; Gereffi, Humphrey & Sturgeon, 2005; Humphrey & Schmitz, 2002) | Not much | Upgrading opportunities of clusters associated with different types of governance of the value chain. | It does not discuss LKS, but it contributes to the on-going debate on local-global dynamism. |
| ***Cluster theory*** | (Porter, 1998, 2000) | LKS is embedded in interaction between firms, mostly via production linkages, and trade association. | Exporting cluster is the source of local growth; while competitiveness or productivity is based on localised factors. | It focuses less on global linkages than on local linkages.<br>It fails to elaborate the socio-institutional aspects; and therefore, the factors contributing to the evolution of a cluster. |
| ***Economic geography of innovation literature:*** | | | Spatial dimension of innovation. | Largely based on the innovative clusters in Western countries, where competitiveness is knowledge-based factors, rather than low costs of input factors. |

| | | | | |
|---|---|---|---|---|
| - Economic geography (EG) | (Audretsch & Feldman, 2004; Jaffe, 1989; Jaffe et al., 1993) | R&D spillovers – captured by patent citation - are geographically localised. | It aims to explain why innovative activities tend to be spatial concentrated, especially in knowledge-intensive sectors. Inter-industry KS is found to be more important than intra-industry KS. | It does not discuss the channels of LKS. The measurement of KS via patent citation is arguable. |
| - New economic geography (NEG) | (Krugman, 1991, 1998) | KS across firms and industries is the source of increasing returns in production.<br>Pecuniary KS is assumed to lead to the regional convergence and divergent phenomenon, rather than pure KS. | Its focus is agglomerations and their impacts on economic performance. NEG provides an analytical framework on regional convergence and divergence. | It is criticised for its mathematical modelling methodology, and disconnection with other literature in economic geography. Krugman has given more attention to measureable (tangible) factors than intangible ones, such as pure KS. KS in this domain is between regions, rather LKS within a cluster or region. |
| - Territorial innovation models: | | | | |

| | | | | |
|---|---|---|---|---|
| + Industrial districts & New industrial districts | (Becattini, 1990; Piore & Sabel, 1984) | LKS appears due to regular contacts amongst local actors owing to shared informal institutions. | The emergence and survival of innovative clusters evidenced from experience of some clusters in Western economies, famously Third Italian clusters, during the crisis. | It overemphasises the importance of local linkages and factors, while lacking an adequate discussion on external linkages, typically how external pressure may affect the cluster evolution. |
| + Technological districts | (Antonelli, 1994; Storper, 1992) | LKS is technological externalities embedded in production network and social interaction, which are highly influenced by localised conventions. | It focuses on how place-based conventions affect the mobilization of production factors, and facilitate social interaction which is conducive for technological learning. | The technological districts focus on advanced regions in the core with rich resources of physical capital, hi-skilled intellectuals and intensive R&D activities. |
| + Learning regions | (Asheim, 1996; Morgan, 1997) | LKS are tied with traded and untraded interdependencies in the formal and informal networks of firms shaped by regional institutions. | It focuses on regional learning process, by integrating the evolutionary economic theory and technological learning perspective. | It still lacks the discussion on the local-global dynamism. |

| | | | | |
|---|---|---|---|---|
| + Innovation milieu | (Capello, 1999) | LKS is unconscious externalities, alike "industrial atmosphere" in Marshallian industrial district. | It focuses on the localised collective learning and the dynamic synergies created by inter-firm interaction; and their benefits to local innovation. | Like the learning region, it is short of discussion on external linkages. |
| + Regional innovation system | (Edquist, 1997b; Freeman, 1995; Lundvall, 1992) | The degree of LKS is subject to the institutional thickness. | It focuses on the knowledge sub-systems of generation, absorption and diffusion, and the influence of local institutional setting on these sub-systems. | The boundary of innovation system would definitely cover the cluster; however, the border line between internal vs external linkages for firms within a cluster is blurred. |

### *2.2.1. Economic development studies*

#### *Collective efficiency (CE) approach*

Collective efficiency (CE) approach has been developed in economic development studies (Schmitz, 1995, 1998, 1999a) to investigate industrial clusters in developing countries.

The context of CE framework is small-scale industries for the reason that specialisation emerges in these industries in the early industrialization in developing economies. The cluster is described as one "*with a deep inter-firm division of labour*", and particularly amongst small firms (Schmitz, 1995, p. 535). In this sense, industrial cluster in developing world is simply the geographical clustering of mostly small and medium enterprises (SMEs), which are local producers of traditional goods. In a well-developed cluster, there is dynamism between competition – due to sharing resources and producing similar products - and cooperation – for a collective purpose (Das, 1998).

CE refers to the arising efficiency gains or competitive advantage from external economies - "incidental CE" - and joint action – "consciously pursued CE". This approach does not explicitly mention local knowledge spillovers (LKS); rather, LKS is embedded in external economies and joint action from inter-firm relations. "External economies" is a term extracted from the work of Marshall, referring to the passive and unplanned gains due to clustering. Yet, external economies are insufficient to explain the competitiveness of the whole cluster; it further requires joint action – or collective action, planned and active CE - amongst firms and local institutions to address common challenges. Joint action could occur in two forms, cooperation and business associations. To enable cooperation, reciprocity and trust are facilitating factors.

Reciprocity occurs when firms within the same cluster act together toward a common specific purpose; for example, sharing the equipment and forming business association (Perez-Aleman, 2011), adopting new technology (Voeten, Haan, Groot, & Roome, 2015).

Trust is essential to enable inter-firm relation. The presence of distrust may ruin the development of business relationships. Locality is not a sufficient factor to establish trust. The nature and associated benefits of trust amongst firms could evolve along with the growth of an exporting cluster; from "ascribed trust" (based on family ties and kinship) to "earned trust" (derived from the process of doing business with other firms) (Humphrey & Schmitz, 1998; Schmitz, 1999b). Particularly, in the context of transition economies (from central planned to market economy), when old ties collapsed, it takes time to establish new ties. A broker is needed to bridge disconnected firms and institutions in order to form a network. Typically, in the case of developing countries, generally, in the absence of effective institutional framework to govern

contractual transactions, institutional trust or minimal trust may not be in place, firms must resort to other forms of trust at meso- and micro- levels, e.g. business association and individual levels for example. In some cases, given the lack of institutional trust, firms do not even trust their government. Practices around the world show that other institutional intermediaries play a facilitating role to build up trust and form a network, such as universities (Tiffin & Kunc, 2011), coordination programme in Chile (Humphrey & Schmitz, 1998) and local economic development forums in Indonesia (Phelps & Wijaya, 2016).

Empirical studies using the CE approach is usually descriptive due to their context-specific, i.e. using case study methodology on low-cost manufacturing clusters originated from traditional, small-scale industries in developing economies (Rabellotti, 1999; Sandee & Rietveld, 2001) with a few exceptions in software industry (Caniëls & Romijn, 2003). Regarding innovation, the CE approach illustrates the differentiation and specialisation of firms along the growth of an exporting cluster; but it fails to investigate the idiosyncratic characteristics of clustered firms. The CE approach also crowds out both external linkages and intra-organisational aspects (what happens inside firms). For the CE approach, the competitiveness advantage of a cluster stems from local linkages and actors; hence, some scholars combine this approach with other theoretical frameworks, such as industrial districts and global value chain (GVC) to analyse the cluster-related phenomenon (Cawthorne, 1995; Perez-Aleman, 2003; Rabellotti, 1995).

***Knowledge systems in economic development studies***

The knowledge system approach represented by Bell and Albu (1999) is more advancing than the CE approach. This approach particularly allows the understanding of technological capabilities accumulation; therefore assists the investigation into the dynamics of cluster development. Given learning is a crucial route toward development, only several empirical studies using the CE approach briefly mention collective learning (Perez-Aleman, 2003; Rabellotti, 1995); however, those studies rarely take knowledge in the central debate. In this regard, the CE approach has mainly focused on technological knowledge embedded in machinery only while other embodiments, such as knowledge and tacit knowledge are overlooked. For the CE approach, technological accumulation via the physical importation of technologies would accelerate growth in less advanced countries. Also, there is a presumption that most of advanced production technologies are imported from Western countries. Hence, many empirical studies on industrial clusters have mainly drawn the attention to the diffusion of imported technology (Sandee & Rietveld, 2001) or global quality standard (Perez-Aleman, 2011).

Bell and Pavitt (1993) criticises the above view by distinguishing technological and production capabilities. By integrating into the relevant GVC, or exporting, firms in developing countries all acquire production capability, but not all of them could obtain technological capability. Technological capability refers to "*the skills, knowledge and institutions that make up a country's capacity to generate and made change in the industrial technology it uses"* (ibid, p.159). Hence, those industrial policies that overemphasise the importance of physical capital accumulation for technology importation may fail to support domestic firms to achieve technological capabilities.

The experience of modern industrialised countries, such as Japan and Germany, demonstrates that making components of a complete product may not add much to the technological learning. In addition, there are different levels of "learning by doing" to accumulate technological capabilities. It may range along the continuum from doing basic routine – which contains little degree of technological learning – to change-related doing such as R&D, product design and engineering – which substantially contributes for the process of technical change (Bell & Pavitt, 1993; Lall, 1992). Unlike the perception that learning-by-doing is merely a by-product of other production activities, the most effective learning-by-doing mode requires strategic intent of firms. Firms need to deliberately invest in building up and strengthening their technological capabilities, beside the reform effort by public sector to provide better human resources for industrialisation.

Along the aforementioned continuum of learning for technological accumulation, Bell and Albu (1999) assign the type of knowledge-using for activities in "*using, replicating and recirculating knowledge that already established within the production system"* (p.1724). Meanwhile, the knowledge-changing type is associated with more complex activities, i.e. "*in the management of innovation processes; in product design and development; or in the search for selection, adaptation and assimilation of new product or process technology (from outside the cluster)*" (ibid). Evidence from empirical literature suggests that the knowledge-using elements are dominantly found in the industrial cluster amongst developing countries, while knowledge-changing ones– which is more conducive for radical innovation – are in advanced countries (Nadvi & Halder, 2005).

Bell and Albu (1999) also shed light on the distinction between knowledge system and production system. Production system is alike to value chain, include every single stage of the production. Meanwhile, knowledge system "*encompasses … flows of knowledge, stocks of knowledge and organisational system involved in generating and managing changes in the products, processes or organisation of production*" (ibid, p.1723). Production system and

knowledge system could theoretically overlap; meanwhile, empirical studies have found the direction of knowledge flows to be uni-dimensional from one cluster in advanced country to one in developing countries only (Nadvi & Halder, 2005).

According to the knowledge system approach, LKS is implicitly an integral part of technological dynamism, i.e. via the organisational characteristics of knowledge system including (i) the diffusion and replication within cluster, and (ii) the acquisition and generation of new knowledge. In this regard, the knowledge system approach adopts the view of CE framework on its knowledge diffusion process – which covers external economies and joint action. Accordingly, LKS contributes to the accumulation of technological capabilities; this, in turn, leads to technical changes embodied in both incremental innovation (adaptation and improvement of existing production methods) and radical innovation (new products).

Yet, the knowledge system approach as theorized by Bell and Albu (1999) is still context-sensitive, i.e. manufacturing large-scale industries, where technological knowledge embodied in either tangible (machinery) or intangible (know-how about production) form. Also, its focus is the whole cluster development trajectories; therefore, it fails to deal with the idiosyncratic characteristics at firm level – which influence the nature and degree of LKS.

### *2.2.2. Cluster theory*

In practice, cluster theory by Porter (1998, 2000) has exerted a significant influence in the cluster initiatives across countries in the world; and the "cluster" definition by Porter is used widely in academic literature despite a number of criticisms from academic scholars (Martin & Sunley, 2003; Nathan & Overman, 2013).

According to Porter, cluster is the core unit of national competitiveness; and competitiveness is based on a combination of local factors, e.g. knowledge, relationships and motivation (Porter, 1998). The cluster, in his word is "*a manifestation of the diamond at work"* (p.23); of which the diamond framework consists of four interacting (local) elements; namely factor conditions, demand condition, nature and intensity of competition, related and supporting industries. LKS is not explicitly discussed in Porter's theory; rather, it is presumed to occur naturally due to trade associations where firms could exchange ideas and therefore, establish collective action to deal with shared problems. He also presumes that the "repeated exchanges" amongst economic actors, buyer-seller and firm-institution would intensify trust within a cluster. And spatial proximity would eliminate uncertainties associated with distant linkages in the supply chain. Porter mentions spin-offs under the term "new business formation"; however, these are not necessarily a conduit of LKS rooted from within-cluster. Instead, new businesses choose to

locate inside a cluster due to the availability of input factors regardless of the location of their parent firms or organisations.

Besides, according to Porter, cluster provides innovation and upgrading opportunities owing to the (presumably) concentration of knowledge providers, such as universities, and specialised suppliers and experts locally (Porter, 2000). Innovation capacity of a firm, referring to the ability to create product and services differentiation compared with its competitors, leads to increasing productivity, and therefore competitiveness of that firm. Here, Porter equates productivity with competitiveness (Nathan & Overman, 2013).

Exporting clusters are the source of economic growth, but it is hinted that local demand market might be the antecedent of exportation strategy:

> Exporting clusters—those that export products or make investments to compete outside the local area—are the primary source of an area's economic growth and prosperity over the long run. The demand for local industries is inherently limited by the size of the local market, but exporting clusters can grow far beyond that limit. (Porter, 1998, p. 8)

Apart from the above note about exporting clusters – which is clearly from demand perspective, global linkages seemingly do not matter much in the cluster theory. This is quite controversial providing with the empirical evidence on the dynamic spatial sources of knowledge that innovative firms use, namely international, national and locally may be equally important (Simmie, 2004).

In terms of inter-firm relation within cluster, strong ties are dominantly more important than weak ties, but Porter does not elaborate on the criteria to categorise whether which one is strong or weak tie (Martin & Sunley, 2003). In addition, the cluster theory fails to acknowledge the social-institutional aspects of a cluster, and it treats clusters in a variety of industries and at different stages the same (ibid). Despite the construction of local business environment, the diamond theory does not elaborate on the role of government, especially the local one. It disregards the 'possible efficiencies' of cluster; hence, "*cannot explain how to correct for them*" (Nathan & Overman, 2013, p. 390).

### *2.2.3. Global Value Chain framework*

Unlike the CE and cluster approaches, the global value chain (GVC) approach, also known as global commodity chain, particularly deals with the geographically distributed production system. This approach is not necessarily only applicable in the cluster context (Gereffi, 1999; Gereffi et al., 2005); however, empirical studies about industrial clusters in developing countries

resort to the GVC approach as a complementary theoretical framework to the CE and industrial district, which mainly concern intra-linkages within the cluster.

The GVC approach offers an analytical framework "*on the sequences of value added within an industry, from conception to production and end use*" (Gereffi & Fernandez-Stark, 2011, p.2) . The framework is particularly relevant for exporting countries, allowing them to "*trace the shifting patterns of global production, link geographically dispersed activities and actors of a single industry*" (ibid). In general, in most of manufacturing and service industries, developed countries tend to dominate in higher value-added sequences of the chain, while developing countries are in the lower value-added.

The insertion of a cluster into the GVC – representing the global economic integration of a specific economy – is beneficial for development by providing that cluster with upgrading opportunities (Humphrey & Schmitz, 2002). Upgrading refers to the qualitative shift such as to "*increase the skill content of their activities and/or move into market niches which have entry barriers*" of the producers given the increasing competitive pressure (ibid, p.1018). In this regard, upgrading shares some similarities with innovation – especially at firm level, when they acquire and/or create something new to themselves; i.e. new functions, new production method, new product/service, even new market.

**Table 2.2: Type of upgrading from the perspective of producers/suppliers**

| Type | Definition |
|---|---|
| Functional upgrading | Acquiring new functions (or abandoning existing functions) to create higher value-added services (to increase the overall skill content of activities) |
| Process upgrading | Reorganising the production system to generate more efficient services or introducing new technology into the production process |
| Product upgrading | Moving into more sophisticated services and increasing the complexity of the product or service offered |
| Inter-sectoral upgrading | Moving into new productive activities in other sector |

Source: (Humphrey & Schmitz, 2002; Gereffi and Fernandez-Stark, 2011)

Regarding the cluster context, governance – referring to the "*coordination of economic activities through non-market relationships*" is particularly important for the "*generation, transfer and diffusion of knowledge leading to innovation"* (Humphrey & Schmitz, 2002, p. 1018). Type of governance would influence upgrading opportunities (Navas-Alemán, 2011). Yet, the GVC

approach does not discuss much about local governance, i.e. within a cluster. The inter-firm relations are embedded in international trade network. The flows of knowledge, and therefore, LKS, are overlapped with this production system – like Bell & Albu (1999) explained before.

Upgrading opportunities vary by industry (Pietrobelli & Rabellotti, 2006) according to the technological level, as shown in the evidence from electronics industry (hi-tech manufacturing) versus footwear industry (low-tech manufacturing) (Humphrey & Schmitz, 2002). In the former case, it appears that local producers have successfully accumulated sufficient technological capability – to step into the design sequence of the global chain - and to turn this into their competitive advantage, offering complementary resources for their customers. Meanwhile, in the footwear industry, local producers find it struggled to climb up the value chain due to the asymmetric power between them and the buyers.

In common, empirical studies about industrial cluster in developing countries have mainly used GVC framework in combination with other cluster approaches to address the local-global linkage dynamism. For example, Perez-Aleman (2003) highlights the "cooperative self-monitoring" process of local producers under the exposure to competitive pressure given the presence of a MNC. With regard to the furniture and footwear industries, Navas-Alemán (2011) stresses that higher value-added activities are associated with higher level of tacit knowledge and higher entry barriers – more difficult to replicate. In this study, while the GVC identified with quasi-hierarchical form of governance offers learning opportunities for process and product upgrading, the national and local value chain (domestic market) provides essential knowledge for functional upgrading. Hence, firms with multi-chain strategy – which serve both foreign and domestic markets – are more innovative than the otherwise the case would be.

### *2.2.4. Economic geography of innovation literature*

#### *2.2.4.1. Economic geography*

In an attempt to understand the propensity of clustering firms, the traditional economic geography studies have employed the knowledge production function (KPF) model. This model originates from the work of (Griliches, 1979) based on the idea that knowledge is both inputs and outputs of a firm's innovation. Inputs of innovation include new economic knowledge, and other factors such as human capital, or sometimes referred as skilled labour or educational level. The conventional model's equation could be presented as: $\mathbf{I_i = \alpha RD_i^{\beta} HK_i^{\gamma} \varepsilon_i}$ with I: the degree of innovative activity; RD: R&D inputs; HK: human capital inputs; i: the level of countries, industries and enterprises (Audretsch & Feldman, 2004). This model was found stronger at greater aggregate levels, such as countries, as more advanced countries have larger R&D

investment, and innovative outputs. Similarly, the model appears to be significant at industry level; meaning intensive-knowledge industries are likely to be more innovative than otherwise the case would be. However, "*there is no direct deterministic relationship between inputs and innovation"* at different aggregate levels (Audretsch & Feldman, 2004, pp. 2716-2717), i.e. the correlations between innovation inputs and outputs vary with the level of analysis, e.g. region, industry; economic externalities are deemed to exist; hence KS has a spatial dimension.

In empirical studies using KPF model, Jaffe (1989) examined the research spillovers from universities at the state and industry level.

> $I_{si} = \alpha IRD^{\beta_1} * UR_{si}^{\beta_2} * (UR_{si} * GC_{si}^{\beta_3}) * \varepsilon_{si}$ with I is innovative output; IRD is private corporate expenditures on R&D; UR is the research expenditures undertaken at universities; GC measures the geographic unit; s indicates state, i indicates industry.

Jaffe found the estimated value of $\beta_1$, $\beta_2$, $\beta_3$ both larger than zero, hence, this implies the existence of KS from universities and R&D laboratories. Regarding firm size, small firms are more beneficial from KS associated with universities and specialised business services despite their negligible internal R&D capacity compared with large firms (Feldman, 1994). Typically, innovative firms tend to be localised in the early stage of industry life cycle, when tacit knowledge plays a significant role; while in the more mature stage, innovative firms are more geographically dispersed (Audretsch & Feldman, 1996).

The limitation in these empirical studies is the absence of KS channels, especially at local level (LKS) (Feldman, 1999). Most of studies have focused more on the measureable and tangible aspect of KS across industries, regions and countries. For instance, some scholars trace KS by using patent citation (Jaffe, Trajtenberg, & Fogarty, 2000; Jaffe et al., 1993), and find that the citing patents are more likely to come from the same region with the cited patents. Or other researchers shift the unit of analysis to individual scientists or inventors, and argue that KS (via co-authorship) tend to be spatially bounded in those regions where scientists and inventors live in (Zucker, Darby, & Brewer, 1998). In those studies about KS from trade, foreign direct investment and imported technology resemble two most important sources for improving production capabilities in developing countries (Anwar & Nguyen, 2011; Görg & Strobl, 2004). Hence, the measurement of KS has largely been based on codified knowledge rather than tacit knowledge. In brief, in the above domain of literature, KS are embedded within scientific publication, high-skilled intellectuals and trade. Despite their acknowledgement of the localised nature of KS, these empirical studies do not explicate the LKS phenomenon within a particular cluster.

#### *2.2.4.2. New economic geography (NEG)*

The contribution of NEG associated with new growth theory (Romer, 1986) is with its analytical framework, to provide a modelling strategy to deal with the spatial aspect of trade and economic growth (Krugman, 1998). NEG aims to explain the forces of regional convergence and divergence relying on economies of scale, increasing returns and imperfect competition. It is assumed that Marshallian agglomeration economies, i.e. labour market, production and consumption linkages, and technology spillovers, are the source of increasing returns in production. Of which, the spillovers of information and knowledge is acknowledged to be amongst the centripetal driving forces between countries and regions (Fujita & Krugman, 2004).

However, as acknowledged by Krugman himself, this model is over-simplified without regarding any particular industries, and even in the absence of intangible factors such as KS (Krugman, 2011). In other words, NEG focuses more on the measurable externalities such as "*economies of specialisation and labour pooling*" (Dahl & Pedersen, 2004, p. 1674). Besides, NEG attracts criticism for its mathematical modelling methodology and disconnection with other literature in economic geography. In particular, the mathematical methodology NEG is criticised for being too abstract and in short of important geographical factors, such as local infrastructure, investment, and local institutions (Martin, 1999). Therefore, NEG may offer little theoretical background supporting the investigation of LKS in this study.

#### *2.2.4.3. Territorial innovation models*

Under the pressure of globalization, a great amount of literature emerges since the 1970s onward, named 'territorial innovation models' (Moulaert & Sekia, 2003), explains the crucial role of local regional economies in the context of developed economies. Studies within the 'territorial innovation' stream are originally country-specific, such as 'new industrial districts' in Italy, 'innovative milieu' in France, 'new industrial spaces' in the US, and 'regional innovation systems' in Europe (Simmie, 2011, p. 547). During the development of this literature domain, firms in advanced countries have shifted the production place of their standardised manufacturing segments to newly industrialized countries (NICs) on account of cost competitiveness. Therefore, for advanced countries, the competitiveness factors are more likely to be "*flexible, networked, knowledge-based and innovation production systems*" (Simmie, 2011, p. 547) instead of cheap labour costs as in developing economies.

Prior to the discussion of individual models, it is noteworthy to demonstrate that the territorial innovation approaches share some commonalities. Regarding the overall purpose, they aim to explain and provide policy framework for the continuous development or the resurgence of

particular regions in US and Europe. At the same time, these theories investigate and analyse the determinants of the uneven spatial distribution of technological capabilities. The main question in issue is whether firms within a concentrated geographical environment tend to be more innovative than isolated firms are. In essence, territorial innovation theories attempt to capture the convergence between economic geography and innovation.

The relevant theoretical development is based on three strands. *First*, in contrast to the belief on "the death of geography", all the territorial innovation studies argue that the concentration of economic activities has taken place in certain regions. *Second*, while the conventional wisdom holds that co-location behaviour is attributable for a decrease in the transaction costs (Williamson, 2000), the territorial innovation theories stress the importance of networks as crucial element for facilitating learning and knowledge diffusion, especially in knowledge-based economies. To reiterate, the competitive advantages of one region or local economy over the others are dependent on other factors than merely market transactions within a restricted geographic area, such as regional culture, conventions and routines, norms, and other social institutions. Last but not least, territorial innovation theories originally seek for a policy framework to address the uneven regional development in the UK and Europe. Despite a degree of commonality concerning "*cooperation, networks, institutions, trust, inter-organisational learning and knowledge transfer*", the territorial innovation theories are distinctive in terms of their focus and approach (Asheim, Smith & Oughton, 2011, p.878).

The below sections will explain individual territorial innovation models in details.

*Neo-Marshallian industrial district or Italian industrial districts*

The Neo-Marshallian industrial district model was initiated by Giacomo Becattini with other scholars in the 1970s. Sometimes, it could be regarded as Italian industrial districts theory as it originates from the successful case studies of some regions in Italy at first. In this stream of literature, small and innovative firms play a crucial role for the adaption and evolution of old industries given the pressure from globalization (Becattini, 1990; Piore & Sabel, 1984). In addition, other factors, including backward and forward linkages, disintegrated networks amongst firms, "*district-wide governance structures, innovative capabilities, the organisation of production"*, also facilitate the stickiness of firms within a geographical area include (Markusen, 1996, p. 295). According to Becattini, studies on industrial districts should break down into numerous involving processes given the complexity and continuous changes in the districts (Dei Ottati, 2018). From an evolutionary perspective, industrial districts experience concurrent and inter-linked processes including (i) the process of localised division of labour, (ii) the integration of labour division, (iii) the integration of contextual and codified knowledge and (iv) the

governance process. The localised division of labour gives rise to both the specialisation and diversity of economic activities in a district. This, in turn is beneficial for the local economic growth and productivity. Meanwhile, the first and second processes are complementary. The mix of cooperation and competition relationships amongst firms on local markets enables the flexible integration of the division of labour. Such integration of the division of labour illustrates how market and non-market mechanism connect to each other.

The third process implies that KS not only from internal ties within the districts, but also through other external linkages. Contextual knowledge is mostly tacit and informal knowledge and to be gained by learning through experience and it is ingrained in the minds of workers and entrepreneurs. Meanwhile, codified knowledge refers to the knowledge generated in the research laboratories in the forms of patents. The industrial environment or "industrial atmosphere" as coined by Marshall consists of 'contextual knowledge', which likely to diffuse due to regular interactions amongst economic agents with various specialisations, and those who "share technical and social codes" (Dei Ottati, 2018, p. 263). In order to avoid the decline of districts, a continuous integration between codified and contextual knowledge is necessary. This statement is particularly relevant for the case of clusters in developing economies, given the sources of codified knowledge, as claimed by Dei Ottati, is mainly produced from outside the district. It also connects with the knowledge system approach in development literature. In particular, importing technology embedded in machinery – representing codified knowledge - may help local firms to improve production capabilities. But to acquire and strengthen technological capabilities, it requires firms to creatively absorb both codified and localised tacit knowledge.

Yet, the industrial districts framework faces some limitations. For example, for some scholars, this is not a valid analytical model, "*but rather a list of stylized facts useful for organising empirical investigations and to compare it with real world cases"* (Rabellotti, 1995, p. 29). Or, being context-sensitive, the industrial district is built upon "*resilient cultures, organised politically on the basic of long-standing communities, unions and the Italian communist party"* (Markusen, 1996, p. 301). In other words, the path-dependency (what happen in the past affect the direction of future development) of industrial districts prevents others to replicate. Like the CE approach, the industrial district literature rarely concerns the idiosyncratic characteristics of firms within cluster apart from firm size.

The neo-Marshallian industrial districts are more likely to be communal and relationally embedded (Cooke, 2009). Yet, a stable community turns to be a block for innovation and development for the districts especially in the absence of external linkages. Neo-Marshallian industrial districts are expected to have certain expectations on reciprocal relationships amongst

firms, which are formed based on norms, rules or routines. Those could be "*a common set of strategic expectations about behaviour amongst mutually dependent entrepreneurs"* (Cooke, 2009, p.304). Once those mutual expectations converge, as a result, any divergences or discrepancies within districts likely become harmonized and mutual. However, to some extent, this phenomenon could impede innovation. The absent of internal contradictions probably "*delay strategic creativity at critical points when a rapid response to the need for innovation is required"* (Cooke, 2009, p. 304).

Last but not least, there is a lack of empirical evidence to prove that firms in Italian industrial districts outperformed other firms outside the districts in the 1990s recession (Cooke, 2009, p.305).

*Technological districts*

Technological districts are dynamic regions endowed with rich resources of physical capital, skilled labour and knowledge, mainly in hi-tech sectors, and based on observations from advanced countries (Storper, 1992). Accordingly, the export specialisation pattern should not be explained by comparative advantages, but absolute advantages owing to sub-national systems of production networks. The technological districts are identified by their 'product-based technological learning industries' (PBTL). This sub-national PBTL system acquires "the advantages of specialisation and flexibility" which are supportive for technological learning (ibid, p.60).

> … technologically dynamic industries typically are organised in the form of production networks, based on elaborate shifting divisions of labour, whether between firms or between units of a single organisation (ibid, p.62).

The technological districts approach aims to explain the mobilization of production factors, their occurrence and connections to each other within a geographical concentration of specialised economic activities. Typically, this approach stresses the importance of place-based 'conventions' to the production networks and technological learning. By conventions, it refers to either informal or formal rules guiding the allocation of production resources, and further facilitating user-producer interactions.

> …the conventional environment of PBTL systems is likely to rest on rules and practices that (1) coordinate shared preferences, particularly with respect to growth or product quality; (2) reconcile discordant preferences that the key actors are encouraged to participate in innovative activity; and (3) regulate the buying and selling of goods and services by defining standards of value. (Storper, 1992, p. 86)

Besides, technological districts framework highlights "the qualitative behaviours of agents in a network" given the uncertainties in new technologies (ibid, p.85). The learning progress of new and not-yet-standardised knowledge attached in market transaction requires the user-producer relationship to be more 'qualitatively dense' than otherwise the case would be.

> The potential positive externalities of production networks are only realized according to the concrete qualities of the transactions themselves. (ibid, p.86).

Hence, technological district framework encourages empirical issues on what factors transform a production networks to a learning system, what specific localised conventions affect this process, what conventions promote or impede the learning in production networks, or which mechanisms enable the collective action.

Spatial agglomeration is not sufficient for LKS to occur; rather it must entail adequate communication channels to intensify "*the rate of accumulation of collective knowledge*" for the sake of technological innovations (Antonelli, 2000, p. 544). For example, some of these communication channels include labour mobility, university-business linkages (or relationship between firms with other specialised knowledge providers), local communication infrastructure (both digital and face-to-face communication), and coordinating agencies (business associations and clubs). It requires the deliberate effort to communicate from the involving economic actors for innovation to occur (Patrucco, 2003).

Spillover effects in technological districts – usually advanced regions are mainly referred to as "*the R&D technological externalities spilling out from the complementary and interrelated R&D activities of other firms localised in the same area"* (Antonelli, 1994, p. 18). The context of technological districts are mainly advanced regions in the core with an abundance of resources for innovation; "*firms localised within technological districts have fast rates of introduction of technological innovations*" (ibid, p.24). Meanwhile, clusters in developing economies usually lack these resources and lie in the periphery.

*Learning regions*

The learning regions approach perceives the economy as a learning entity. The learning economy conception roots in the work of Lundvall (1992), considering knowledge as the most crucial resource of an economy; therefore, learning and learning capacity play a strategic role for a country's innovativeness and competitiveness (Asheim, 1996). This approach strives for a combination between the network paradigm and the evolutionary economic school. Accordingly, innovation is an interactive process and to be "*shaped by a variety of institutional routines and social conventions"* (Morgan, 1997, p.493). Such conventions and routines form 'social capital'

– which in turn, contributes greatly to the learning process. Less favoured regions may have little or no social capital; and to construct social capital via trust, inter-firm relation, a supporting local government is the least factor.

> Developing new routines – with respect to reciprocity, trust, formal interaction and informal know-how trading, etc. – requires time, resources … (Morgan, 1997, p.497).

Localisation still matters in the world of globalization due to "*the association between organisational and technological learning within agglomeration*" (ibid, p.495) for two types of interdependencies, traded (via user-producer relations) versus untraded ones "*which attach to the process of economic and organisational learning and coordination*" (Storper, 1995, p.210). Hence, LKS, especially in the form of tacit knowledge are embedded in both these formal and informal network of firms (ibid). Especially, untraded interdependencies refer to *"a structured set of technological externalities which can be a collective asset of groups of firms/industries within countries/regions*" (Dosi, 1988, p. 226). They are shaped by localised conditions such as conventions, norms, values, and other institutions (Storper, 1995). In turn, localised untraded interdependencies would promote learning and enhance the local innovation process.

The learning regions approach takes a step forward compared with the industrial districts approach. By emphasising the importance of (technological) learning, the former offers a way out of the lock-in situation especially in disadvantaged regions with historically unfavourable conditions. However, the learning regions approach has not escaped from criticism for its absence of external linkages discourse. Admittedly, local and regional networks are important, but national and international linkages outside the local regional boundaries are beneficial for innovation at firm level alike.

*Innovation milieu*

The innovative milieu approach stems from the GREMI Research program (the European Research Group into Innovative Milieus) since the mid-1980s. In the beginning, Aydalot led the project in 1986, proposed a hypothesis that "*'something', localised on the regional level, made it possible to understand why certain regions were more dynamic than others"* (Crevoisier, 2004, p. 368). Overall, this approach is inclined toward the sociological aspects with its main emphasis on 'collective learning' based on a dynamic set of skills and apprenticeship, and the co-operation based on interactions between economic agents within the milieu.

A milieu is perceived as a socio-economic entity, while collective learning resembles "*a vehicle for spatial transfer of knowledge"* (Capello, 1999, p. 354). Accordingly, 'collective learning' refers to the localised accumulation process of knowledge that is freely diffused amongst

economic agents in a supporting environment bounded by common norms, rules and other forms of conventions and routines. In such process, there is a transformation of knowledge into "*strategic and innovative synergy and capacity*" (Capello, 1999, p. 356). The process of collective learning would depend on the absorptive capacity of individual firms, and their strategies. In this relevance, it implies the heterogeneity within the milieu.

Capello (1999) interprets collective learning as the results of both conscious and unconscious behaviour of firms. Of which, he associates the industrial atmosphere of Marshallian industrial district with the unconscious learning of firms inside innovation milieu. Accordingly, LKS according to innovation milieu approach is mainly unconscious:

> (Collective learning) as a result of the conscious co-operative behaviour of local agents or as an externality, generated by the local environment, that agents feel free to exploit as they wish … the latter is the dynamic counterpart of Marshallian industrial atmosphere, …requiring no conscious effort on the part of agent (ibid, p.354).

Besides, the innovative milieu approach proves to be more dynamic than the traditional Marshallian industrial districts. While the traditional industrial district theory pursues static efficiency, of which firms cooperate to reduce transaction costs; the milieu approach emphasises spatial dynamic economics, of which economic actors within the milieu co-operate to reduce uncertainty. However, once the milieu reaches the point of stability, i.e. stable labour market, and stable relationships within the milieu, collective learning may turn from "a barrier to entry" to "a barrier to exist", and the milieu becomes less technological competitive (Capello, 1999, p. 359). The continuity and dynamic synergies are perhaps maintained and reinforced within the milieu; however, the restricted localised relations between familiar economic agents are likely to isolate the involving firms and, in turn, to impede innovation. Similar to the learning regions approach, the limitation of the innovative milieu is its closed nature restricted by internal linkages. To enable to evolution and development of a milieu or territory in general, external linkages and an open, dynamic nature are demanding.

*Regional innovation system (RIS)*

Building up from other territorial innovation approaches and clustering theories, the RIS approach is a comprehensive approach integrating the social network theory (Granovetter, 1985) and innovation theory (Edquist, 1997a; Freeman, 1995; Lundvall, 1992; Nelson, 1993). It stresses the importance of knowledge, learning and social interaction to innovation based on case studies of successful clusters in advanced countries. Of which, the social interactions amongst

(economic and non-economic) actors in the same cluster would be conducive to the diffusion of knowledge for innovation.

To iterate, the aforementioned territorial innovation models more or less refer to network dimension of LKS, either in informal or formal network. Similarly but to a wider extent, in RISs, scholars discuss 'network regions' including "*systematic communication and transaction linkages among nodes through networks of people and institutions intra-regionally and globally*" (Cooke, 2009, p.296). Notably, the RIS approach lays knowledge in the centre of discussion. It embraces interactive sub-systems and processes of knowledge generation, accumulation and diffusion amongst learning agents from either private or public sectors. In addition, the RIS approach is practice-based toward a conceptual framework for "*government policy-making, and as a basic for formulating the innovation strategies of firms*" (Edquist, 1997a, p. 16). RIS "*contains the most systematically developed conceptualisation of interactive learning; including the link between devolution, institutions and interactive learning"* (Chaminade & Wang, 2008, p.1686). Hence, RIS has gained its momentum in studies about both clusters and regions in developing and developed economies.

From institutional perspective, an RIS could be divided into thick and thin region (Amin & Thrift, 1995). Such categorisation represents two extreme of RIS based on the regional structure of organisation and institution. The 'institutional thickness' refers to both the presence and efficiency of institutions, with the notion of 'institution' sometimes covers both rules and players. Particularly, a strong institutional thickness consists of four factors, i.e. (i) the presence of a variety of different kinds of institutional arrangements - players, (ii) a dense network of social interactions, (iii) the collective representations of involving economic actors, and (iv) the establishment of local socio-cultural identity.

Thick regions tend to be more innovative than thin regions. Types and patterns of interaction in these two types of regions are different alike. A thick RIS would have "strong organisational infrastructure" and "*a culture of collective representation, and shared norm and values which serve to constitute the social identity of a particular locality"* (ibid, p.218). As opposed to thick region, thin region mostly consists of small and medium enterprises, it lacks organisational support. While firms in thick region majorly count on domestic linkages, those in thin regions stretch beyond the border of region to look out for external linkages.

Some authors contributed to the institutional thickness conception by adding the middle level lying between the thick and thin level with empirical data from different regions in Sweden, Norway, Estonia, China and India (Chaminade & Plechero, 2015) . A large proportion of firms

in this additional tier have international collaboration. They are innovative but to a smaller extent than firms in thick regions, and to a larger extent than those in thin regions.

Presumably, a higher degree of institutional thickness is associated with a higher level of KS, like the case of Silicon Valley (Saxenian, 1996). Yet, it is arguable to ascertain the magnitude of institutional thickness (Chaminade & Plechero, 2015) ; some argue that urbanized areas tend to have thick institutional conditions, while less-urbanized with thin conditions (Tödtling, Lengauer, & Höglinger, 2011). Likewise, clusters or regions in the developing world tend to acquire a much lower degree of institutional thickness compared to those in the advanced countries. Nevertheless, how the tight institutional constraints influence the LKS phenomenon within a cluster in developing countries still stays in the black box.

Another well-known framework to detect barriers against the system of innovation is the system failure framework (Woolthuis, Lankhuizen, & Gilsing, 2005). This framework has two dimensions, including actors (demand, companies, knowledge institutes and third parties) and rules (infrastructure failure, institutional failure, interaction failure and capabilities failure). This framework aims to point out which rules and whom the system failures may be associated with. Of which, the institutional failure is divided into formal and informal institutional failures, which restrict innovation. Regarding the formal institutional ones, subject to the extent of how a given legal framework protects innovation from imitation, it could range from low to high appropriability conditions (Malerba & Orsenigo, 1997). Toward the edge of lower appropriability, there would be pervasive degree of KS and vice versa. A too high appropriability condition causes formal institutional failure, such as too strong intellectual property rights protection system, since it severely limits knowledge externalities and may impede innovation at the end.

Beside, a regional or local innovation system, embedded within the national innovation system, ought to create favourable conditions for innovation and entrepreneurship, especially spin-offs since this is an important channel of KS (Audretsch & Lehmann, 2005). With respect to formal institutions, a substantial amount of literature has discussed the intellectual property (IP) legal system and its paradox toward innovation (Samaniego, 2013; Stiglitz & Greenwald, 2014). Nevertheless, the overall quality of the local (or national) legal system could exert a certain degree of influence on KS, for the reason that KS also occur in contractual technology transfer (Finn et al., 2011).

The informal institutions cover social norms, rules, culture, playing a crucial role in shaping the local knowledge network and in disseminating information and knowledge through social interactions. Those place-specific factors could distinguish successful regions from declining

regions. Informal institutional failures emerge when social norms, conventions, routines and customs impede innovation, such as low trust, risk aversion and poor entrepreneurial spirit.

The proposed system failure framework though is useful, but its components only regard to hard infrastructure, while other type of soft infrastructure like knowledge infrastructure is missing. Besides, some criticise that the system failure approach could be 'misleading' for policy guidance since the role of State needs to go beyond failure fixing to be market and system creator (Mazzucato, 2015).

***Summary***

Above critically summarize the most relevant theories and approaches guiding the research in LKS phenomenon and its relation with innovation. While the endogenous economics assumes the automatic occurrence of KS, it does not enlighten on the mechanisms of LKS within a cluster, and how LKS contributes to innovation at firm level within the same cluster (Romer, 1990). To be guided by the evolutionary economics, the territorial innovation models, especially RIS approach, have shed more light on the nature and importance of LKS to innovation of a cluster or region (Edquist, 1997b; Freeman, 1995; Lundvall, 1992). However, the concern is with their context-sensitive, which has been built up from Western countries case studies. Besides, the economic development studies have discussed the upgrading of industrial clusters in developing economies for a long time. Yet, these clusters are mainly specialised in 'old' economy – traditional production industries. And, the theoretical frameworks guiding these studies, i.e. CE, GVC, and industrial districts, treat the cluster as a whole, and fail to acknowledge the idiosyncratic characteristics at firm level. In addition, when each individual theoretical approach stands alone, they fails to elaborate on the local-global dynamism, typically how this dynamism affects the LKS phenomenon.

With a focus on technological capabilities, Caniëls and Romijn (2003) conceptualise three external factors on the building of technological capability of co-located firms, including (i) national science and technology, and educational infrastructure; (ii) macroeconomic environment and sectoral regulations, and (iii) speed of international technological changes. Within the cluster context, Caniëls and Romijn (2003) provide taxonomy on the impact of KS (along with pecuniary agglomeration advantages) on intra-firm technological learning based on the collective efficiency (CE) approach. Accordingly, LKS could be both passively and actively influence internal technological learning at firm level via (i) changing attitudes and motivation; (ii) human capital formation through informal learning-by-doing; and (iii) technological transfer via labour mobility, user-producer interactions. Then, Caniëls & Romijn (2003) illustrate their proposed framework relying on secondary data of Bangalore software cluster.

However, this framework is problematic due to its core presumptions such as domestic demand is sufficient to affect firm behaviour; and to reduce cost of production, exporting firms make use of local resources. These two presumptions may fit well with the case of clusters in traditional manufacturing or craft industries, since they have served domestic markets for a long time before exportation. On the other hand, the nature of sectors in their theoretical framework and their empirical evidence are fundamentally different; particularly, tangible (of manufacturing and craft) versus intangible (software services). Despite the fact that this proposed analytical framework is informative, it fails to conceptualise the internal factors inside firms, and how these factors could influence LKS due to inter-firm interactions.

Overall, there is a missing theoretical and analytical framework to particularly deal with the LKS phenomenon.

The absence of an integrated theoretical framework creates uncertainties surrounding the nature and the role of LKS. On the one hand, the mutual consensus holds that KS has a spatial dimension, it attenuates with geographical distance. However, most of the theoretical approaches in economic geography of innovation emerge from the pre-Internet era and in the context of industrialised countries. Given the advancements of new technologies to aid distant communication, the on-going debate occur as whether geographical distance may lose its dominant power over other types of proximity (Rodríguez-Pose, 2011).

Also, the intentional learning and knowledge sharing activities across border of a cluster like conference, trade exhibition or workshops abroad have increasingly gained popularity. Thus, instead of viewing different knowledge flows as to be contradict, the concern in academia now shifts away from considering which single type of knowledge flow is more important to perceiving the joint significance owing to a dynamic combination of knowledge, i.e. from different sources, channels and geographical bases, to firms' innovation and economic performance (Grillitsch & Trippl, 2014).

> What we need for the future is multi-level studies based upon microeconomic data for economic agents, who recognize that economic agents and regions are heterogeneous, that different economic agents use different types of knowledge, use different knowledge channels, differ in their absorptive capacity, etc. (Karlsson & Gråsjö, 2012, p. 22)

In brief, there is a need to develop a conceptual framework allowing researchers to gain an insight into different knowledge subsystems within a cluster, especially LKS from integrated dimensions. The next section proposes one framework for this purpose.

## 2.3. A proposed conceptual framework

Given the review of theoretical literature, this section proposes a conceptual framework to guide the assessment of the nature, pattern and importance of LKS according to three dimensions, namely absorptive capacity, network, and institutional setting. These three dimensions as shown in Figure 2.1 represent three themes of determinants affecting LKS within cluster.

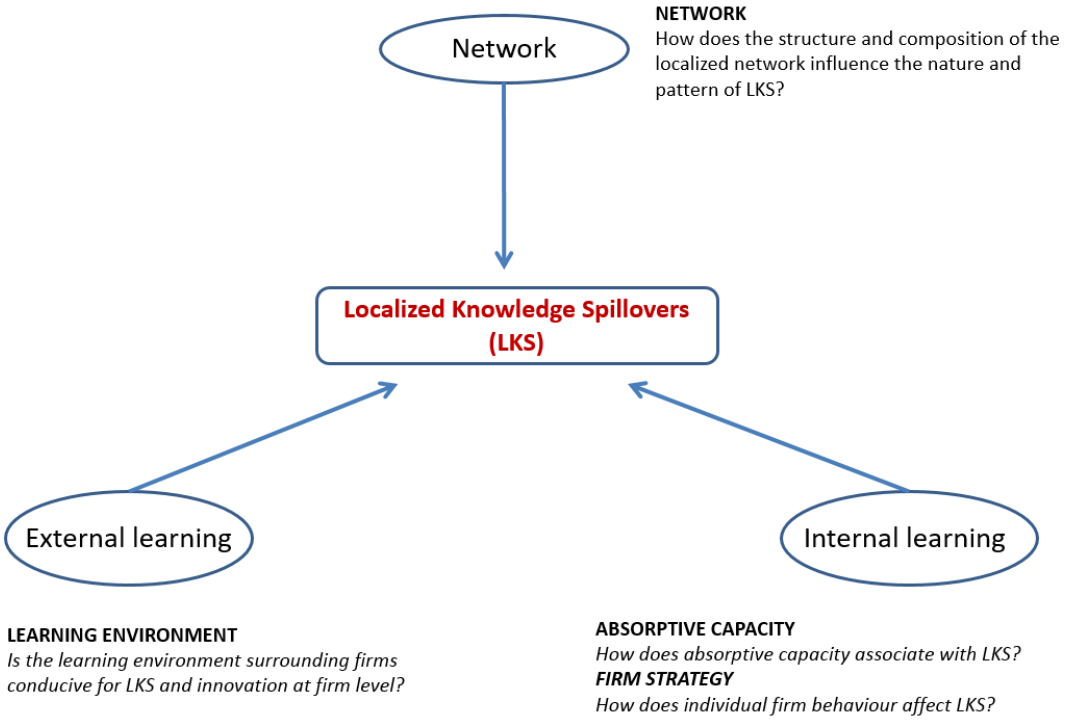



**Figure 2.1: A proposed framework to analyse LKS based on its determinants**

### *Internal learning*

#### *Absorptive capacity*

LKS do not occur naturally and it is not automatically beneficial to the recipient firms like the endogenous economics dictates (Romer, 1986). In other words, clustering firms do not equally enjoy the benefit from LKS. Rather, the heterogeneous levels of absorptive capacity amongst firms would moderate the effects of LKS to innovation at firm level. The knowledge stock of a firm consists of its own knowledge resource, as a result from its R&D activities for example, and external knowledge originated from its competitors, customers, suppliers and other institutions outside the industry such as universities or research institutes (Cohen & Levinthal, 1990). Absorptive capacity of a firm would act as a moderator for its internalisation of KS from external sources. On the one hand, firms may decide to invest into its own R&D expenditure to strengthen its absorptive capacity. On the other hand, the externalization of internal knowledge generated by firms tends to reduce their propensity to invest into its R&D activities. However,

such propensity could be counter-balanced by firm behaviour to strengthen its absorptive capacity through R&D intensity. To elaborate on the absorption process:

> Absorptive capacity can be defined as the organisation's relative ability to develop a set of organisational routines and strategic processes through which it acquires, assimilates, transforms and exploits knowledge acquired from outside the organisation in order to create value. (Jiménez-Barrionuevo, García-Morales, & Molina, 2011, p. 192)

Accordingly, to acquire new external knowledge means to identify, evaluate and obtain new external knowledge, which is important to firms' innovation. To assimilate is to understand, interpret and internalise new external knowledge. Then, those firms need to transform, i.e. to integrate, the new external knowledge into a part of their knowledge stock in harmonization with their organisational practices and routines. The last phase, 'to exploit', refers to the use of external knowledge for the commercial ends, i.e. by deriving benefits from a combination of internalised knowledge with firms' own knowledge base. As a result of the absorptive process, firms may introduce new or significantly improved product, process, organisational and marketing innovation to the market. At the end, firms could improve their productivity and economic performance.

*Firm strategy*

Apart from absorptive capacity, the innovation strategy of firms and therefore their knowledge searching strategy would affect the amount of LKS in exchange between co-located firms. LKS could be either intentional or unintentional to recipients of knowledge. In the case of unintentional spillovers, it means LKS occur unconsciously. Some argue that for those types of accidental KS, innovation strategies of firms are irrelevant (Roper & Love, 2017). At the same time, for intentional KS, when firms are aware of the potential sources and channels of KS, then innovation strategies are crucial for knowledge searching behaviour, locating and exploiting external sources for innovation.

Strategies of firms in turn vary with sector, industry and geographical location, but in general, ones could divide firm strategy into innovation-based strategy and imitation-based strategy, respectively to first-movers and followers (Ulhøi, 2012). These two types of innovation strategies differ by the targeting result of innovation. While innovation-based strategies aim for radical innovation, which is new to the world, and new to the market; the results of imitation-based strategies are likely to be incremental innovation, i.e. new to the firm. Therefore, their learning behaviour could be distinguished, while the former seeks *"pro-active, interactive and*

*exploratory knowledge search strategies*" (Roper & Love, 2017, p.8), the latter may count on knowledge acquisition and KS.

***Network***

The network dimension concerns the structure and composition of knowledge network amongst co-located firms and organisations. This dimension is relevant since it shapes the pattern of knowledge diffusion within cluster, and helps to identify structural holes to facilitate the convergence between first-movers and followers in a cluster. There are respectively two types of knowledge network; one regards the network of formal collaborations and contractual transactions, the other refers to informal sharing knowledge via friends in gatherings and other forms of informal conversations.

Of which, the former network is easier to track for the reason that market-based transactions are recorded, i.e. between firms and their clients, suppliers and partners. This type of network assumingly contains knowledge diffusion alike (quasi LKS) (Antonelli, 2006). Firms may receive feedbacks from customers about their products, so as they could significantly improve the current product or launch new product. Likewise, linkages with suppliers, or other firms in the vertical value chain probably inform firms about sectoral and industrial changes. In this situation, firms could adapt to sudden changes promptly. Or in collaboration relationship with universities and research institutes, firms could gain access to technological advancements developed in the laboratory at the right time.

On the other hand, the network of LKS via social interaction mostly delivers tacit knowledge potentially valuable to firms in innovation. Since knowledge is embedded in human beings, the network of social interactions must be studied from micro-level, e.g. individuals and firms. The individuals involved in the network could either be people at the management level for innovation relevant decision, and staffs participating in innovation activities, including but not limited to R&D and scientific activities.

In this relevance, trust is important to facilitate the sharing of information. Trust in turn depends on a variety of factors, especially, physical proximity and frequency of interaction. Physical closeness does not necessarily generate trust amongst economic agents automatically, but it does facilitate the frequency of interaction, like informal gatherings, accidental meetings; therefore, it could regularly build and improve trust.

The close proximity to different sources of knowledge, e.g. suppliers, clients, partners, obviously grants certain firms with competitive advantages over their competitors. Given the popularity of Internet, communication in general become much easier and more convenient, therefore, the

timely receipt of knowledge turns to be extremely crucial for firms in innovation. For the reason, the value of information to potential innovators may degrade with time, which is in turn probably dependent on physical closeness to the original source of information. For example, Shearmur and Doloreux (2016) demonstrate the time-dependency of different types of information. Accordingly, market information is likely to be time-sensitive while technological information and basic science are less time-dependent. Thus, firms relying mostly on technological and scientific knowledge may have less desire to locate within cluster (Iammarino & McCann, 2006). Rather, they communicate and collaborate with strategic partners like universities and research institutes instead of any neighbour firms and organisations by a mere chance.

Nevertheless, the examination of LKS from network of firms is from a relational perspective. Therefrom, other non-relational perspectives are essential to assess LKS, like the afore-mentioned absorptive capacity and the following external learning environment.

***External learning or Institutional setting***

The institutional setting dimension sets the context of learning environment within a cluster. Particularly, it seeks to understand the effects of both formal and informal institutions on knowledge exchange amongst co-located actors.

The formal institution refers to a regulatory framework supporting innovation activities either at the regional and national level. Theoretically, the regional innovation system (RIS) in harmonisation with a systematic national innovation system should create favourable conditions for innovation and entrepreneurship, especially spin-offs since this is an important channel of LKS. In addition, regarding innovation diffusion, intellectual property rights (IPRs) protection regime often triggers a controversial debate in academia. In particular, the main concern is how to grant sufficient incentives for innovation without hampering follow-on innovation. Commonly, developing countries like India, China, and Vietnam implement a weak IPRs enforcement in order to tap into global knowledge mainly from foreign-originated sources. This might be in conflict with FDI-attracting policies, given the major source of knowledge for innovation at domestic firms in developing countries stem from foreign-original sources. However, foreign investors would hesitate to relocate their knowledge-insensitive activities like R&D, or to transfer new technology to places where lack IPRs protection.

The informal institutions are similar to ‘untraded interdependencies’ (Storper, 1995), covering social norms, rules, culture, trust, play a crucial role in shaping the knowledge network and in disseminating information through social interactions. Those place-specific factors distinguish successful regions from declining regions. Despite the increasing popularity of communication

through Internet, face-to-face communication still secures an important role in social learning (Bathelt & Henn, 2014; Storper & Venables, 2004). Proximity and frequencies of face-to-face interaction strengthen trust amongst co-located actors. In turn, trust "*helps in decreasing the risk and uncertainty accompanying inter-firm relationships*" (Capello, 1999, p. 356).

### 2.4. Empirical studies on LKS

A systematic literature review was conducted following (Tranfield, Denyer, and Smart, 2003) to critically evaluate and summarise current knowledge relevant to the research topic from past studies 'to ensure that no existing understanding or knowledge is missed' (Arshed & Danson, 2015, p. 32). To search for empirical literature, two search strings were used, i.e. (i) "cluster" + "developing countries", and (ii) "knowledge spillovers" + "innovation" + "cluster", on Scopus - the largest academic abstracts of peer-reviewed literature in the world, at the end of March 2020. By doing so, it could filter in those studies about cluster in developing countries – the context of study – to keep only those studies discussing LKS and/or other terms covering LKS such as external economies, joint action, and industrial atmosphere. Meanwhile, the second search string allows retaining only those explicitly mentioning LKS in the context of a cluster. This contains both the cases in developed and developing countries.

The literature on knowledge spillovers is extensive (Cerver-Romero et al., 2018); therefore, it is important to distinguish the present PhD research with other literature domains on KS by developing the inclusion and exclusion criteria for the literature review process (Appendix H). There are five dominant clusters of relevant research to knowledge spillovers, including (i) KS location, (ii) KS agglomeration, (iii) KS institutional approach, (iv) KS demography and (v) KS of entrepreneurship (Cerver-Romero et al., 2018).

In particular, the *first* approach of KS location concerns R&D KS based on patent citation at cross-region and/or cross-country level. The *second* approach of KS agglomeration investigates the role of technological spillovers to economic growth, i.e. whether intra- or inter-industry spillover effects are more important (Marshall-Arrow-Romer versus Jacobs externalities), and whether diversity or specialisation of a region is more conducive for economic growth (Glaeser et al., 1992). A few cluster theories, such as learning region and regional innovation system, also belong to this group. These cluster theories try to explain the existence of clusters, the importance of local versus global sources of knowledge to innovation at firm level within a cluster. However, despite acknowledging the important role of public policies for the occurrence of KS, Cerver-Romero et al. (2018) do not elaborate further on how and why. Interestingly, in the *third* approach namely KS institutional approach, there are opposite opinions on the emergence of KS. While the endogenous economic school assumes KS occur automatically

(unplanned and unintentional KS), the literature on territorial innovation models - under the influence of evolutionary economics - particularly pay attention on the role of geographical proximity on the emergence and patterns of KS within a certain boundary (as illustrated in details section 2.2). The *fourth* approach of KS demography is associated with urban economics, which concerns more about KS within cities. Meanwhile, the *fifth* approach perceives entrepreneurship as a conduit of KS (Audretsch & Lehmann, 2005), and pursues to explain the determinants of entrepreneurship rates across industries and regions, and the meaning of entrepreneurship to economic growth.

To remind, this research is about localised knowledge spillovers (LKS) within a cluster. Hence, it does not belong to the first (*i*) and the fourth (*iv*) domains. The search for relevant empirical literature therefore excludes those studies in these two domains. The present research particularly concerns the local-global dynamism following the second (ii) approach, the mechanisms of LKS following the third (iii) approach. Also, it explicitly agrees with the KS theory of entrepreneurship that entrepreneurship or spin-off is an important channel of LKS. Furthermore, since learning is a route to development, the empirical development studies about industrial cluster in developing countries are highly relevant to the present research (as explained in section 2.2.).

| Table 2.3: Summary of relevant empirical studies on LKS within a cluster | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **No.** | **Research** | **Sector/Industry** | **Country** | **Method** | **Mechanism of LKS** | **Innovation** | **Intra-firm characteristics** | **Intra-cluster linkage** | **Global linkage** |
| | ***The present PhD study*** | ***Software*** | ***Vietnam*** | ***Mixed*** | ***Network Spin-off Labour mobility*** | ***Yes*** | ***Yes*** | ***Yes*** | ***Yes*** |
| 1 | (Helmers, 2019) | Hi-tech industries | UK | QUAN | Network | Yes | Yes | No | No |
| 2 | (Dyba, 2016) | Food & Furniture | Poland | QUAN | Network | No | No | Yes | No |
| 3 | (Kim, Lee, Choe, & Seo, 2014) | Software | Korea | QUAN | Network | Yes | No | Yes | No |
| 4 | (Henn, 2013) | Diamond Cutting | India | QUAL | Network | Yes | No | Yes | Yes |
| 5 | (Huber, 2012) | IT | UK | QUAL | Network | Yes | No | Yes | No |
| 6 | (Kesidou & Snijders, 2012) | Software | Uruguay | Quan-led MIXED | Network | Yes | Yes | Yes | No |
| 7 | (Kimura, 2011) | Traditional craft | Vietnam | QUAN | Network | Yes | Yes | Yes | No |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 8 | *(Wang et al., 2010)* | *ICT* | *China* | *MIXED* | *Network* | *Yes* | *Yes* | *Yes* | *Yes* |
| 9 | (Trippl et al., 2009) | Software | Austria | QUANT | Network | Yes | Yes | Yes | No |
| 10 | (Silvestre & Dalcol, 2009) | Oil & gas | Brazil | QUAL | Network | Yes | No | Yes | Yes |
| 11 | *(Vu et al., 2009)* | *Iron & steel* | *Vietnam* | *QUAN* | *Network* | *Yes* | *Yes* | *Yes* | *Yes* |
| 12 | (Kesidou, Caniëls, & Romijn, 2009) | Software | Uruguay | Qual-led MIXED | Network | Yes | Yes | Yes | No |
| 13 | *(Kesidou & Romijn, 2008)* | *Software* | *Uruguay* | *QUAN* | *Network*<br>*Labour mobility*<br>*Spin-off* | *Yes* | *Yes* | *Yes* | *Yes* |
| 14 | *(Kesidou & Szirmai, 2008)* | *Software* | *Uruguay* | *QUAN* | *Network*<br>*Labour mobility*<br>*Spin-off* | *Yes* | *Yes* | *Yes* | *Yes* |
| 15 | *(van Geenhuizen & Reyes-Gonzalez, 2007)* | *Biotechnology* | *Netherlands* | *QUAL*[*] | *Spin-off*<br>*Network* | *Yes* | *Yes* | *Yes* | *Yes* |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 16 | (Tsang, 2005) | Software | Boston, London, Dublin | QUAL | Network<br>Labour mobility | No | No | Yes | Yes |
| 17 | (Zhou & Xin, 2003) | ICT | China | QUAN | Spin-off<br>Network | Yes | No | Yes | No |
| 18 | (Perez-Aleman, 2003) | Agroindustry | Chile & Nicaragua | QUAL | Network | Yes | No | Yes | No |
| 19 | (Sandee & Rietveld, 2001) | Roof tile | Indonesia | QUAN | Network | Yes | Yes | Yes | No |
| 20 | (Rabellotti, 1999) | Shoe | Mexico | MIXED | Network | No | No | Yes | No |
| 21 | (Das, 1998) | Mosaic flooring tile | India | QUAN | Network | Yes | No | Yes | No |
| 22 | (Rabellotti, 1995) | Footwear | Mexico & Italy | QUAL | Network<br>Labour mobility | No | No | Yes | No |
| 23 | (Cawthorne, 1995) | Cotton knitwear | India | QUAL | Network | No | No | Yes | No |

*The whole study uses Mixed method, but to address the research questions regarding LKS, it uses qualitative method.

Table 2.3 summarises the most relevant empirical studies to LKS within a cluster and its relation to innovation at firm level. The publication dates of these studies range from 1995 to 2019 with focuses on a variety of different sector/industry. In common, the majority of empirical studies about LKS and its relation with innovation have used case study methodology; and there is a diversity of data analysis methods in use, including quantitative, qualitative and mixed methods. The context of previous studies are mostly hi-tech clusters in advanced countries or low-cost manufacturing clusters in developing countries. Two main theoretical approaches have guided the empirical studies; one is economic development perspective, and the other is territorial models of innovation.

From economic development perspective, relevant studies in the 1990s and early 2000s use the CE, industrial districts, cluster and GVC approaches to investigate the growth of industrial clusters in developing countries (Cawthorne, 1995; Das, 1998; Rabellotti, 1995, 1999; Sandee & Rietveld, 2001). These studies dominantly employ qualitative analysis from interviews and/or descriptive analysis of quantitative data. The sector/industry are largely small-scale manufacturing sector, with a long history of serving domestic market before exportation. Often, the inter-firm relations in these clusters are strongly based on kinship and family ties (Cawthorne, 1995; Kimura, 2011; Rabellotti, 1995; Vu et al., 2009). A few exceptions could be found in other industries, such as domestic-oriented ICT service in China (Zhou & Xin, 2003), or agro-industrial clusters in Chile and Nicaragua (Perez-Aleman, 2003). The limitation of these studies is with their absence of global linkage discussion, particularly, how global pipeline interacts with the local buzz process inside the cluster. Also, LKS is not explicitly discussed; rather, it is often embedded within inter-firm relation (network channel), while innovation is embedded in upgrading. The quantitative correlation between LKS and innovation is not testified in these studies.

Built upon the territorial innovation models, a part of the literature examines LKS and its effects on innovation in advanced countries. Accordingly, LKS – as an integral part of local competitiveness - may vary by industry and the life stage of a cluster (Feldman, 1999). It is also subject to the ‘stage in the knowledge value chain’ and the segment of a particular industry (van Geenhuizen & Reyes-Gonzalez, 2007). In this domain of literature, qualitative empirical case studies are exploratory in nature, i.e.they describe how the status quo of LKS but do not offer a systematic explanation for this status quo. In other words, the rationales for the presence and nature of LKS are quite descriptive and fragmented. Notably, there is a certain degree of agreement when it comes to the weak legal protection of intellectual property rights in

developing countries, which causes difficulties "*for producers to prevent imitation or to exclude others"* (Basole, 2016, p. 176; Wang et al., 2010).

Meanwhile, quantitative empirical case studies in general lack insights into the mechanisms behind the (non-)significance of different channels of LKS to innovation (Kesidou & Romijn, 2008; Kesidou & Szirmai, 2008). Other quantitative studies are quite descriptive, and they have not testified the quantitative importance of LKS for innovation at firm level (Dyba, 2016; Trippl et al., 2009). Despite the presumption on the channel of LKS via social interaction, recent quantitative studies fail to capture LKS via this channel by the measure of distance (Helmers, 2019).

Besides, based on the limitations associated with the theoretical approaches from section 2.2, table 2.3 demonstrates for each empirical study (i) whether innovation was discussed, (ii) whether the intra-firm idiosyncratic characteristics were discussed or not, (iii)whether local linkage was discussed or not and (iv) whether global linkage was discussed or not. In general, it evidently lacks contemporary studies addressing all of the afore-mentioned topics with a few exceptions (van Geenhuizen & Reyes-Gonzalez, 2007; Vu, Sonobe, & Otsuka, 2009; Wang, Lin, & Li, 2010). Even amongst these exceptions, they often focus on one or two channels of LKS only. The relationship between channels of LKS and innovation is sometimes presumed, and not quantitatively tested. In addition, since the nature and degree of LKS may vary by industry and country, table 2.3 shows the diversity of sector/industry under previous examination, and points out why the present PhD research is more comprehensive and different with previous empirical studies.

Only four studies are marked with all "yes" entries, covering clusters in both developed and developing countries.

In particular, Wang et al. (2010) explain the absence of LKS in Shenzhen likely due to the institutional setting of this cluster, namely "*an export processing zone with a short history of development … there are very few, if any, well-established research universities or institutes"* (p.2004). In explanation for the shortage of benefits from global linkages, the reason is generally due to low value-added segment of the ICT sector in the GVC. However, does this mean there is no help for technological and organisational innovation from global linkages? In addition, despite its primary data in hand containing some intra-firm characteristics, such as number of patents, R &D employees, this study does not investigate the quantitative and qualitative relation between these intra-firm characteristics and LKS. Some important questions remain untouched. How individual firms take advantage of their global linkages, as well as local linkages for innovation purpose? Or what factors would distinguish firms who benefit from such linkages and

those who do not? In other words, the provided rationales for poor LKS in Shenzhen cluster were made irrelevant to the idiosyncratic characteristics at firm level.

In another study in Netherlands about biotechnology, van Geenhuizen and Reyes-Gonzalez (2007) stress that the importance of LKS to innovation is subject to the stage in knowledge value chain and the type of business. Particularly, for manufacturing firms, LKS matters more in the early stage of start-ups, especially the idea generation. For service firms - who have developed and mainly relied on local vertical linkages with their customers, LKS is always an important source of knowledge for innovation. The authors do not clearly define the concept of LKS, but it is extracted from the article that spin-off and personal network of entrepreneurs are two key channels of LKS. Despite its touch upon all the listed matters in Table 2.3, there is no explanation on how intra-firm characteristics may influence the global linkage tendency of a firm. Also, the context of this research is a hi-tech industry in an advanced country, where local firms have well developed a medium-to-high level of innovative capability. The cluster context is loosely identified by a requirement of spatial proximity of a minimum number of young firms to at least one research institute.

Strikingly, regarding software sector, which combines both codified and tacit knowledge, the influence of LKS on innovation is evidently an on-going debate. Tsang (2005) highlights that "*the spillover of tacit knowledge due to labour mobility is a characteristic of the software industry*" (p. 1344) and "*tacit knowledge forms the basis of innovative activity in the software industry*" (p.1322). Yet, this study neither investigates the quantitative correlation between LKS and innovation; nor discusses the internal characteristics at firm level. As opposed, in another qualitative study, LKS within the Cambridge IT cluster is found not to contribute much to the innovation at firm level (Huber, 2012). In the case of Montevideo software cluster in Uruguay, Kesidou and her co-authors have found the positive relationship between LKS via labour mobility, spin-offs and informal interactions (Kesidou & Szirmai, 2008; Kesidou & Romijn, 2008; Kesidou et al., 2009; Kesidou & Snijders, 2012). These publications are derived from her PhD thesis (see Figure 2.2 for her research design).

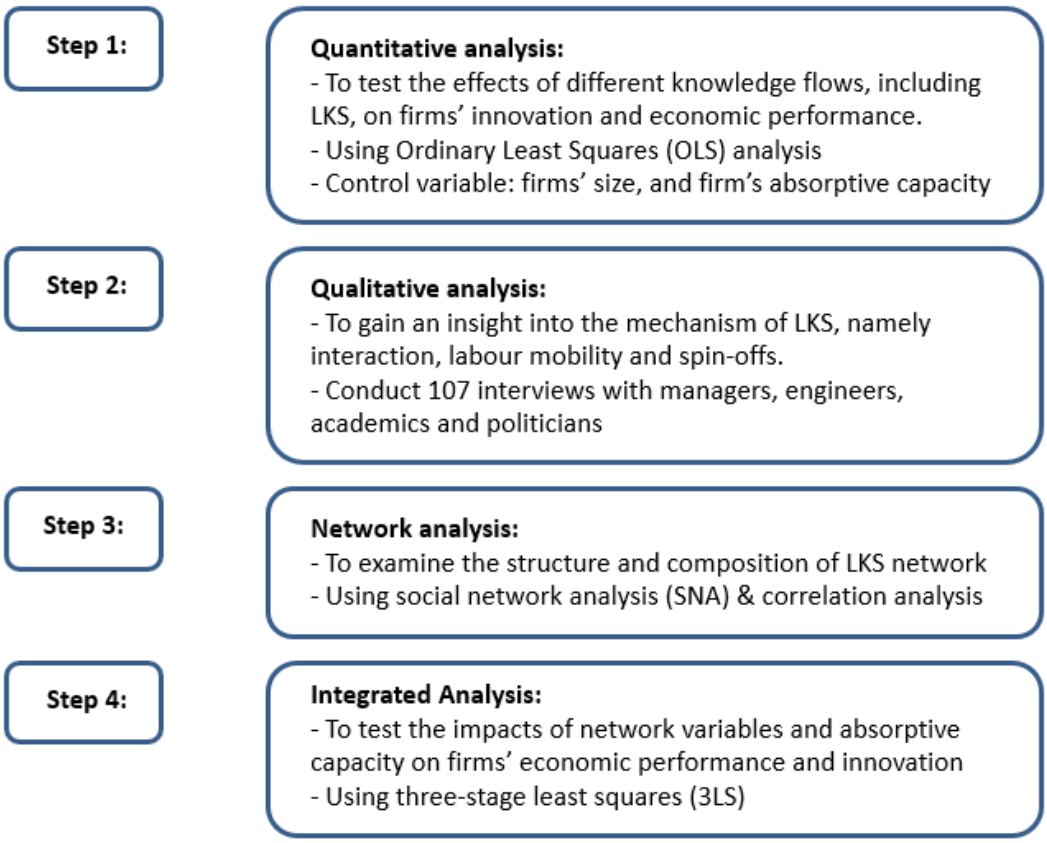



**Figure 2.2: Summary of Kesidou (2007)'s research design (own illustration)**

In her research, Kesidou uses Likert scale to capture the importance and existence of LKS and international knowledge flows, and testifies in a three-stage least squares the effect of different knowledge flows on innovation, then export performance. Accordingly, LKS causes a stronger effect than international knowledge flows on technological innovation (Kesidou & Romijn, 2008). Yet, for export performance, international knowledge flows are superior to LKS (Kesidou & Szirmai, 2008). Hence, innovativeness is an antecedent of economic successfulness. To compare amongst three main mechanisms of LKS, inter-firm interaction (informal network) and labour mobility (the inflow rate of new employees from within cluster) are the most important channels for technological innovation. Meanwhile, for organisational innovation, only LKS via spin-off generates statistically significant result. In terms of local-global dynamism, the regression analysis does not show the statistically significant result on interaction effect between international and local knowledge flows (Kesidou & Romijn, 2008).

Kesidou's research has provided extremely useful guidance for this study. However, it has some limitations that this study could learn from and improve. *One* is the limitation associated with the qualitative sub-study (Kesidou, Caniëls, & Romijn, 2009). The qualitative chapter in Kesidou's thesis and paper did not describe in details the relevant methods for data collection and analysis (Kesidou, 2007). Other important information like interview questions was missing.

*Two* is with its method regarding the treatment with LKS via informal network in social network analysis. The use of degree centrality as represented for LKS via informal network may violate the assumptions of OLS analysis, i.e. independence of error term (Borgatti, Everett, Johnson, & Everett, 2018), for the reason that network indicators are measurements on related subjects. However, Kesidou does not mention this problem, neither the statistic method to deal with such violation. As a result, it could damage the validity of statistically significant results, namely the standard errors are biased.

*Three*, this research builds up from previous findings on local-global dynamism including those from Kesidou's research, to qualitatively explore how global linkages (international knowledge flows in her words) may interact with LKS.

Besides, the present study also searches for empirical studies about KS and cluster in Vietnam due to its relevance of research context. Howard, Newman, and Tarp (2016) show the evidence that KS is the strongest force for agglomeration in Vietnam. The authors capture KS from technology transfer based on interaction with suppliers and consumers only – formal network or production linkages. Similarly, Finn et al. (2011) investigate innovative and technological capacity of non-state manufacturing firms in Vietnam. These authors do not measure KS directly; rather they make inferences on horizontal and vertical KS. In their findings, horizontal KS – embedded in labour mobility or technology adaption from foreign firms – is quite vague. On the other hand, vertical KS derived from forward and backward linkages depends on the position of manufacturing firm in its vertical supply chain. For example, there are about 39% of firms producing intermediate goods potentially enjoy KS from backward linkages (considering firms as suppliers of intermediate inputs). For forward linkages - considering firms as customers of intermediate inputs - only 10% of the survey population reports the existence of technology transfer from their suppliers. While these two studies provide an overview about spatial agglomeration and horizontal versus vertical KS respectively in Vietnam, they do not address LKS within a particular cluster; for this reason, this falls into the exclusion criteria in the search for relevant empirical studies (see Appendix H).

There are a few studies with the context of Vietnamese cluster; but their research context is in 'old-economy' industry – manufacturing of traditional goods with long history of domestic market development before exportation.

For example, Voeten et al. (2015) compare two traditional craft villages in Northern Vietnam with regard to the topic of how economic actors respond to environmental problems as negative externalities from their production. Nevertheless, this research does not discuss LKS at all.

Kasabov (2013) uses the primary interview data from three IT clusters in Vietnam to develop his framework on difficulties against start-ups in early-stage peripheral clusters. He does not mention LKS; but the analysis uncovers the status quo of LKS embedded in network, i.e. "*inadequate personal contact, absent informal and formal networking arrangement, and little …local cooperation"* (ibid, p.749). However, this study was conducted at a specific time in the past, and more updated studies are required to check the above facts. For this reason, this previous study could provide a benchmark for the present study to compare its findings later in this thesis.

Kimura (2011) examines the matter of social learning during the technology adoption process in rural non-farm industry (paper manufacturing factories). He explains the evolution of a traditional craft village to become a modern industrial cluster. LKS in this study is embedded within kinship network, which facilitates the knowledge diffusion process, and helps producers in the cluster to overcome their financial constraints. Particularly, learning from relatives was found significant for technology adoption decision for later-applicants. The global linkage is not amongst the major concern of this study, since the cluster under study is domestic-market-oriented.

In another research, Vu, et al. (2010) use quantitative method to study the knitwear clusters in Vietnamese rural villages with regard to product innovation (high-quality clothes for exports) and process innovation (technology adoption in manufacturing process). In these villages, the manufacturing activities are mainly subcontracting activities in knitting and fabricating for both domestic and foreign market. This study does measure intra-firm characteristics, such as human capital measured by schooling years, management skills and marketing experience. On the other hand, KS is embedded within the variable of social capital through kinship with abroad Vietnamese businesspersons, more likely representing the knowledge flow from global linkages. This variable is found conducive to innovation, which is measured as an output by the expansion of exports (export ratio), process innovation with the adoption of vertical integrated production system (subcontracting ratio), the value added and the labour productivity. But, no channels of LKS are discussed in this paper.

In summary, the review of empirical studies reveals several important gaps that the current research could fill in, as below.

Firstly, while the cluster initiatives in developing economies often presume the automatic presence of LKS, few efforts have been devoted toward synthesizing factors moderating the effects of LKS to innovation according to its channels. An insight into these factors would help

policy makers in developing countries to design their policies in order to facilitate LKS beneficial to innovation of clustered firms.

Secondly, there is a lack of contemporary studies investigating the importance of LKS to innovation at firm level within a 'new-economy' cluster in developing countries, perhaps due to the recent emergence of these clusters (Manning, 2013). As pointed out earlier, there is mixed evidence about the effect of LKS on innovation (Huber, 2012; Kesidou, 2007; Tsang, 2005) together with the contextual differences between low-cost manufacturing clusters and knowledge-intensive clusters (Manning, 2013). Studies in the context of a new-economy cluster in developing countries, i.e. knowledge intensive cluster, would extend current understanding on the importance of LKS to innovation of clustered firms.

Finally, the consensus from past studies holds that global linkages play a major role for firms in developing countries to innovate. Nevertheless, how the global connections could further diffuse knowledge, especially tacit knowledge in the form of LKS, to local communities remain unknown. Local firms in developing countries would be beneficial from the tracing of knowledge diffusion from these linkages since they could mobilise their resources to leverage their international connections for the innovation process.

### 2.5. Chapter summary

This chapter has explained the most relevant theoretical approaches and empirical studies relevant to LKS phenomenon within a cluster in developing countries. While the economic development studies have largely focused on industrial clusters, i.e. in manufacturing and traditional craft industries; the economic geography of innovation, especially territorial innovation models, exerts the influence on mostly hi-tech clusters in both developed and developing countries. The review of empirical studies also reveals some problems associated with mono-methods, i.e. either quantitative or qualitative method only.

Overall, this chapter has critically identified some crucial theoretical and empirical gaps to deal with LKS phenomenon and its relationship with innovation in developing economies. Particularly, taking into consideration of (i) the mixed evidence on the relationship between LKS via its channels and innovation, (ii) the contextual differences between different type of cluster according to sector/industry, and (iii) the fragmented and partial explanation for the (non-)significance of LKS channels on innovation, the author has proposed three main gaps that this study could contribute to. Particularly, a study in LKS phenomenon and its relation to innovation should develop a systematic framework in explanation for the existence of LKS based on its channels. Secondly, there is still scarcity in research effort to explore an increasingly popular

cluster context in developing economies, e.g. software outsourcing cluster, given the mushrooming cluster initiatives by developing government to catch up with the ICT Revolution. Last but not least, the export-led nature of cluster poses an interesting inquiry into how local-global dynamism would affect the nature and pattern of LKS within the cluster; yet, this inquiry remained unanswered.

# Chapter 3: RESEARCH METHODOLOGY & DESIGN

## 3.1. Chapter overview

This chapter explicates the specific research methodology and research design being chosen to address the research objectives and to answer the research questions presented in chapter 1.

A research is conducted to investigate a chosen research phenomenon in a systematic way and make contribution to knowledge (Saunders, Lewis, & Thornhill, 2012). To conduct a research, it requires a reasonable research methodology together with an instructive philosophical stance. Meanwhile, a research design elaborates the research methodology by providing the framework to guide the process of data collection and data analysis (Bryman & Bell, 2015).

This chapter is structured as follows. Section 3.2 revisits the research objectives and research questions; section 3.3 discusses the research strategy including philosophical paradigm and research approach; section 3.4 illustrates the research design, including case study design, sampling approach, mixed-method methodology, and the variables and measurement for the quantitative analysis. Then section 3.5 discusses the matters of validity and reliability of the selected methodology. The final section 3.6 summarises the chapter.

## 3.2. Revisiting research objectives and research questions

The research process starts with general research ideas influenced by personal research interest of the researcher. This process is not necessarily a linear process (Bryman & Bell, 2015). Hence, while the initial research interest guides the literature review, research objectives and questions are gradually refined and become more complete due to literature review (Hair, Wolfinbarger, Money, Page, & Samouel, 2011).

As discussed in chapter 2 (section 2.3), there are three main determinants of LKS, namely external learning environment, internal environment and network. This in combination with the empirical gaps (section 2.4), trigger the research interest in the following particular questions:

1. How does the institutional setting affect LKS within QTSC? (Chapter 4 & 6)
2. How do the structure and composition of social network within QTSC influence the nature and patterns of LKS? (Chapter 5 & 6)
3. How significant LKS via different mechanisms are to innovation at firm level within QTSC? (Chapter 5 & 6)
4. How do idiosyncratic characteristics inside a firm affect LKS within QTSC? (Chapter 5 & 6)

5. How does the local-global dynamism influence LKS amongst firms inside QTSC? (Chapter 6)

Research questions (RQ) numbered 1, 2 & 4 respectively deal with external learning environment, network dimension, and internal learning aspects of LKS. Meanwhile, the inquiry into RQ3 aims to examine the significance of LKS via different channels to innovation at firm level. RQ5 regards the controversial debate around local-global dynamism, particularly seeks to investigate whether knowledge flows from global linkages will transform into LKS within the cluster. Each of these research questions will be dealt with in equivalent chapter(s) as shown in the brackets.

## 3.3. Research strategy

### *3.3.1. Philosophical paradigm*

A philosophical paradigm refers to a harmonized set of ontological, epistemological and methodological issues (Denzin, 2010). Such paradigm is essential for any research project since it guides how the phenomena or reality to be studied and how it is studied by certain methods (Crotty, 2003). Philosophical paradigms are incommensurable (Kuhn, 1970, cited in Bryman & Bell); and the selection of a particular paradigm ought to be based on the research purpose embedded in a specific research context.

In economics, positivism has been the dominantly influential paradigm (Caldwell, 2013) especially after the published work of Milton Friedman ((1953), 1966). Friedman's work is even considered to liberate those researchers who wish to construct mathematical models but are still worried of unrealistic assumptions (Mäki, 2003). Accordingly, ones need no concern to justify the validity of theories and hypotheses by their respective assumptions. Yet, positivism is not appropriate for the current study. In particular, positivism is an epistemology-driven philosophical framework with the ignorance of ontology and axiology. The equivalent ontological position of positivism would be naïve realism (Guba & Lincoln, 2005). This type of realism dictates a closed and static world; it rejects "*the independence of thought and reality*" (Downward & Mearman, 2007, p. 87). Such perception drives the research away from social reality (Lawson, 2009). Positivism seeks explanatory power based on simplistic assumptions of social reality. For these reasons, positivism does not fit to explore social reality and emergent themes like LKS and innovation in developing countries.

The inquiry for looking beyond positivism has gained momentum in the literature of economics alike. For example, Blaug (1992) encourages economic researchers to involve multiple sources of evidence and theories such as historical events and other social science apart from law-like

generalisation and statistics. At the same time, he promotes the explanation about the role of a particular unit, e.g. such as firm, or an individual human in his/her interaction within an institution.

Taking the research objectives and research questions into consideration, this research employs critical realism point of view as the guiding philosophical framework for several reasons. Critical realism has a detailed discussion on ontology. In particular, it recognizes the external being of social reality regardless of human minds. At the same time, critical realism emphasises the significance of interpretation process and social construction (Watson, 2013). Especially, this view is distinguished from constructivism, which perceives the social world only from verbal and non-verbal construction. The recognition of hermeneutics in critical realism could help reorient economics toward social sciences (Bhaskar, 1978, as cited in Downward & Mearman, 2007), since economics should be distinguished with mathematics or physics (Davis, 2008).

According to critical realism, there are three strata or layers of reality, namely the empirical or experience (observables), the actual (includes actual events, which occur no matter we can observe or not) and the real (or 'causal mechanism' – the mechanism causes actual events to happen). Each layer connects to each other. Accordingly, the role of researchers is to investigate these multi-dimensional social realities. Notably, critical realists aim to find out "*the underlying causal mechanisms between the different ontological levels*" (Kim, 2012, p. 814), namely the unobservable structure causing the observable events.

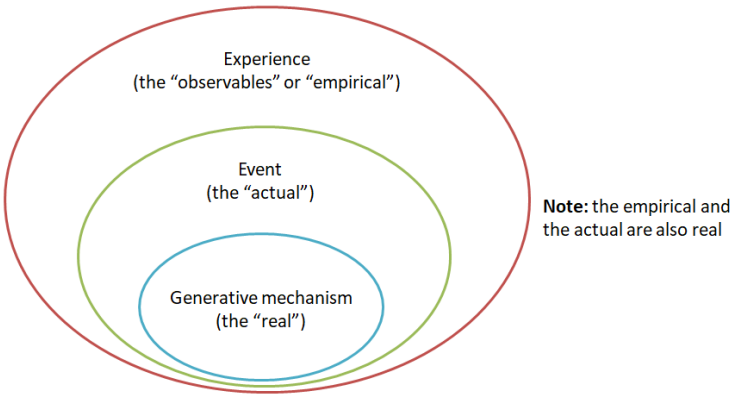



**Figure 3.1: Strata of reality according to critical realism (based on Morgan (2016))**

Figure 3.1 illustrates a simplified visualisation of different layers of reality according to critical realism based on Morgan (2016). The position of each circle reflects the distance of reality to the researchers. For example, the outer circle represents the observables or empirical, which is the first reflection mirroring in the mind of researchers. Coming into the middle circle, it refers to

the actual events; those take place no matter we could observe and experience or not. Hence, the reality in this dimension contains both the observable and the unobservable. The deepest layer or the inner circle, which is not visible from the beginning to researchers, is the causal mechanism.

With regard to causal mechanism, since critical realists view the external world as an open and dynamic system, there is no single and static causal mechanism. In other words, 'patterns and regularities' as extracted from the 'potential causal mechanisms' are likely to be tendencies (Kim, 2012). These tendencies are therefore less "determined and predictable" than would be the case with law-like statements/propositions (ibid, p.814). Similarly, there is no ultimate or constant causal mechanism for a given phenomenon for two reasons. *First*, the social ontology following critical realism is contextualized subject to specific study and historical conditions (Hodge, 2008). *Second*, 'cause' in the causal mechanism should be perceived as "an evolutionary concept of emergence" (Downward & Mearman, 2007, p. 88). It involves social interactions between individuals and institutions under the influencing environment; so, cause is also transfactual.

In addition, the ontology and the epistemology issues are likely to emerge together (Crotty, 2003). Each ontological view relates to an epistemological position reflecting the construction of knowledge (Mason, 1996). The ontology pays attention to the nature of social reality and the existence of reality and phenomena (Saunders, Thornhill, & Lewis, 2012), the epistemological questions deal with the sources of knowledge, and how knowledge can be gained (Bryman & Bell, 2015). While positivism strictly considers only objective observations from experience as acceptable sources of knowledge, critical realism does not necessarily reject the use of objective observations (Downward, Finch, & Ramsay, 2002). The consensus amongst economists hold that observations are influenced by the beliefs and presumption of the researchers, hence they are far from the completely objective (Hausman, 1994). In this relevance, critical realism acknowledges a certain degree of subjectivity, while still pursues the objectivity. Likewise, the ontological and epistemological positions of critical realism enable the use of mixed-method methodology in the current study.

As argued in chapter 2, previous empirical studies using mono-methods, i.e. only quantitative or qualitative, fail to provide a complete picture of the existence and importance of LKS to innovation at firm level. While the quantitative studies could point out whether LKS is significant for innovation or not, and which channel of LKS is more important to innovation; they could not provide insights into the mechanism(s) behind the (non-) significance of LKS to innovation. That explains why there is mixed-evidence of LKS to innovation in the literature. Hence, the qualitative method could offer complementary strength to the quantitative one, in

order to achieve both explanatory and exploratory research purposes. With the aid of mixed-method methodology, this study is able to address the research questions (see chapter 1), and to obtain a much more comprehensive picture of the LKS phenomenon within a knowledge-intensive cluster in developing countries.

### *3.3.2. Research approach*

Table 3.1 shows the three modes of inference in research.

**Table 3.1: Deduction, induction and abduction: from reason to research**

| | **Deduction** | **Induction** | **Abduction** |
|---|---|---|---|
| **Logic** | In a deductive inference when the premises are true, the conclusion must be true | In an inductive inference, known premises are used to generate untested conclusions | In an abductive inference, known premises are used to generate testable conclusions |
| **Generalizability** | Generalizing from the general to the specific | Generalising from the specific to the general | Generalising from the interactions between specific and the general |
| **Use of data** | Data collection is used to evaluate propositions or hypotheses related to an existing theory | Data collection is used to explore a phenomenon, identify themes and patterns and create a conceptual framework | Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth |
| **Theory** | Theory falsification or verification | Theory generation and building | Theory generation or modification; incorporating existing theory where appropriate, to build new theory or modify existing theory |

Source: Extracted from Saunders, Thornhill, and Lewis (2012, p.145)

The use of either deduction or induction would not be sufficient to this study. Deduction is usually associated with quantitative methods, which aim to falsify or verify an existing theory. Therefore, deductive reasoning "*can only cope with knowledge that already exists or has been acquired*" (Downward et al., 2002, p. 483). Meanwhile, inductive logic popularly used in qualitative methods generates theory based on data. The use of inductive logic, though supportive to create new knowledge, is not sufficient. In particular, for the current research, the data collection is actually informed by certain theories and approaches from existing literature.

Hence, given the guiding philosophical position, i.e. critical realism, the present research employs abduction as the mode of inference. While deduction moves from theory to data, induction moves from data to theory, abduction combine both these two processes.

> (Abduction is) *a logical operation by which conjectures about possible reasons for an observed fact (in need of being explained) are derived*. (Witt, 2009, p. 364)

## 3.4. Research design

### *3.4.1. Case study design*

The use of case study as research strategy is appropriate to gain insights into LKS within a cluster and its relation with innovation at firm level in developing countries. A case study is "*the study of a phenomenon within its real-world context"* (Yin, 2012, p. 5).

As clarified in chapter 2, the context of previous empirical studies are either 'old' economy clusters (i.e. manufacturing and traditional crafts) in developing countries or hi-tech cluster in developed countries; but a knowledge-intensive cluster in developing countries obtain distinctive features compared with these former two type of clusters (Manning, 2013). In particular, in developing countries, low-cost manufacturing clusters mostly employ low-skilled labour, while knowledge-intensive clusters would require hi-skilled labour. On the other hand, the regional innovation system and other cluster theories dictate that LKS within an agglomeration of industrial firms would positively influence innovation performance at firm level (see chapter 2 of literature review). Yet, these theories have originated from case studies in advanced countries; in which, innovation is perceived as the main source of competitive advantage (Asheim et al., 2011) together with "*flexible, networked, knowledge-based and innovation production systems*" (Simmie, 2011, p. 547). Meanwhile, the competitiveness of clusters in developing countries is more likely based on static factors such as relatively cheaper labour costs compared to advanced countries. Hence, the legitimacy of theoretical discourse and empirical findings in other types of cluster than knowledge-intensive cluster in developing countries remains questionable.

Furthermore, given the importance of institutional setting to LKS and innovation, case study could shed some lights on how a distinctive setting of context, i.e. knowledge-intensive cluster in developing countries, influences the peculiarities of LKS and its relation with innovation at firm level.

Figure 3.2 demonstrates the research procedure. To start with, the research problems or research questions are developed from a 'sound theoretical base' (Hair et al., 2011) based on research gaps. Chapter 2 has provided a systematic literature in relevant theoretical approaches and

empirical studies to LKS within a cluster in developing countries. This helps to identify research gaps and to refine the research questions.

The secondary data of macroeconomic and sectoral information help to elaborate the context of study, namely the Quang Trung Software City (QTSC) cluster in Vietnam, i.e. (i) to facilitate a broad understanding about the macro aspects of Vietnamese economy through different period, and (ii) to provide with important information on the development and strategy of the IT industry and clusters in this country. Also, as will be shown in chapter 4, this context represents some essential characteristics of developing countries, particularly 'thin institutional setting' such as weak research capacity and under-developed national and regional innovation system (Amin & Thrift, 1995; Tödtling et al., 2011). Once the essential characteristics are identified, "*it will be logically possible to generalise from a single example of a phenomenon by means of case-study analysis*" (Downward et al., 2002, p. 492).

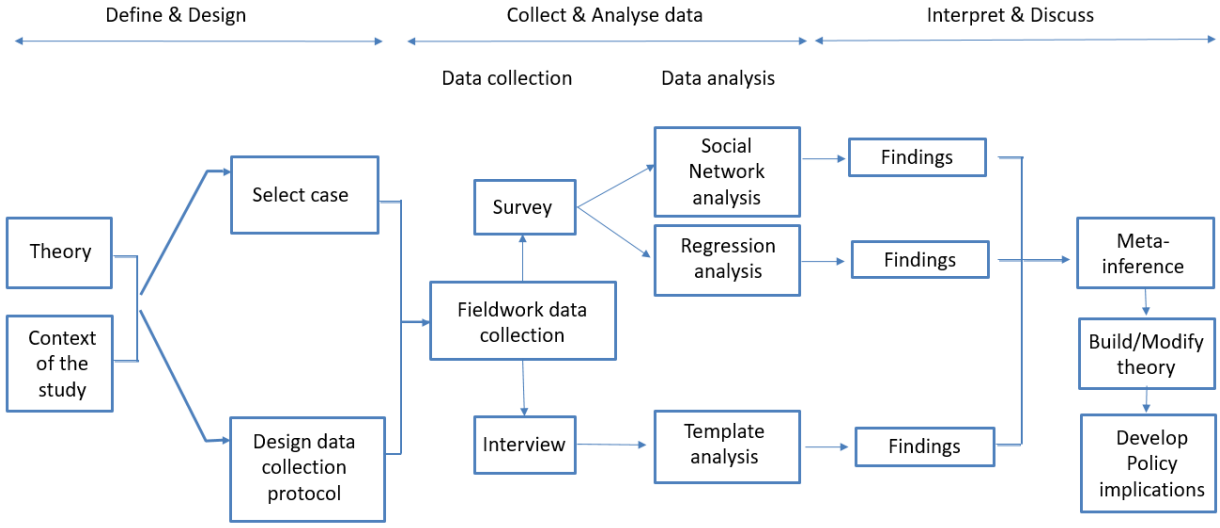



**Figure 3.2: Research procedure (modified by the researcher based on Yin (2014)).**

Based on the literature review and research context, the researcher moves on to select case and design the data collection protocol before the field trip. Doing fieldwork as part of case study could help to better understand the data (Yin, 2012, p. 5). For this research, there are two main methods of primary data collection in use, namely survey and semi-structured interview. The quantitative data are analysed using the social network analysis and regression analysis; while the qualitative data are analysed by template analysis, and partly by the chi-square test. In chapter 7, the findings from individual analytical methods are integrated in the meta-inference. The abduction logic is used to build or modify relevant theory, resulted in theoretical contributions in chapter 8. This is then followed by policy recommendations for Vietnam and other developing countries, and further practical recommendations for firms within a cluster in these countries.

### *3.4.2. Sampling procedure*

The cluster selection criteria refer to the work of Kesidou (2007). The selected cluster should be (i) a knowledge intensive cluster; (ii) export-intensive cluster; (iii) economically and technologically dynamic cluster. The present study chooses the Quang Trung Software City (QTSC) cluster for an in-depth analysis of LKS phenomenon in Vietnam. This is amongst a few IT concentrated clusters in Vietnam to be officially recognized by the government. The unit of analysis is clustered firms in QTSC located at District 12, Ho Chi Minh City, Vietnam.

The above selection is based on several reasons, but mainly due to (i) the country context, and (ii) the feasibility of data collection. As will be demonstrated in details in chapter 4, the political and economic conditions of Vietnam make it an appealing case worth of studying. From one of the poorest countries, Vietnam has become a lower middle-income country with one of the fastest growth rates in the world. An insight into the case of a knowledge-intensive cluster under the government initiative in Vietnam would be useful for other developing countries at the similar economic development stage. QTSC is chosen due to its leading economic performance amongst all IT clusters in Vietnam. This is the largest IT cluster in Vietnam. It satisfies the criteria to be a knowledge-intensive and export-intensive cluster in developing countries.

Also, QTSC is chosen as the research site due to the cooperation from the QTSC Development Company – who is in charge of the cluster management. This was the only cluster management agency who responded to the invitation of the researcher (will be explained in details in section 3.4.3.a).

This study has used purposive[ii] and convenience[iii] sampling methods (Tashakkori & Teddlie, 1998).

For the quantitative strand, each firm within the cluster has an equal and independent chance of being selected for participating in the study. The targeting participants for innovation survey are all member firms located within QTSC located at District 12, Ho Chi Minh City. This study only takes account of firms with more than one year old for data collection, since some of the survey questions specifically request the data dated back to the last one year (between June 2017 and June 2018). Meanwhile, the network survey takes inputs from key personnel such as president, vice-president, head of R&D department (if any), and chief of engineer or technical department of all firms and institutions within QTSC. Each of these individuals will represent the position of their firm in the network.

Those who participated in the survey are invited to the interview based on convenience sampling. The targeting interviewee for the qualitative strand would be firms' representatives,

often director, vice president and manager of the companies. A list of detailed occupations of the interviewees is provided in Appendix C.

### *3.4.3. Mixed-method methodology*

Mixed-method methodology combines both quantitative and qualitative methods into one research. It is evident that mixed methods research has been increasingly gaining popularity in academia (Fielding, 2012; Flick, 2017). There are a number of reasons to use mixed methods (Creswell & Plano Clark, 2007, pp. 9-10). *One*, quantitative methods could compensate for the weaknesses of qualitative methods and vice versa. Therefore, mixed methods research enables researchers to approach those research questions, which could not be solved by mono methods. *Two*, the flexibility in using different tools of data collection without restriction to a single type of quantitative or qualitative method offers a comprehensive set of evidence. *Three*, mixed-methods research emphasises the collaboration of qualitative and quantitative strands, though sometimes involving conflicts for the sake of inquiry. *Fourth*, it allows multiple perspectives to approach the research phenomena. *Finally*, mixed-method research is useful and practical as researchers could utilise any methods deem to be appropriate to address the research problem. The benefits of mixed methods outweigh its potential difficulties such as greater effort and time to collect and analyse both qualitative and quantitative data in mixed-methods.

Typically, in economics, using mixed-method methodology can enlarge the knowledge stock of economics, and open new opportunities for inter-disciplinary research, of which the collaboration between economists and qualitative researchers in other social sciences is emphasised (Starr, 2014). Also, mixed-method methodology could improve the quality of economic research, i.e. in terms of value and ethics, by making inferences upon findings from both quantitative and qualitative components.

The use of mixed-method methodology in the current study typically has two main specific purposes based on the summary of Greene, Caracelli, and Graham (1989), i.e. complementarity and expansion. *First*, the quantitative and qualitative strands deal with separate but connected research questions. For example, the quantitative strand examines the network structure of LKS within the research cluster, and tests the effects of LKS on innovation at firm level. Meanwhile, the qualitative strand explores the local institutional setting, which influences LKS and innovation at firm level. *Second*, qualitative and quantitative approaches facilitate each other to investigate different aspects of the LKS phenomenon in developing countries. Little is known about the nature and characteristics of LKS, as well as its influence on innovation at firm level in developing countries, partly due to the scarcity of secondary data and the incomplete institutional framework in support of innovation and LKS (Ndabeni, Rogerson, & Booyens, 2016; Nguyen,

Doan, & Nguyen, 2013). By combining both qualitative and quantitative methods of data collection and analysis, this study achieves both explanatory and exploratory purposes at the same time. On the one hand, it testifies which channels of LKS affect innovation. Simultaneously, it illustrates the network structure of LKS within the cluster. On the other hand, it explores the complex causal mechanism where idiosyncratic factors interact with each other to shape the current existence and importance of LKS within QTSC.

#### *3.4.3.1. Data collection*

Mixed-method research could be classified in terms of priority and sequence (Bryman, 2016). In terms of time orientation or sequence, this study uses the concurrent research design, meaning that primary data collection at different strands will happen at the same time and within close proximity (Teddlie & Yu, 2007). There are three strands of data collection, based on innovation survey, network survey and semi-structured interview. The emphasis of each strand will be treated equally. Respectively, the data analysis based on three forms of data collection would be complementary to each other. An integrated discussion based on three strands of data analysis will generate a more comprehensive picture of the phenomenon of LKS within QTSC. In terms of priority or the dependency relationship between samples in use for each strand (Onwuegbuzie & Collins, 2007), the sample of participants in semi-structured interview is nested within that in innovation and network surveys, but it also extends to include three organisations inside QTSC.

The data collection was conducted from a fieldwork trip to Vietnam from 9$^{th}$ July to 7$^{th}$ September 2018. The list of companies in use was taken from the most updated one in the official website of QTSC right before the fieldtrip. According to this list, there were 150 companies, seven (7) educational and training institutions and one (1) research institute. When examining the addresses of companies in this list into details, the researcher found 12 companies, including 11 domestic firms and 1 foreign invested firm, situated outside the geographical boundary of QTSC, i.e. in other building under the name of QTSC but located in District 1, Ho Chi Minh City.

To double check the availability of companies inside QTSC, I had searched on the websites of member companies for those who had a company website, and directly visited the buildings inside QTSC, for those allowed the researcher to visit given the granted permission from the director of QTSC Development Company. In addition, I have carefully searched for company registration information on the website of national business registration portal[iv]. As a result, in the list of 150 companies from the official website of QTSC, I found three (3) firms as infrastructure providers, and at least 38 missing companies including 37 domestic firms and 1

foreign invested firm, either have moved outside QTSC or terminated their operation. Therefore, the population for this study was reduced to 97 firms only.

The data collection faced several caveats. In the beginning, the researcher attempted to collect available secondary data at firm level within the cluster. I sought help from QTSC Development Company to gain access to their database. Unfortunately, they refused to provide their data for the reason of protecting information of their clients, i.e. firms within the cluster. Later, during a face-to-face conversation with one firm owner inside QTSC, he refused to provide data on certain questions on purpose. He confessed that even his firm does not provide with the correct data in the annual surveys distributed by QTSC Development Company. According to this business owner, his firm always has two accounting books, one is the real one and the other is to work with government agencies. As a matter of fact, this issue of authenticity limitation in national statistical database has been noted in other developing countries (Tian, 2013).

At the same time, the researcher contacted the Vietnam Software and IT Service Association (VINASA). However, they replied that they do not collect or hold any relevant data to the current research. Besides, due to personal network, the author contacted government officers at the Ministry of Science and Technology; this is the authority body in charge of governing hi-tech parks/clusters in Vietnam. The officer then provided me with a report on activities of industrial zones, economic zones and equivalent cluster models, but without any statistic data.

Also, there is a lack of secondary data at macro-level on IT sector and industry in Vietnam. For example, World Bank has conducted Enterprise Survey including questions on innovation at firm level in Vietnam through different years; however, the number of firms in IT sector and industry is not sufficient for quantitative analysis. For example, in the most recent Enterprise Survey, in 2015, there is only one firm in the IT sector participating in the survey. In addition, reports from the specialised ministries and professional association provide only a glimpse of the IT sector in Vietnam. Like the Ministry of Information and Communication (MIC), they publish the annual ICT White Book with some aggregate statistic data. Or, the VINASA releases the top 50 leading IT companies in Vietnam. Hence, it is evident that the public data on innovation at firm level within clusters in Vietnam is scarce.

Another challenge was that some companies did not have their official website or contact phone number. Therefore, the researcher had employed multiple approaches to gain access to firms for the sake of data collection, including face-to-face interview, email interview, and phone interview, in order to achieve as much information as possible. Given the fact that the QTSC Development Company could not directly provide the list of company emails due to their internal policy; instead, they supported by sending invitation emails to all companies inside

QTSC on behalf of the researcher. They have sent emails to companies two times, one dated 4th May 2018, the other dated 2nd July 2018; but the results were minimal. Only two companies answered and returned the surveys with some missing data. The researcher therefore had to approach individual firms via face-to-face visit at their offices, and cordially inviting them to participate into the research.

Simultaneously, another way of recruiting participant was contacting firms within QTSC via phone. To complete the innovation and network surveys, sometimes, the researcher had to call to each company several times since not one single person could obtain most information. Some companies refuse to transfer the call to the person in charge, or to provide the data with the excuse due to their internal policy. As a consequence, these surveys were done with some missing data. The majority of consent forms were signed on hard copies; some are done by electronic signature given the participants had been given important information about the study, including the research purpose, and the rights of participants as included in the information sheet.

At the end, there are in total 28 interviews, and 46 network surveys and 42 useable innovation surveys (Figure 3.3).

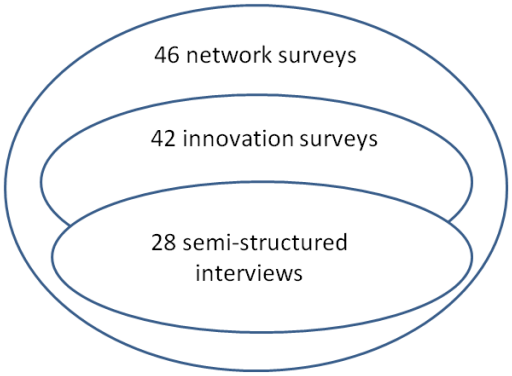



**Figure 3.3: Description of the samples for this study**

Apart from primary data collection, this thesis also uses secondary data from primary sources, for example, statistic data and official reports from World Bank, GSO, MIC, other government ministries and agencies, and other international organisations.

The following sub-sections describe in details the quantitative and qualitative primary data collection.

*Quantitative data collection*

*Network survey*

The purpose of network survey is to capture LKS via social interaction embedded in the informal network. Participants in the network surveys are firm representatives, such as chief of technical department, chief executive officer or firm owner. Those are selected since they are at management level and a decision maker in firms. The survey requests participants to list names of companies where their friends work at within QTSC; those friends must be persons whom the participants seek advice from and/or share technical information with. Along with the respective listed firms, the participants are required to choose the frequency of contact between two people following the work by (Granovetter, 1973). The frequency of contacts would strengthen trust, and further enable the exchange of knowledge between two people (Lissoni, 2001). There are four (4) levels of frequencies, namely (i) Very often (almost every week), (ii) Often (almost every month), (iii) Sometimes (a few times per year), and (iv), Rarely (one time per year or less). The researcher has collected 46 network surveys, of which 42 participants are the same as of those in the innovation surveys. The network covers 48 firms and 10 institutions within QTSC.

The researcher then used UCINET software – a popular software in social network analysis (SNA) to compute the degree centrality of each firm in the informal network. This measure is used as the indicator for LKS via informal network or social interaction.

*Innovation survey*

Regarding innovation survey, firms within QTSC are distributed with a questionnaire consisting of 13 questions (see Appendix E). The questionnaire is based on literature review, research questions and following the guidance from Oslo Manual and Community Innovation Surveys by Eurostat.

As explained earlier, the population of firms within QTSC is 97. Given the sample size is 42, this figure accounts for 43.4% of the whole population. According to the internal report about QTSC prepared by KPMG Vietnam in 2017, out of 147 members, there were one-third of QTSC members are foreign invested firms (equivalent to 49 firms), and the remaining are 98 domestic firms. The researcher takes into consideration of 12 firms located in District 1 including 11 domestic firms and 1 foreign invested firm, which are not our research subjects; and another 38 missing companies, i.e. 1 foreign and 37 domestic firms, as detected from the fieldwork. After subtracting the number of domestic firms and foreign firms respectively, there were 50 domestic firms and 47 foreign firms left in the total population. Our sample size has the ratio of foreign versus domestic firms to be 22:20, which is quite close to the figure of the whole population inside QTSC, i.e. at the ratio 47:50. Hence, the sample size is quite representative for the whole population of QTSC.

*Qualitative data collection*

The qualitative empirical sub-study uses semi-structure interviews involving representatives from firms and institutions for a couple of reasons.

The interview method is quite popular and amenable to a variety of research purposes (Scott & Garner, 2012). Particularly, with regard to this study, the semi-structured interviews with representatives from firms and institutions provide 'direct access' to their working experience at their firms and institutions inside QTSC (Silverman, 2013, p. 201). Additionally, semi-structure interviews allow the most research-focused interaction between the researcher and participants in order to clarify meaning of particular ideas and phrases within the interviews (Kazmer & Xie, 2008).

This study targets persons at the highest (as possible) management level of firms and institutions inside QTSC since these persons could understand their firms' or institutions' development strategy, and they are in the high rank of decision-maker at their own firms or institutions. These include directors, managers, chief of technical departments, head of the branch and other equivalent positions. Details on the positions of participants could be found in Appendix C.

The invitation for participating in the research had been sent via email by QTSC Development Company at first; however, this way of recruitment was ineffective. Hence, the participants were recruited based on convenience sampling method due to the accessibility of the researcher to participants, meaning that those participants were contacted directly by the researcher, and they agreed to take part in the research.

Interview questions are based on the research objectives and questions (see Appendix D). The interview questions for three educational institutions particularly focus on their cooperation strategy and activities with firms inside QTSC, in order to gain a better understanding on the nature and pattern of LKS amongst co-located actors within QTSC.

With regard to the research ethics, before each interview, all important information including the information sheet and the consent form were sent to the participants. This enabled the participants to understand the research purpose and their rights as a research participant. In the beginning of each interview, the researcher introduced again about the research purpose and stressed that all personal information such as name and identity would be anonymised. The interview questions are mainly open-ended questions starting with "how", "what" and "why". These questions were phrased in a non-threaten way using probes when necessary. Sometimes, after a monologue by the participants, the researcher paraphrased the overall opinion as said by

the participants and used closed-ended questions to confirm such opinion. At the end of each interview, the floor is open for any questions from the interviewees.

Except for two interviews via email, all interviews were recorded given the permission of the interview participants in advance. Then, they are fully transcribed and only those related to the research questions are translated into English if necessary, since there are two interviews conducted in English. For two interviews conducted via email, they have gone through the same ethic procedure like the others.

At the end, the current research has achieved 28 interviews, including three from institutions and 25 from firms inside QTSC. The collected data consists of rich and in-depth information regarding knowledge exchange activities amongst firms, and between firms and institutions inside QTSC.

#### *3.4.3.2. Methods of data analysis*

Each type of collected data will be separately analysed at first. This study uses regression analysis, social network analysis (SNA) and template analysis to respectively deal with the data collected from innovation survey, network survey and interview. Then, separate findings from individual methods will be integrated to generate a comprehensive picture of LKS phenomenon within QTSC.

Figure 3.4 illustrates the respective methods of data collection and analysis in each research strand.

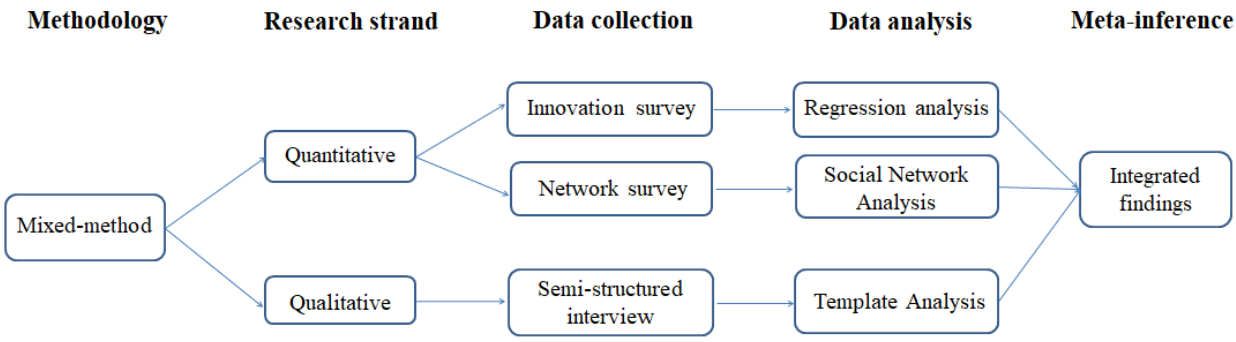



**Figure 3.4: Mixed-method methodology of this study**

In chapter 5 about the quantitative analysis, the social network analysis (SNA) will be used to map the informal network within QTSC. SNA will calculate the degree centrality of each firm in the network. The degree centrality will be used as indicator representing LKS via social interaction, an independent variable of the regression analysis.

The multivariate regression analysis with robust techniques will be used to testify the effect of different channels of LKS, educational level, firm size and firm age on organisational innovation at firm level.

Then, in chapter 6 about the qualitative analysis, the template analysis helps to gain an in-depth into the local institutional setting, the local-global dynamism and inter-actor interactions within the cluster. The chi-square tests are used to confirm the differences amongst group of firms according to their software business activities.

Chapter 7 will present the integrated findings in respond to each research question.

Each firm and institution will be consistently coded in the form of a number from 101 to 158 throughout the quantitative and qualitative analysis.

*Methods of quantitative analysis*

The quantitative analysis consists of two methods, namely Social Network Analysis (SNA) and Multivariate Linear Regression Analysis. Within each method, there are a number of analysis techniques in use to verify the hypotheses, such as t-test and robust analysis techniques.

SNA has gained momentum in the relevant literature to relational structure (Butts, 2008). Accordingly, SNA is used to "*predict the structure of relationships amongst social entities as well as the impact of said structure on other social phenomena*" (Butts, 2008, p.13). A social network consists of nodes and ties. A node, as known by other names such as vertices or players, refers to the co-located actors within QTSC, i.e. firms and institutions. A tie, or link or edge, is established if two nodes are connected. This study assumes reciprocal relationship based on mutual benefits between two connected economic agents (nodes), so the ties would be undirected following Kesidou (2007). In addition, in the order of descending level of frequency of contact, the weight of edge between two nodes in the network will take the value of 4, 3, 2 and 1 respectively.

SNA can present the collected network data by the adjacency matrix. An adjacency matrix is a matrix "*in which the rows and columns represents nodes and an entry in row I and column j represents a tie from i to j*" (Borgatti et al., 2018, p. 20). Each edge or tie is weighted with the frequency of interaction between two nodes. The current research concerns two types of matrices, namely dichotomous and valued matrix. The dichotomous matrix does not take account of frequency of contact, so it is binary network, i.e. the score of a tie will be given 0 if there is no connection between two nodes, and 1 if otherwise. On contrary, the valued matrix gives the score of ties between two connected nodes equivalent to their frequency of interaction, i.e. 1, 2, 3, or 4.

Regarding the assisting software, this research uses one of the most popular SNA software, namely UCINET and its associated visualisation tool, namely Netdraw. The SNA could give us both macro and micro characteristics of the informal network of participants inside QTSC. While the macro-characteristic-section describes some structural features of the network, the micro analysis section tests some inferential hypotheses at node level (equivalent to firm level).

With respect of Multivariate Linear Regression Analysis, chapter 5 will first conduct the correlation analysis and some descriptive analysis to gain a better understanding of the obtained dataset. Then it examines the assumptions of Ordinary Least Square (OLS) to identify the potential problems with the dataset. It moves on to explain different robust analysis techniques, and compares the results from these techniques before reaching the conclusion on significant versus non-significant results. The assisting statistics software in use is STATA.

*Method of qualitative analysis*

For the qualitative analysis, the template analysis will be used. Template analysis is a subset of thematic analysis, which is one of the most popular methods of qualitative data analysis in academia. Thematic analysis refers to a broad approach which seeks to identify, to analyse and to report patterns and trends in the qualitative data in order to answer the given research questions (Braun & Clarke, 2006; King & Brooks, 2017). In particular, template analysis[v] is a generic style of thematic analysis, meaning that it does not necessarily attach with a fixed philosophical or methodological approach. Given the chosen philosophical position, i.e. critical realism, this study "*seeks some degree of generalizability- albeit a more cautious and nuanced form than in neo-positivist qualitative research*" (King & Brooks, 2017, p. 18). In addition, template analysis is selected since the analysis made use of a prior theme in advance based on literature review regarding the determinants of LKS at firm, including external learning environment, internal learning and network.

There are seven (7) steps of template analysis conducted in the present research following the guidance from King and Brooks (2017).

| **7 steps of template analysis following (King & Brooks, 2017, pp. 3-4)** |
|---|
| **Step 1:** Familiarization with the data |
| **Step 2:** Preliminary coding |
| **Step 3:** Clustering |
| **Step 4:** Producing an initial template |
| **Step 5:** Developing the template |
| **Step 6:** Applying the final template |
| **Step 7:** Writing up |

At first, the researcher familiarizes with the data through the whole process of data transcribing and translating, and checking for the highest level of accuracy against the audio records. As a result of this process, there are some commonalities detected amongst firms within the same group of business activities, i.e. pure software outsourcing, software production and mixed between outsourcing and production. So, preliminary coding was conducted in four sub-sets of data, i.e. three groups of firms, and one group of three institutions, under the light of a prior theme on determinants of LKS. The coding process is done manually on printed transcripts using sticky notes for coding as suggested by King and Brooks (2017). Each top-level theme and codes within the same theme ought to be distinctive with ones in the same hierarchical rank. A chunk of text could belong to more than one code or theme due to the interpretation of the context. During the coding process, each transcript has been read through up to at least 10 times to obtain not only descriptive but also interpretative and in-depth information from the same data.

Then, the researcher organises codes and themes into relevant clusters to make the template for analysis. In particular, a respective version of template is created after the coding of one subset, then this version is adjusted in order to also fit with the other subsets. The author scanned any new detected codes found in one subset in the other subsets to make equivalent adjustments on the template. This process has been done repeatedly until a semi-final template fitting with all transcripts is achieved.

In the final stage, all codes and themes are imported into NVivo - a widely used software - for qualitative data analysis. This data importation step helps to detect either missing codes – emerging codes from the re-reading of all transcripts, or redundant codes – the existing codes in the semi-final template could be merged into other codes or themes. Nevertheless, there is no redundant code while there are only a few missing codes. For example, in the final template, three additional sub-codes emerge, namely language skills (1.1.1.4), MSEs has a disadvantage in recruitment (1.1.2.3), and cooperation culture (2.2.2.4). At last, a final template of coding is finished and saved electronically in NVivo. This serves two purposes; namely (i) for the convenience of working on the data and (ii) for an electronic backup of the qualitative data.

Notably, along with the process of data transcription, translation and analysis, a research diary was kept to take note of (i) important and/or outstanding points made by the participants, (ii) definitions of codes and themes and (iii) the development of a final template for analysis.

Apart from the above method of analysis in respect of quantitative and qualitative data, the researcher also uses the quantitative analytical technique on qualitative data, i.e. chi-square tests (in chapter 6). This is to verify the differences between sub-themes, i.e. knowledge searching behaviour and the initiative of firm leaders, according to software business activities.

### *3.4.4. Variables and measurements for the quantitative analysis*

This section will demonstrate the measurement method for variables in the quantitative analysis.

***Innovation***

The measurement method for the regression analysis was subject to Oslo Manual 3rd version in 2005[vi]. Accordingly, due to the research context, there are two matters worth of considerations when measuring innovation performance, particularly in services sector and in developing countries.

Innovation in developing countries tends to have some noteworthy characteristics (OECD, 2005). *First*, the type of innovation is likely to be incremental innovation, mainly marketing and organisational innovation. *Second*, the acquisition of machinery and other technological facilities plays an important role for innovation process. To capture innovation in developing countries, researchers need to pay close attention to human resource, linkages and the application of information and communication technology (ICT).

At the same time, in literature, innovation in services sector obtains some distinct features. In particular, the type of innovation is majorly organisational (Mina, Bascavusoglu-Moreau, & Hughes, 2014). Innovation in services is likely to rely less on R&D intensity, more on non- R&D expenditure, ICT, and external sources of knowledge compared to manufacturing (Mina et al., 2014). To capture innovation in services, the intangibility and social interactions are essential (Vence & Trigo, 2009).

For this reason, the quantitative strand particularly focuses on organisational innovation captured by INN_ORG variable. It is measured by the number of ICT applications.

***LKS***

As discussed in chapter 1, this study seeks to capture LKS within a cluster via three main channels, namely network (mainly social interaction), labour mobility and spin-off.

*Degree centrality*

LKS occur both intentionally and unintentionally through contractual business (or cooperation) network and social network. On the one hand, the innovation survey particularly asked firms to provide names of co-located firms and institutions within QTSC, which (i) have business or cooperation activities with their firms; (ii) they came to seek advice once they encounter technical difficulties. For business or cooperation network, out of 46 participants, there are four (4) firms reporting cooperation activities amongst themselves to share their human resources, three (3) firms reporting cooperation projects with the QTSC Development Company, nine (9)

firms reporting their internship programs in collaboration with the inside-QTSC educational institutions. Hence, the business or cooperation network or formal network is evidently sparse within QTSC.

For this reason, this study particularly deals with LKS via social interaction embedded in the informal network only. The variable of LKS via social interaction is captured by degree centrality indicator as generated by UCINET software. Accordingly, degree centrality is the number of ties (linkages) that a node (firm or institution) has.

*Labour mobility*

Labour mobility, especially of skilled personnel, acts a channel of LKS from one place to the other since knowledge is embedded within human beings. Ideally, labour mobility should capture the mobility of skilled employees amongst member firms within the same cluster; however, participant firms inside QTSC do not record any data on previous workplace of their employees, and they could not provide such data for the researcher. Therefore, LKS via labour mobility in this study is capture by the inflow rate of new employees following (Boufaden, 2017). The participants firms provide the number of their total current employees, new employees and leaving employees between June 2017 and June 2018, e.g. this time-period is chosen as one-year period dated back from the fieldwork trip in QTSC, which started from July 2018.

**Inflow rate = Number of new employees/Number of total current employees**

*Spin-off*

Following Kesidou (2007), in this study, LKS via spin-off is measured by a dummy variable, i.e. Spinoff. In particular, Spinoff takes the value of 1 if firm is a spin-off of a firm or institution inside QTSC; and 0 if otherwise.

***Other variables***

**Absorptive capacity**

In the beginning, the researcher planned to capture absorptive capacity through two indicators, level of education and expenditure on R&D. In literature, the level of education is a key factor contributing to absorptive capacity (Kesidou, 2007). Moreover, the research context is a knowledge-intensive cluster, which is embedded within the global offshore services value chain. In this regard, from the GVC's perspective, the value measurement of each segment is correlated with the level of education (Gereffi & Fernandez-Stark, 2010). Basically, the higher formal educational degrees of employees a firm acquires, the more likely that firm is capable of higher

value-added activities. Hence, in terms of upgrading in the relevant GVC, which share some commonalities with innovation at firm level, the level of education is supposed to play a significant role in innovation at firm level.

For this variable, the researcher asked firms to provide with the number of their employees according to different levels of qualification, including (i) college and vocational degree, (ii) bachelor degree; (iii) master degree, and (iv) doctoral degree. The educational level is calculated as weighted average of these four entries following (Kesidou, 2007).

**Educational level = (Doctoral Degree * 4 + Master Degree * 3 + Bachelor Degree *2 + College and Vocational Degree) / (Total number of employees * 10)**

For R&D expenditure, the researcher encountered a difficulty in collecting this type of data, since the majority of participants firms reported that they did not have a fixed amount of budget for R&D activities, even most of them did not specify the R&D expenditure on their accounting reports. Eventually, the variable on R&D expenditure was excluded for two reasons. *One*, as pointed out earlier, the services sector relies less on R&D activities as compared with the manufacturing sector. *Two*, during the data collection process, participants prove to be confused and uncertain about the intensity of R&D activities at their own firms, partly indicating the unpopularity of R&D activities across firms within the research cluster.

Other control variables in this study include firm size and firm age. Table 3.2 summarizes how different constructs are measured and through what variables.

**Table 3.2: Measurement of variables for regression analysis**

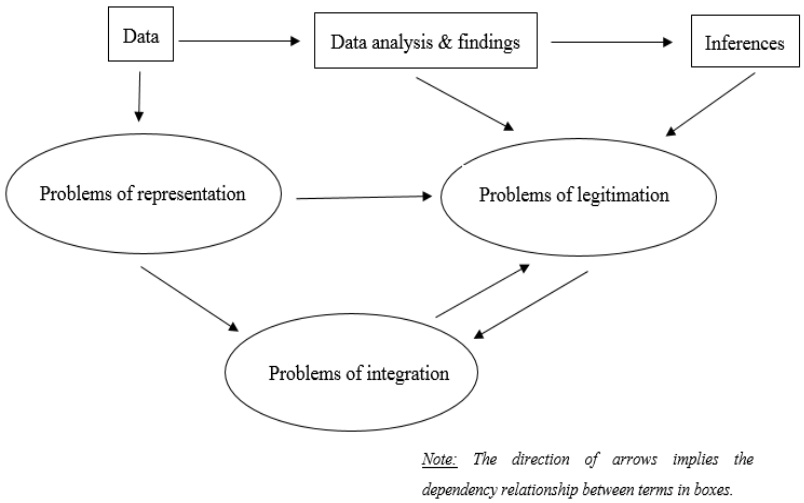
| Construct/Concept | Variables | How to measure? |
|---|---|---|
| Organisational Innovation | INN_ORG | Number of ICT applications |
| Absorptive capacity | EDU | Level of education |
| LKS | Spinoff | LKS through spin-off is a dummy variable<br>(1= If firm is a spin-off, 0= Otherwise) |
| | Inflow | LKS through labour mobility<br>Inflow Rate = Number of new employees/ Number of total current employees |
| | Degree | LKS through social interaction is captured by the network measure, i.e. Degree centrality |
| Firm size | SIZE | Total number of current employees |

| | | |
|---|---|---|
| Firm age | AGE | 2018 minus the year of establishment in Vietnam |

Besides, in SNA, other dummy variables such as firm ownership and VNITO membership were also collected for the t-tests. For the qualitative strand, the software business activities, namely software production, software outsourcing, mix between outsourcing and production, and other non-software business, are collected for the chi-square test.

### 3.5. Validity and reliability of mixed-method methodology

The criteria for assessing validity and reliability of mixed-method research are varied. Quantitative and qualitative researchers have disagreements over the conception of validity and quality (Maxwell & Mittapalli, 2010; Quinlan & Zikmund, 2015). Since this study separately analyses collected data from three forms of data collection, then integrate them, the reliability and validity of the present research is at first subject to those at each data collection and analysis strand. Nevertheless, the assessment of individual research strands is not sufficient to justify the reliability and validity of the whole research. The inferences drawn upon the integration of data analysis and findings may need criteria for judging its validity and quality alike. For the current research, the valuation criteria for reliability and validity are concerned with the matters of representation, integration and legitimation (Collins, 2010; Collins, Onwuegbuzie, & Jiao, 2007; Onwuegbuzie & Johnson, 2006) (Figure 3.5).




Source: own illustration by the researcher based on (Collins, 2010; Collins, Onwuegbuzie, & Jiao, 2007; Onwuegbuzie & Johnson, 2006)

**Figure 3.5: Reliability and validity problems in mixed-method methodology**

### *3.5.1. The representation*

The representation matter is associated with data sampling, and could affect the external validity of quantitative findings, and the transferability of qualitative findings (Tashakkori & Teddlie, 1998). In particular, it concerns the difficulties in encapsulating lived experiences through data collected in the forms of either words or numbers.

Regarding the quantitative strand, the questionnaire was designed based on literature review and research questions. Especially, it refers to specific guidance on measuring innovation in developing countries by Oslo Manual 2005, and the Community Innovation Surveys by Eurostat. Before the official questionnaire was sent out to firms, it had been adjusted and modified several time based on the opinion from academic experts, two representatives from the QTSC Development Company, and two IT firms within QTSC. Owning to their advice, the survey content was kept short and concise with 13 questions instead of 35 questions as in the beginning. The survey questions are presented with accurate information on time period, such as the number of leaving and new employees between June 2017 and June 2018. For some statistical data, such as the number of employees according to four levels of qualifications, the researcher had to double check with the department or person who is in charge of the data management in that firm. All technical terms, such as innovation and spin-off, are explained in details throughout the survey.

Besides, since LKS is invisible and it leaves no paper trail (Krugman, 1991); therefore, in terms of measurement methods, more than one indicator are chosen to reflect different aspects of the same concept. The chosen indicators, labour mobility, spin-off and network correspond to the existing literature on the channels of LKS.

Regarding the qualitative strand, the data collection aims to achieve a 'thick description' of experience of the participants. However, the chief concern is that bias may appear when researchers communicate with participants, i.e. in interview, "*there is a gap ...between what people do and what they say they do*" (Scott & Garner, 2012, p. 281). To reduce the risk of bias in the qualitative strand to the minimum, during the interview process, the researcher sometimes summarised what the participants had said recently, then used close-ended questions to confirm with the participants about their opinion. Only two interviewees agreed to verify the interview transcripts and audios to make sure the records accurate. A research diary was kept from the fieldwork to take note of important discussion during and outside the interviews. This is to improve the reliability of qualitative research strand (King & Brooks, 2017).

### *3.5.2. The legitimation*

The matter of legitimation is associated with the internal validity in quantitative strand, and with the credibility of inferences or conclusions in qualitative strand (Tashakkori & Teddlie, 1998).

> Internal validity is the credibility of the inferences/conclusions that are derived from linking … observations/data. (Tashakkori & Teddlie, 1998, p. 70)

The legitimation regards the quality of findings and meta-inferences. The latter term refers to conclusions and interpretations based on findings from the quantitative and qualitative research strands (Onwuegbuzie & Johnson, 2006). Legitimate meta-inference is attributable for legitimate inferences in each strand. Of which the traditional criteria, namely reliability, validity and replication applicable in quantitative and qualitative research would have same authority in the respective strands (Teddlie & Tashakkori, 2009).

In quantitative strand, the legitimacy of inferential statistics is supported by numbers, such as p-values and R-square. The generalization power of the quantitative results would be subject to the sample size and the number of independent variables in regression models (Hair, Black, Babin, & Anderson, 2018). Chapter 5 of quantitative analysis will show that the results are valid based on these figures.

Meanwhile, in qualitative research, the term 'transferability' is used instead of generalizability; referring to the matter whether the findings are transferable to other context (Quinlan & Zikmund, 2015). Notably, case studies "*are generalizable to theoretical propositions and not to populations or universes"* (Yin, 2014, p. 21). Typically, as guided by critical realism, case study design could obtain generalization power "*if the essential characteristics of a phenomenon can be identified*" (Downward et al., 2002, p. 492). The research cluster – QTSC - entails common characteristics of clusters in developing countries, 'thin localised institutional setting' – an absence of crucial actors and the inefficiency of available institutions for innovation and diffusion of useful knowledge for innovation. Hence, the inferences could be generalized from the sample to the whole population of the research cluster (QTSC), and from the research cluster to other clusters with similar context, i.e. service outsourcing clusters, in Vietnam and other developing countries.

As explained in details in section 3.4.1, the deductive and inductive mode of inference will respectively support the legitimation of inference in the quantitative and qualitative strands.

### *3.5.3. The integration*

Ensuring the representation of data and the legitimation of inferences in each research strand will promote the reliability and validity of integration process – or meta-inference. The integration of data, data analysis and inferences within MMR ought to show the interaction or 'conversation' between quantitative and qualitative spheres in response to the research questions (Bryman, 2007). Otherwise, a MMR is merely a comparison or collection of findings between two mono-method sub-researches. To avoid the above scenario, Chapter 5 shows how SNA and regression analysis connect to each other; the former generates one important independent variable for the later. In addition, Chapter 7 of integrated findings demonstrates the complementary between findings from individual methods of data analysis under the research context provided in chapter 4.

In closer details, each strand of research based on three forms of data collection may deal with parts of the research questions. Then, the integration of findings and inferences would create a comprehensive picture about the nature, pattern and significance of LKS within a knowledge-intensive cluster in developing countries.

Overall, the integration is a complex process since it involves multiple simultaneous steps, "*compare, contrast, infuse, link, modify one on the basis of another"* (Teddlie & Tashakkori, 2009, p. 300). Therefore, to obtain the meta-inference, which associates with the abduction logic, understanding the research purpose, i.e. research questions, literature review and research context are of extreme importance (Onwuegbuzie & Johnson, 2006).

## 3.6. Chapter summary

This research methodology and design chapter has demonstrated the use of critical realism, abduction logic, case study design and mixed-method methodology under the light of research objectives and research questions in this study. This framework combining philosophical position, mode of inference, research design and research methodology enables the researcher to address the research questions, which aim to explain and explore the LKS phenomenon and its relation with innovation at firm level in a knowledge-intensive cluster in developing countries.

This chapter has also explained the methods of data collection and data analysis for the quantitative and qualitative strands, paving the way for detailed analysis in later chapters. Due to the extreme scarcity of secondary data, this study has collected a set of primary data, containing 48 network surveys, 42 innovation survey and 28 semi-structured interviews, from the largest software cluster – QTSC in Vietnam during summer 2018. In later chapters, each form of data

collected will be separately analysed using SNA, regression analysis and template analysis before being integrated to generate meta-inferences in response to the research questions.

Finally, this chapter has discussed the validity and reliability issues and elaborated on how the researcher has done to guarantee the research quality.

## Chapter 4: RESEARCH CONTEXT

### 4.1. Chapter overview

This chapter explains the research context, covering the following themes:

- Macroeconomic conditions in Vietnam from 1965 to present;
- An overview of the IT cluster development and cluster policy in Vietnam.

### 4.2. Macroeconomic conditions in Vietnam

Being a communist country, Vietnam inherits the legacy of Soviet Union managing its socio-economy in accordance with its five-year socio-economic development plans approved by the National Assembly. In comparison with other transitional economies, Vietnam started its industrialisation with few industrial plants (Dollar, 1994). The overall economic development of Vietnam could be divided into four periods (Nguyen, Luu, & Trinh, 2014).

#### *4.2.1. From 1965 to Doi Moi (Renovation) reform in 1986:*

This research chooses to begin the analysis of Vietnamese economic development with the year of 1965 for the reason that the North of Vietnam started to build its industrialisation according to the first Five-Year plan (1961-1965) under the control of the Vietnamese communist party's government. Whereas, in the South of Vietnam, concerning the expansion of communism the America decided to intervene in the conflict between the communist-led, Viet Cong, and the temporary South Vietnamese government. Due to the bombing strikes of the America in the North of Vietnam (1965-1972), the first Five-Year plan was disrupted. Those strikes severely caused damage to the infrastructure and transport systems. Therefore, the North Vietnamese economy was detrimentally affected.

In general, this period is characterized by the traditional central planning system, in which the government decisively prescribed most of economic factors including the industrial inputs and outputs, the means of production and price (Nguyen, Luu & Trinh, 2014). Market played no role in the central-planning system. Foreign assistance mostly from communist allies such as Soviet Union, and China, Eastern European countries was the main source for domestic investment. And the SOEs were the principal recipients of such investment. In addition, most of available resources were distributed to serve the war (1965-1976), and then to recover from the war (1976-1986). Due to the specific situation of the country, the Vietnamese communist government made little attempt in trading activities and economic integration except its participation in the Council for Mutual Economic Assistance (COMECON) trading system in 1978. This is an economic organisation led by Soviet Union, which later collapsed due to the dissolution of Soviet Union.

Little evidence was found to clearly show the size of internal trade between Vietnam and other member countries within COMECON.

Taking the political situation at that time into consideration, the planning system worked to some extent but at the cost of efficiency (Perkins & Vu, 2010). Under the embargo of Western countries, it was impossible for a communist country like Vietnam to trade with the opposite ideological side of capitalist countries. Hence, the planning system, which was in compliance with the leading communist Soviet Union was probably appropriate for Vietnam to take advantage of foreign aids from communist community. However, the economy of autocracy proved inefficient in a variety of aspects.

In closer detail, the priority of heavy industry according to the first Five-Year plan was forced to shrink to light industries and agriculture between 1966 and 1973 (Nguyen et al., 2014). Apart from those industries, over the period from 1965 prior to the country reunification in 1976, for the sake of winning the war, the industrialisation in the North focused on fighting industry. Most of foreign aid from communist allies, particularly China, Soviet Union and Eastern countries was allocated for technical and scientific research activities on this industry. This aimed to build the socialist industrialisation in the North on the one hand, and to support the war in the South on the other hand. The governmental planning was appropriately designed for the sake of winning the war and uniting the two parts of the country as a whole. However, from labour perspectives, as the majority of population especially those in the labour force joined the army for fighting in the war, the North had to build its economy suffering from severe labour shortage. In terms of agriculture, the economy developed on the basic of village subsistence agriculture (ibid). This type of agriculture was retained until the late-1980s.

After the reunification in 1976, most of economic efforts including the foreign aids were directed to build infrastructure and industrial bases in support of the national industrialisation. The newly established government in Vietnam was exposed to serious challenges such as labour shortage and low labour productivity. Other obstacles for the national industrialisation were the shortfalls in material and manufacturing technology, and the devastated infrastructure and transport systems as a result from the war.

Furthermore, the Vietnamese government pursued ‘the revolution of the relations of production’ (Fforde, 2009) by enlarging its disrupted first Five-Year plan to the second Five-Year plan from 1976 to 1980.

With regard to the second Five-Year plan, the government continued to organise the whole economy, particularly allocating both the input materials and the output production. Similarly,

instead of using a market-based price scheme, Vietnam maintained the planning system in which through its SOEs, the government designed industrial polices for the whole economy. Particularly, until the early 1990s, heavy industry was still the prime concern to strengthen the national defence.

The monopoly of SOEs was an outstanding feature of planning system. In the absence of company law, industrial manufacturing and even foreign trade were a privilege of SOEs. On the other side, the private entrepreneurship was not legally recognized, therefore, had little voice within the industrialisation progress. Accordingly, the notion of business autonomy received no due consideration from the government. Despite receiving the large proportion of public investment, most of SOEs proved inefficient due to their unprofitable business. Such bureaucratic style of business under the governmental and provincial command seemingly did not help to achieve the economic development goals when most of targets proposed in the second Five-Year plan failed at the end of this period.

Additionally, regarding the agricultural policies, the land reform now extended to apply in the South. Still, from 1976 to the early 1980s, the agricultural economy is based on collective farming. Measuring on contribution to GDP, this sector accounted for over 80%, much larger than other industries. Though 80% of the population and 70% of labour force (Bui, 2000) relied on agriculture sectors for living, the domestic production together with food imports could not satisfy the domestic food demand. The cutting in food aids from China in 1978 and the West in 1979 (Ravallion & Van de Walle, 2008) exacerbated the matter of food shortage. As a consequence, Vietnam in the late 1980s experienced a major famine throughout the country.

Apart from the food security, Vietnam underwent a super inflation. On the one hand, a substantial money supply after reunification led to higher inflation. The real deposit interest rate was negative while CPI increased 774% by 1986 (Nguyen et al., 2014). On the other hand, the national consumption was bigger than the national income. This along with foreign aids created a heavy amount of debt. It was recorded that the amount of debts was comparable to the annual national income by the early 1980s (Bui, 2000). Moreover, the state budget escalated “from 25% to 45% of revenues” (ibid). The deficit in trade balance was inevitable given the poor foreign trade. In particular, the import volume was triple than the export.

For the whole period from 1965 prior to 1986, the saving rate amongst households was low due to the backward systematic banking management. Similar to most of other services, banking was maintained as mono-banking system under the governmental command, of which there was no separation between state bank and commercial banks or investment banks. There was neither

effective policies to encourage saving nor any policies towards mobilization of saving money (Nguyen et al., 2014).

At the mid-1980s, the level of industrialisation saw no major improvement after ten years pursuing the heavy industry. As a consequence, the whole economy stagnated. Simultaneously, the inflation devalued the real income and worsened the poverty in Vietnam. The GDP deflator index just before 1986 was 398.1% (World Bank Data). Basic amenities such as food and consumer goods were alarmingly deficient. The country was on the brink of a social and economic crisis. Hence, in the sixth Party Congress in 1986, the National Assembly decided to implement its third Five-Year plan. This plan marked a breakthrough transition in social-economic development in Vietnam, which is so-call the Doi Moi (Renovation) reform.

#### *4.2.2. From Doi Moi Reform in 1986 to pre-Asian currency crisis 1997*

The Doi Moi (Renovation) reform was led by the reformers who favoured the combination of institutional intervention and market force. Accordingly, since 1986, Vietnam‘s industrialisation progress has been governed toward socialist market-oriented. This transformation was totally different by comparison with others in Western-bloc countries (Bui, 2000). In particular, Vietnam aimed to strike the balance between “social and political stability” and “macro-economic stabilization” (ibid, p.23).

Taking failures and difficulties prior to Doi Moi reform into consideration, the fourth five-year plan (1986-1990) was devised for multiple purposes. On account of the failed SOEs, the government now reduced its subsidies on certain enterprises which had resulted in losses. However, the Communist Party still maintained the leading role of SOEs to implement its industrial policies. In its master plan, a list of positive movements in terms of ideology was mentioned, especially “to diversify the ownership of publicly owned assets” (ibid, p.23). In this relevance, the government wanted to establish a diverse economic structure by encouraging the contribution of private sectors.

Strikingly, for the first time, the government of Vietnam has proposed to integrate into the international and regional economics. A few milestones in this period could be noted, such as Vietnam’s official membership of ASEAN in July 1995, and the normalization of diplomatic relations between Vietnam and America in the same year. The act of lifting economic embargo on Vietnam from America was extremely meaningful in creating opportunities for Vietnam not only to develop its trade but also to easier approach sources of aids from international organisations.

In this period, the industrial policies prioritised three main sectors: food production, consumer goods and export goods. Likewise, between 1991 and 1995, the industries in focus consisted of heavy industry, natural resource-intensive industries such as oil and mining, and food stuff industries. Due to the cheap labour advantage, the country gave prominence to labour-intensive exporting industries.

In support of the new industrial policies, which considered multi-involvement of economics sectors, the government implemented an equivalent legal reform by issuing a range of new laws. The most notable one was the Law on Investment 1987, which recognized the importance of foreign investment. Following this improvement was the separate function between commercial banks and central bank in 1988. The Company Law was issued in 1991 illustrating the recognition of diverse economic agents. Notably, the Constitution 1992 legalizes foreign investment and promise not to expropriate foreign investors' assets in Vietnam. It further mentions the market factor as the orientation for economic development, and introduces the definition of private property and individual rights in relevance to doing business in Vietnam.

The trade policies were designed in pursuit of two main targets. *One*, to create foundation for a market-economy, the government relinquished its price control. Alternatively, the local prices were liberalized in connection with the world prices so as the price factor should be based on the relations between supply and demand. On the other hand, private and foreign sectors could legally trade unlike the previous situation when trading was only in privilege of SOEs. In addition, the government implemented various instruments such as tariffs and quotas and eliminated "exchange rate distortions" (Nguyen et al., 2014). *Two*, the government was intent on export-oriented growth by removing the old protectionist regime against export.

As a result, trade has played a vital role in the national total production. Figure 4.3 shows a leap in the proportion of trade as percentage of GDP from 1986 to 1990, from 23.2% to 81.3% respectively. The latest figure for 2018 is 187.5%.

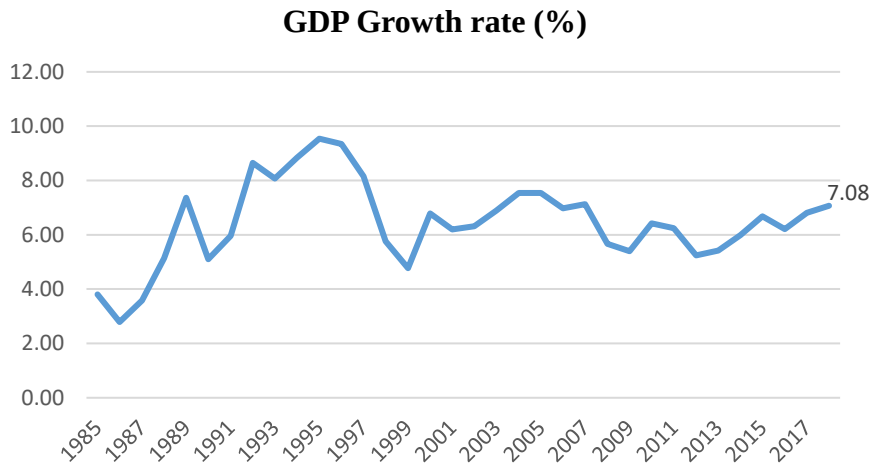
At the end of this period, Vietnam generally recovered from the brink of crisis in the late 1980s. In terms of social improvements, the basic infrastructure for electricity, library, education, healthcare and communication modes was enormously enhanced. The rates of owning television and radio set were 20% and 50% respectively during the early 1990s (Bui, 2000, p.24). Remarkably, Vietnam experienced a sharp decrease in number of poor households living under the poverty line. Most of previous literature agreed with the Vietnamese success in poverty alleviation (Abbott, Bentzen, & Tarp, 2009; Bui, 2000; Fforde, 2009). After 1989, Vietnam emerged to join the top worldwide rice exporters.

Besides, other indicators proved the country's achievement in social stabilization and economic development. For example, in the 1990s, the annual GDP growth rate was 7.2% and inflation was under control remaining at single-digit. New emerging industries such as oil and mining for export brought capital for the domestic economy. By taking first steps in the regional integration, Vietnam could gain access to more exporting markets. In addition, there were signals of labour mobility from agriculture to other sectors like manufacturing; however, the overall labour productivity remained very low. And the business performance in many SOEs was arguably criticised for their poor management with growing vested interest groups.

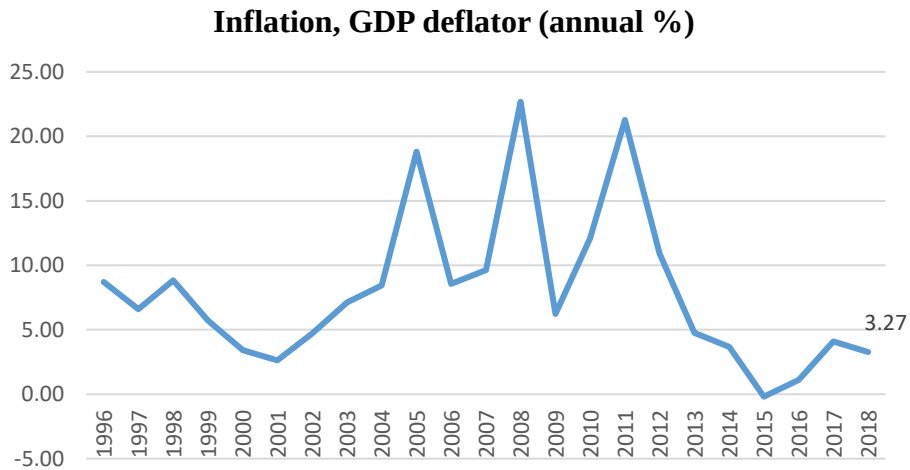
#### *4.2.3. The period from 1997 to 2007*

In this period, Vietnam maintained its guarantee on liberalisation through trade and investment. Similarly, in an effort to captivate foreign capital and in preparation for its admission of WTO at the same time, the government implemented a major legal reform. Particularly, a new Law on Foreign Investment was introduced on 12 November 1996 and later amended on 2000. By comparison with its previous version in 1987, this code considerably expanded the forms of investment and the rights of foreign investors. In addition, the Law on encouragement of domestic investment in 1998 was later revoked, and a new Law on Enterprises 2005 was passed to replace its old version in 1999 and the Law on State Enterprises (2003). By doing so, it removes restrictions against the establishment of private-owned enterprises. As a result, the number of registered private enterprises sharply rose over the period. A research reported that there were 45,691 newly registered companies in 2006 contributing to the total number of 200,000 private enterprises (Nguyen et al., 2014, pp.6-7). This was in association with a drop in the number of SOEs, from 12,084 in 1990 to 2,980 and 670 enterprises registered as exclusive SOEs and 50% state-ownership respectively in 2005 (ibid). Notably, the government established export processing zones and industrial zones to facilitate exporting activities. Prior the entry of Vietnam into WTO in 2007, the export contribution to GDP steadily rose over the period, i.e. from under 40% up to 70% in 2007 (Figure 4.4).

**Figure 4.1-4.8: Some macroeconomic statistics data of Vietnam**




**4.1**

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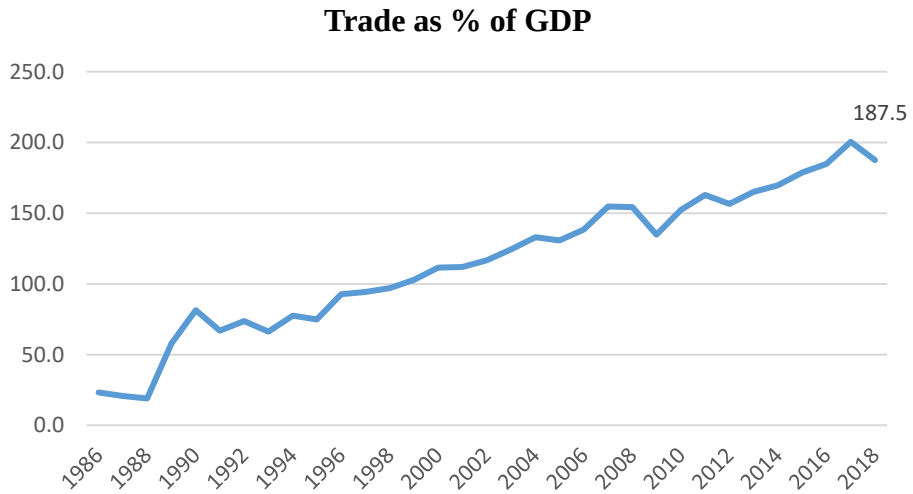


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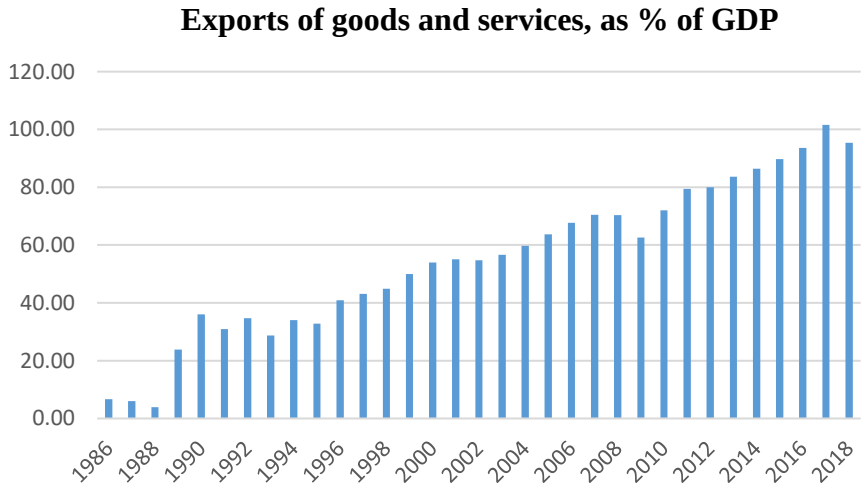
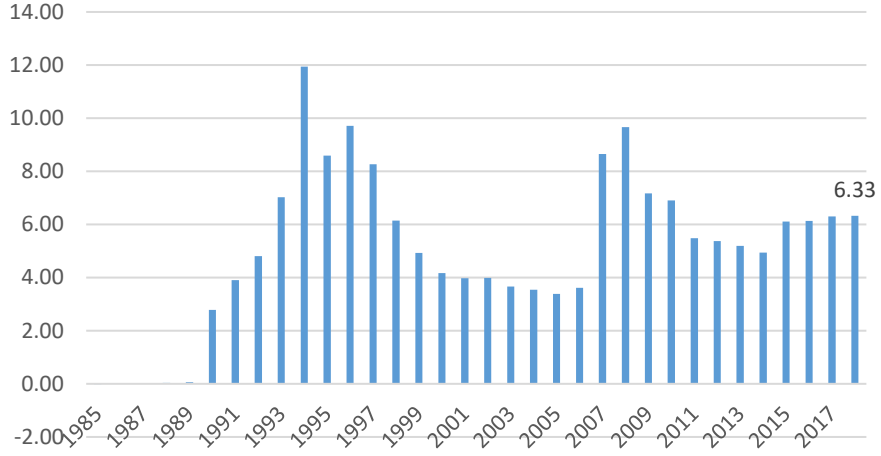


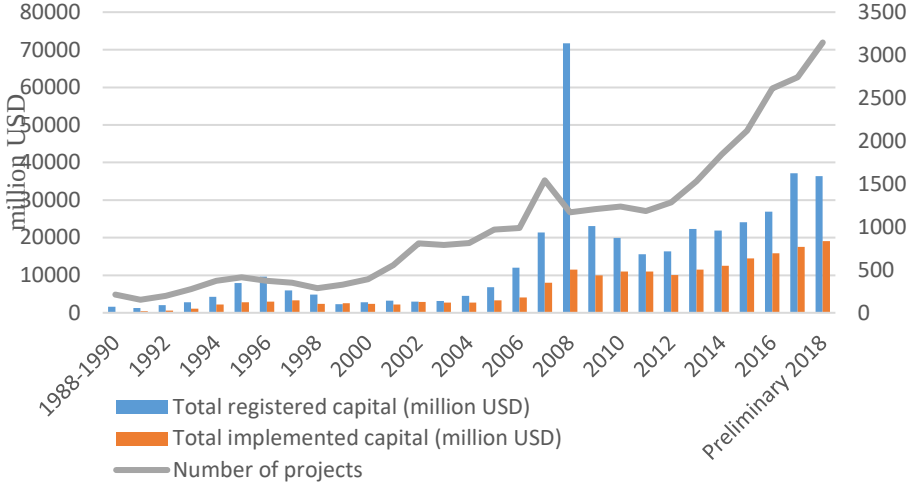

**4.4**

**FDI, net inflows, as % of GDP**



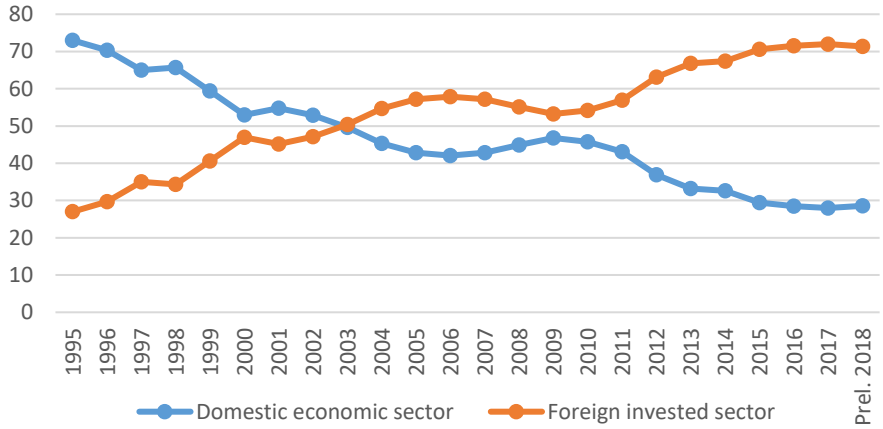

**4.5**

**FDI inflows into Vietnam from 1990 to 2018**



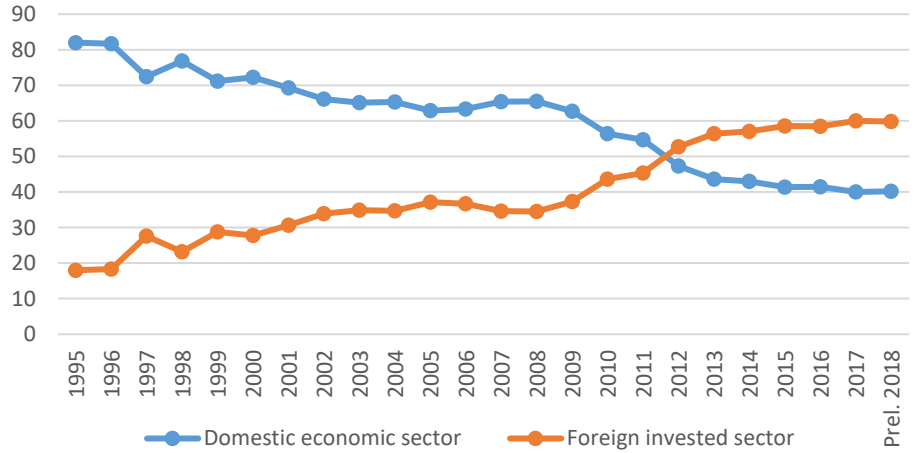

**4.6**

**Exports of goods by sectors in Vietnam (%)**




**4.7**

**Imports of goods by sectors in Vietnam (%)**




**4.8**

**(Sources: World Bank Data & GSO)**

Starting from 1996, Vietnam launched periodic Public Investment Programmes, namely 1996-2000, and then developed to the 2001-2005 programme serving its socio-economic development strategy for the period between 2001 and 2010. Of which, the government set objectives for industrial development in pursuit of an efficient and sustainable growth. As a matter of fact, there are periodic lists of priority industries attached to each five-year plan equivalent to the above-mentioned programme. For example, in 1996, Vietnam started defining some specific heavy industries like steel and cement to meet the domestic demand, and several labour-intensive industries for exports including textile, footwear, garment, paper production and handicrafts. In 2001, the orientation of industrial development was introduced covering 11 leading industries. Furthermore, in the strategy proposal, each leading industry was supported by preferential incentives and subsidies. The proposal took into account a group of key concerns, namely (i) market-oriented policies, (ii) policy to mobilize resources, (iii) tax policy; (iv) R&D policy; and (v) human resource development policy (Nguyen et al., 2014).

For most of these industries, the government maintained protectionist measures majorly through financial incentives, like the preferential access to credit and reward scheme for agricultural products. However, at the end of this period, the results were disappointing. Most of SOEs' business, through which the government manipulated its industrial plan, failed miserably. For the reason, the listing of too many leading industries caused fragmented public investment, which in fact resulted in inefficiency. Each listed industry in the proposal was assigned for the equivalent competent agencies to design its strategy. But, some agencies did not carefully consider the current capacity or more specifically its comparative advantage. Consequently, there were gaps between the expected targets and the real results. Overall, a number of leading industries proposed during this period were short of detailed examination and achievable outcomes (ibid).

At the end of this period, a variety factors intensified pressure on inflation. The lowest GDP annual deflator rate was 2.7% in 2002, but then this indicator soared to the average of 9% and peaked at 22.7% in 2008. From both internal and external sides, namely an economy dependent on credit-led growth and increasing money supply in accompany with a rise in raw material prices, i.e. oil and energy, the high inflation was inevitable. At the end, it caused macroeconomic instability. Others criticised the country's backwardness in a number of essential matters for sustainable growth, including technology and legal system (Bui, 2000).

Though the adoption of free market policies during this period was slow, it was still affected by the Asian currency crisis to some certain extent. The net inward FDI flow slightly decreased over the period until 2007 when Vietnam official becomes a member of WTO.

Obviously, the Asian crisis was not the sole reason for the slowdown in terms of economic performance in Vietnam. Rather, the structural and institutional weaknesses were the principal reasons. Despite the success in certain areas, especially poverty reduction and high GDP growth rate averaged at around 6.5%, the transformation in socio-economic development in Vietnam was still limited. The government relied on SOEs to design its industrial plans; hence the market factor though exists but plays an ill role. The available resources have been purposely distributed to inefficient sectors. On the other hand, private sectors, mainly small and medium size enterprises have not been given appropriate attention from the government.

#### *4.2.4. The period from 2007 until now*

After 11 years of substantive negotiation, on 11 January 2007, Vietnam officially becomes a member of WTO. The participation of WTO means that Vietnam has to remove its tariffs and non-tariffs, and to eliminate it subsidies, i.e. the reward scheme on agriculture at the same time. Before 2015, the country continually insisted on the export-led economic growth focusing on labour intensive manufacturing despite its failures in import-substitution and supporting industries (Pincus, 2016). Since 2015, the Vietnamese Communist Party determined to shift toward a new economic growth model, from export-led growth to productivity-led and innovation-led growth. The purpose is to strengthen the national competitiveness and upgrade its position in the global value chain.

> *The model of economic growth in the upcoming time ought to combine effectively the development in both breadth and depth, to improve the quality of growth and competitiveness based on productivity, scientific and technological application, innovation, to enhance the quality of human resource in order to strengthen national competitiveness, and to be proactive in the integration into global economy, to develop quickly and sustainably (toward the sustainable development goals until 2030 by United Nations)…*(Politics report at the 12$^{th}$ Party Congress, 2015).

In closer details, in compliance with WTO's commitment, i.e. national treatment rule, anti-dumping and anti-subsiding, Vietnam had conducted a legal reform, especially in commercial and investment law. In general, the country relaxed requirements for foreign investment both in terms of legal forms of foreign-owned entities and investment sectors. In preparation for another trade deal –TPP, Vietnam conducted another legal reform. A range of new laws and regulations have been introduced to improve the legal framework for investment in Vietnam. Some of new regulations are new Law on Investment and Law on Enterprises in 2014.

Strikingly, the Vietnamese government found another way to continue its 'subsidies' to SOEs, by changing the forms of these corporations into state economic groups (Vu, 2014). Unfortunately, this only exacerbated the problem of SOEs. The combination of fragmented and ill-connected SOEs into bigger groups could not improve their business performance. At worst, most of credit given to SOEs from domestic banks, which in their nature still link to SOEs themselves, were misdirected to other investment sectors, i.e. real estate, rather than to their core business sectors. On the other hand, the private sector was discriminated by comparison with SOEs and foreign-owned enterprises. Many experts warned the alarming rate of bankruptcy amongst non-state sector (VBN, 2016). Similarly, the escalation of money supply as a result of credit-led growth policy caused weaknesses in macro-policies. The inflation rate, calculated by the GDP deflator annual rate reached its worrying highest record at around 21% in this period.

In this period, the industrial policies have been continuously encouraging exports. Particularly, the government persistently introduces a list of priority and leading industries attached with its strategy[vii]. This method of picking-winner likely attracts criticism. Again, in the absence of comparative advantage-disadvantage assessments, the design of nearly 40 industries in leading and priority category is a waste of available resources. In furtherance, many of the attached strategies for those industries lack descriptive components for a proper strategy. Those stop by giving general favourite treatment and incentives including tax concession to encourage industrial development or merely acting as offers to investment in preferential sectors. From a comprehensive view, the most serious shortage lies on the vision for developing the whole industry. Hence, amongst priority and leading industries, no connection was apparently recognized and established to support each other. Accordingly, the industrial policies end up being incoherent and inefficient.

Besides, given its effort to promote exportation, unfortunately, the global crisis hit Vietnam in late 2008. Likewise, the recession in trade partner countries of Vietnam had a negative impact on its export activities. The exports of goods & services suddenly dropped from 69.72 in 2008 to 66.37 billion USD in 2009. Nevertheless, it took only one year for the exports sector to recover. Since then, the volume of goods and services exportation has gradually increased to reach 233.65 billion USD in 2018 (World Bank Data).

However, the current exporting activities consist of many critical features. *One*, Vietnamese exports majorly rely on imported input. For instance, the textile industry currently relies on about 70% of imported raw materials including cotton and yarn, mostly from China and South Korea (Wong & Nguyen, 2015). This reliance is at risk from any increase in global price of input

materials. In addition, the impacts from economic openness on trading prices could exert pressure firstly on inflation and further to national economic growth.

*Two*, despite of its major contribution to Vietnamese export turnover, foreign invested sector is also the one importing most (Figure 4.7 & 4.8). During the period between 1990 and 2018, the country mainly experiences trade deficit in most years with a few exceptions in 2012, 2013, 2014, 2016 and 2017. Trade deficit is not necessarily a detriment to economy given that the main imported goods are machinery equipment and raw materials. Rather, it reflects the growing domestic demand of the country. The proportion of imported machinery equipment and raw materials are estimated at 42.5% and 547.6% respectively in the total imported goods (GSO, 2018).

## 4.3. IT cluster development and cluster policy in Vietnam

The IT industry has always been chosen as one of the spearhead industries in Vietnam; therefore, it has received enormous support from the government. Particularly, the government of Vietnam has been aware of the importance of IT industry for modern industrialisation and economic growth, and for the catching-up progress with more advanced countries. This section will illustrate some key relevant legal and policy documents regarding the IT industry development and the software cluster development in Vietnam.

### *4.3.1. IT industry*

Overall, the IT industry has substantially received support and incentives from the government, but the country faces some serious challenges against its sustainable development. Sturgeon and Zylberberg (2017) recently summed up challenges against the development of ICT sector in Vietnam, which also hold true for the IT sector.

**Figure 4.9: Challenges against the IT sector in Vietnam**

Source: Sturgeon & Zylberberg (2017, p.137)

**1. Poor business climate:**

- Lack of transparency in public procurement contracts;
- Bureaucracy is cumbersome;
- Lack of a code of conduct guiding the practices amongst firms in the IT sector;
- Lack of support for private domestic firms;
- Weak legal enforcement of intellectual property right;
- Backward education system fails to catch up with modern international business environment.

**2. Industry-specific barriers against start-ups and small-and-medium enterprises**

- Lack of financial funding;
- Small size and scale of accelerators and incubators;
- Lack of intermediaries to connect local and international markets.

**3. Failure to attract Vietnamese diaspora to invest in the IT sector due to bureaucratic obstacles**

**4. Restricted FDI in Research and Development**

- Problems in policy and legal framework design: narrowly define hi-tech activities, which could be entitled for fiscal incentives;
- University-industry linkages are weak, hence resulting in a limited number of successful technology transfer cases.

**5. Challenges against the economic upgrading of global value chain in both hardware, software and service industries**

- Hardware: limited backward linkages and supporting industries, fierce global competition in semi-conductor industry, weak capability of Vietnamese firms in terms of technology, capital, energy and water requirements;
- Software & service industry: challenges due to the shortage of professionals capable of language proficiency, technical and managerial skills.

The following sections will address the policy framework for IT industry and demonstrate the current situation of Vietnamese software industry.

#### *4.3.1.1. Policy framework for IT industry development in Vietnam*

*The shift in the path development of IT industry to export-oriented model*

The government and the Politburo of Vietnam have continuously emphasised its prime concern over the IT industry since the 1990s (Resolution 49/CP, Resolution 7/2000/NQ-CP, and Resolution 13/NQ-TW).

In 1993, Resolution 49/CP issued by the government of Vietnam pointed out the backward position of Vietnam in the matter of IT development, therefrom outlined the objectives and proposed solutions to improve its development toward 2000. After the wars, Vietnam had very limited resources for IT development, particularly there were a few IT experts, a few higher

education institutions with IT training subjects and weak IT research capacity of public research institutes. Hence, in this period, Resolution 49/CP was issued to promote the adoption and application of IT rather than IT production. On the one hand, it stressed the needs of technology transfer from abroad with state funding and foreign aids. On the other hand, it recognized the significance of IT application for state management and for increasing productivity and efficiency in all economic sectors. Also, this policy document set the objective to build IT infrastructure as foundation for the development of IT industry in Vietnam with a specific priority paid to software industry.

It is then followed by Decision 211-TTg issued by the Prime Minister in 1995 to approve the national program on IT. Accordingly, in this period from 1995 to 2000, Vietnam focused on the construction of IT infrastructure in addition to the preparation of IT human resources via three means. There were (i) via education, i.e. only three public universities in Hanoi, Da Nang and Ho Chi Minh City were majored in IT, (ii) via IT training centres, i.e. to provide short-to-medium courses on IT issues, and (iii) sending Vietnamese students and researchers to study abroad. Applied research received priority over basic research to promote the application of IT in the economy. For the development of IT industry, software industry was the prime concern. However, the domestic software industry targeted the domestic market at first, especially in order to substitute for expensive software imported from abroad. The selection of software over hardware as prime concern in this period was reasonable, since to develop hardware industry - a capital-intensive industry, it requires expensive and fundamental technological infrastructure that Vietnam could not afford at that time. Hence, the domestic hardware industry relied on joint venture and technology transfer to establish assembly and production factories serving the domestic market. Especially, according to Decision 211-TTg, the education and training of human resource for the hardware industry should be based on the software industry. Besides, investment in the IT industry especially FDI are entitled to tax incentives. This policy document proposed to establish an IT industrial zone inside hi-tech parks, i.e. to take advantage of technology transfer, and to experiment a pilot project in export-driven software industry. Hoa Lac Hi-Tech Park was established in 1998 to actualize this idea.

Then, in 2000, the Resolution 7/2000/NQ-CP on the establishment and development of software industry in the 2000-2005 period has shifted the path development of the software industry away from a domestic-market-driven purpose to an export-driven one. Accordingly, Vietnam should initially develop IT outsourcing industry for service exportation. For domestic market, it prioritised to develop software in substitution for imported one. In addition, software enterprises were entitled for the highest level of preferential treatment including tax subsidiaries, e.g. tax

exemption, exportation tax, VAT, corporate tax and personal tax for R&D staffs, together with credit and land preferences (Decision 128/2000/QD-TTg). Resolution 7/2000/NQ-CP specifically mentioned the establishment of a direct gateway connecting to global Internet at QTSC and Hoa Lac Hi-Tech Park allowing software enterprises to gain access to high-quality Internet connection at competitive prices comparable to other countries in the same region. Besides, the government would support software enterprises in export promotion activities.

For the period between 2005 and 2010, there was no major change in the development strategy of Vietnamese IT industry in general and software industry in particular. Yet, there was effort into completing the legal environment to support IT development in Vietnam with the issuance of Law on Information Technology in 2006, Law on Technology Transfer in 2006, and the amended Law on Intellectual Property Rights in 2009. Especially, Decree 71/2007/ND-CP on guiding some provisions of Law on Information Technology 2006 emphasised the priority of development in software industry (together with digital content industry). As the key policy document in this period, Decision 246/2005/QD-TTg continued to emphasise the significance of the ICT industry for modern industrialisation and economic development in Vietnam. Following the guidance of this policy document, Decision 51/2007/QD-TTg approved the program on the development of software industry to 2010 with vision to 2020. Accordingly, Vietnam prioritised the development of offshore-outsourcing services. Besides, Vietnam would upgrade its IT industrial zones by enhancing the telecommunication and Internet infrastructure - a target similar to what Resolution 7/2000/NQ-CP dictated. Notably, in this period, there is Decision 331/QD-TTg on human resource development program for IT to 2010. Of which, Ministry of Education and Ministry of Labour, Invalids and Social Affairs are mainly in charge of developing the workforce for IT industry in Vietnam.

For the period 2011-2020, relevant policy document stresses the development of Vietnamese IT industry through key IT concentrated zones and key IT products (Decision 1755/QD-TTg, Decision 392/QD-TTg, Decision 153/QD-TTg). A policy document by the Communist Party in 2014, i.e. Resolution 13-NQ/TW, continues to emphasise the utmost importance of IT application and development for the modern industrialisation in Vietnam. Accordingly, the IT concentrated zones plays an important role in the development of IT industry especially software industry (Resolution 26/NQ-CP). The country aims to establish at least seven IT concentrated zones by 2020. Some targets and objectives for IT industry in general and software industry in specific could be found in Figure 4.10 below.

**Figure 4.10: Some key objectives and targets for Vietnamese IT industry by 2020**

(Summarized from Decision 1755/QD-TTg, Decision 392/QD-TTg, Decision 153/QD-TTg, Decision 698/QD-TTg)

- Annual growth rate of software, digital content and IT service industry at least at 15%.
- Top 10 countries for software outsourcing and digital content service provider. Of which, Hanoi and Ho Chi Minh city are amongst top 10 most attractive location for software outsourcing in the world.
- At least seven IT concentrated zones
- 70% of total labour in enterprises will be trained in IT
- 1 million employees in IT industry
- At least 90% university lecturers, and 70% of college lecturers majored in IT will achieve master level of education; at least 30% of university lecturers will achieve doctoral level of education.

Besides, the government maintains preferential treatment to IT enterprises via tax incentives (Resolution 41/NQ-CP). Especially, enterprises located in IT concentrated zones are entitled to the same credit and land incentives as those in economic zones and hi-tech parks (Decree 35/2017/ND-CP, Decision 1238/QD-TTg). In terms of the IT infrastructure, the cost of telecommunication and Internet in Vietnam has been maintained low in order to increase the competitiveness of IT enterprises. According to the most updated Global Information Technology report by World Economic Forum in 2016, in the affordability pillar, Vietnam has secured the highest position (number 1 out of 139) for fixed broadband Internet tariffs. Hence, Internet connection is now affordable to a wider range of enterprises beyond the boundaries of a

few hi-tech parks and IT concentrated zones as indicated in the early stage of IT industry development in Vietnam.

Since 1990s until now, sometimes, the policy implementation has failed to deliver the missions set by the government. For example, in Resolution 7/2000/NQ-CP in 2000, the government assigned relevant ministries to establish a Venture Capital Fund for Hi-Tech Development especially for software development. In 2005, this plan was also repeated in Decision 246/2005/QD-TTg on approval of the strategy for the ICT development in Vietnam until 2010 with orientation toward 2020. Yet, in practice, there has been none of such fund existing.

Overall, IT industry, especially software industry has continuously received special attention of the government of Vietnam. Since 1990s, Vietnam has improved its infrastructure for IT development. It has also made effort to complete the legal framework in support of IT industry in Vietnam. The IT enterprises in general are entitled to a variety of tax incentives. The next section will move on to discuss the policy framework shaping software cluster development in Vietnam.

*There is a lack of coordination between IT clusters and innovation matter*

The policy framework on IT clusters evidently is poorly connected with innovation policy framework.

IT concentrated zones are identified as hi-tech parks in Vietnam. It indicates the perception of policy-makers to consider technology used in outsourcing clusters as high technology. Yet, this is questionable since the software and IT service industry of Vietnam in general is in the low value-added segment of the offshore service GVC (Sturgeon & Zylberberg, 2017). The operation of both hi-tech parks and IT concentrated zones aim to facilitate technology transfer especially from modern technology in the world, and to build up the endogenous capability for Vietnamese domestic firms by attracting local and foreign investment. However, there are some distinctions in their development trajectories. For example, the purpose of IT concentrated zones are for exports, meanwhile this is not necessary for hi-tech parks. While the IT concentrated zones have very limited R&D intensity, the hi-tech parks are much richer in R&D intensity. In practice, the former cluster model focuses on software outsourcing and IT services; while the later cluster model aims for commercialization of research results in certain prioritised industries such as IT (mainly hardware), new technology, new materials and automation.

Below is the definition of ‘high technology’ according to the Law on High Technology 2008:

> *High technology means technology has an intensive amount of scientific research and technological development; it is integrated from modern scientific and technological achievements; it creates quality products with superior features, with high added-value,*

*and environmentally friendly; it plays an important role in the formation of a new manufacturing or service industry or in the modernization of the existing manufacturing and service industry.*

Hence, while hi-tech parks lie within the national innovation system due to its R&D and commercialization activities, IT concentrated zones are generally disconnected. The only connection is probably through the business incubators inside IT concentrated zones that in fact, out of three recognized IT concentrated zones in Vietnam, only QTSC has one. In this regard, the national innovation system in Vietnam is incomplete and still in the nascent stage (Nguyen, Doan, & Nguyen, 2013). Particularly, the regulations on business incubators are not complete yet. This matter is briefly mentioned at Article 30 of Decree 76/2018/ND-CP on guiding some provisions of Law on High Technology issued in 2018. This Article aims to develop science and technology (S&T) market; specifically targeting S&T firms especially small and medium enterprises.

Vietnam also has a much lower rate of GDP expenditure on research and development than its neighbouring countries. In 2015, GERD (GDP expenditure on R&D) rate of Vietnam is 0.44%, lower than other countries, e.g. OECD (1.95%), U.S. (2.79%), China (2.07%), Japan (3.59), Korea (4.23), Malaysia (1.3%), and Thailand (0.63%) (World Bank Data). In general, there is a low level of public-private partnership in innovation matters; also, the network of innovative actors has not been established across the country.

In addition, as noted earlier from Sturgeon & Zylberberg (2017), there are industry-specific barriers against start-ups and small-and-medium enterprises, namely lack of financial funding; small size and scale of accelerators and incubators; and lack of intermediaries to connect local and international markets. The IT industry of Vietnam also experiences low level of FDI in research and development (R&D) activities, although it is the common problem with other economic sectors in Vietnam. The university-industry linkages are weak, hence resulting in a limited number of successful technology transfer cases.

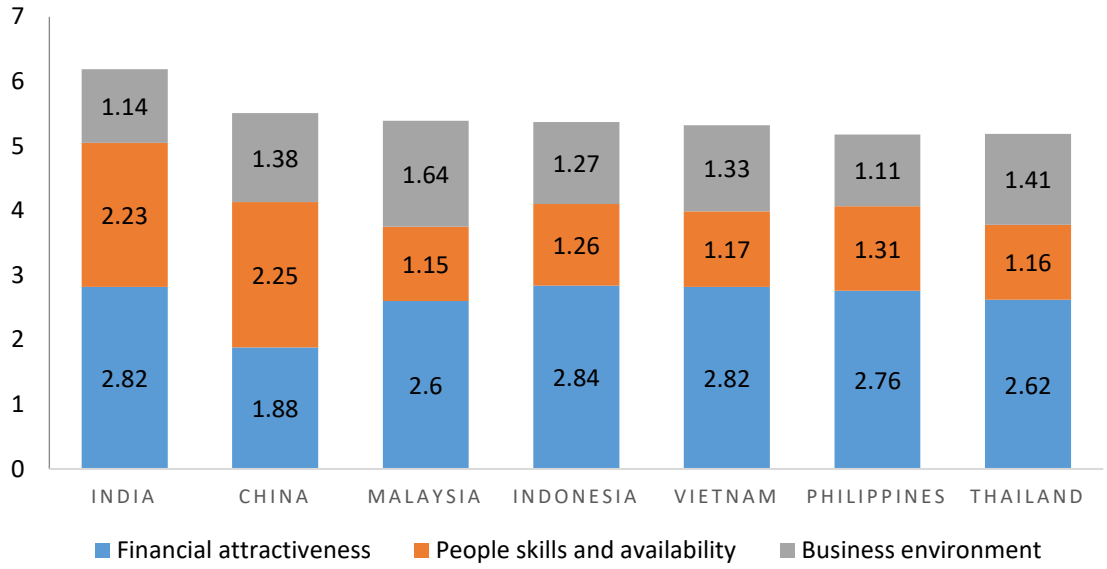
#### *4.3.1.2. The current situation of Vietnamese software industry*

Vietnam has emerged to become one of the most attracting places for offshore services. It has jumped from the 11$^{th}$ place in 2016 to the 5$^{th}$ place in 2019 according to the Global Services Location Index (GSLI) by A.T. Kearney (2019). Figure 4.11 shows a comparison in terms of three components of GSLI, namely financial attractiveness, people skills and availability and business environment. Accordingly, the emergence of Vietnam is attributable for its competitive labour costs; yet the scores on skills and availability is the lowest compared with other Asian

countries, like India, China, Malaysia, Indonesia, Philippines, and Thailand. Similarly, according to (Sturgeon & Zylberberg, 2017), the growth of software outsourcing and BPO in Vietnam has been driven by cost factors.

Another striking thing to note is that in top 10 most attracting countries for offshore services, there are seven places equivalent to these above countries against three countries from Latin America. In other words, the emergence of Vietnam as top destination for offshore services is also due to its geographical proximity to emerging countries like China and India, and to other advanced countries like Japan and Korea.

**Figure 4.11: Global Services Location Index 2019 of top countries in Asia**




Source: own illustration based on A.T. Kearney (2019)

The box below illustrates some achievements of the IT outsourcing industry of Vietnam in global ranking and specialised reports.

**Figure 4.12: Some achievements of the IT outsourcing industry in Vietnam**

- ✓ 5th place in the ranking of offshoring places according to the A.T. Kearney's 2019 Global Services Location Index (GSLI) based on three main criteria, namely financial attractiveness, labour skills, and business environment.
- ✓ The most attractive place (1st position) amongst pioneering countries for outsourcing according to the Business Process Outsourcing (BPO) and Shared Service Location Index 2016 by Cushman & Wakefield based on three criteria, i.e. assessing costs, risks and operating conditions.
- ✓ Top 6 countries for outsourcing in Asia/Pacific according to the report "Evaluate Offshore/Nearshore Countries for Outsourcing, Shared service and Captives in Asia/ Pacific, 2016 by Gartner, a research and advisory company and a member of the S&P 500.
- ✓ One in top 10 countries has the most engineering graduates according to a report by the World Economic Forum (excluding India and China).

Regarding the offshore service GVC, the majority of firms are in the ITO segment, with a recent shift to BPO sector (Sturgeon & Zylberberg, 2017). Vietnam is the most attracting pioneering place for BPO and shared services according to the BPO and Shared Service Location Index 2016 by Cushman and Wakefield. However, most of BPO jobs shifted from previous locations such as India and China to Vietnam are currently taken by foreign invested firms. Theoretically, this may leave Vietnam with limited room for upgrading in its position in the offshore services GVC (Humphrey & Schmitz, 2002) due to the shortage of skilled labour (Sturgeon & Zylberberg, 2017).

In terms of economic performance, in 2016, for the software industry, the total revenue and revenue from exports are 3,038 and 2,491 million USD respectively. So, the revenue from exports contributes for about 82% of the total revenue in software industry. Software is a knowledge-intensive industry as opposed to the capital- and labour-intensive hardware industry. The number of registered enterprises in software industry is double than that in hardware industry; meanwhile, the number of employees in hardware is 5.8 times larger than the figure in software (see Appendix G).

In terms of human resource, there is a lack of skilled labour in the IT industry in general and software in particular. According to Navigos Group – a leading recruitment firm in Vietnam, the employment demand in the IT industry is always amongst the highest compared with other

industries in the Vietnamese economy (Navigos Group, 2017b). Vietnamworks, a subsidiary of Navigos Group predicted in 2015 that Vietnam would be in short of about 500,000 employees – accounting for 78% of the total labour demand in the IT industry (Vietnamworks, 2015). Especially, this problem is the most severe with software firms, given a fact that the number of firms registering recruitment services with Vietnamworks had increased up to 124% within 4 years (ibid).

Besides, the growth of wage has increased faster than that of revenue per employee and enterprise in the software industry. During the period between 2009 and 2018, the CAGR (Compound Annual Growth Rate) of average wage of software employees is 0.097%, while these figures for the average revenue per employees, and the average revenue per enterprise are -0.38% and 0.25% (computed using data from MIC (2014, 2017)). This implied the shortage of skilled IT labour and "*raised concerns about productivity and growth sustainability in these two industries*" (Vu & Austin, 2014, p.26). In Vietnam, IT workers in Ho Chi Minh City and Hanoi received the highest average salary. According to the IT labour market report 2019 by Vietnamworks, this figure in Ho Chi Minh City, Hanoi and other cities are $1066, $1000 and $772 respectively.

From supply side, out of 666 universities and colleges in Vietnam, there are 250 schools with the training major in IT subjects, equivalent to 37.5%. Out of 469 vocational schools, there are 164 schools with the training major in IT subjects, equivalent to 35% (see Appendix G). The curriculum in these schools are publicly criticised for its outdated content, failing to include popular subjects and topics according to the market demand such as AI and Block chain. In addition, graduates from Vietnamese universities, colleges and vocational schools are in general short of soft skills and language skills.

Apart from formal education and training, Vietnamese IT labour could participate into training activities conducted and organised by their own employers. However, it seems that training benefits do not occur in a large number of firms. According to Vietnamworks, in 2015, 75% of IT job seekers expect to gain training opportunities from their employers, but only 14% of the total IT firms offer training benefits (Vietnamworks, 2015). The forms of training may be varied, but mostly to improve the English, technical, leadership and management skills of IT employees. For example, Vietnamese firms may support their employees to obtain international technical certificates issued by global leading firms such as Amazon Web Services, Microsoft or Cisco. Besides, probably due to the rapid changes in IT sector and the advancement of Internet, IT employees are commonly self-studying via online environment; i.e. about 79% of participants in a survey by Vietnamworks reported this forms of learning (Navigos Group, 2017a).

### *4.3.2. IT cluster development in Vietnam*

This section will particularly pay attention to the legal and policy framework affecting software clusters in Vietnam. It will be shown that such framework is not supportive for either innovation or knowledge diffusion within these clusters in Vietnam. The section ends with some background information on the largest software cluster in Vietnam – QTSC.

#### *4.3.2.1. Policy framework supporting IT clusters in Vietnam*

So far, the policy framework supporting the software industry promotes the model of export-driven IT concentrated zones in order to make use of technology transfer. It is also emphasised from the relevant policy document that software is amongst the prioritised sector in the IT industry.

As could be seen from previous section, the cluster initiative emerged the first time in Decision 211-TTg. However, the first software clusters actually went into operation in the early 2000s. This was also aligned with the time where global offshore service broke from its shells of manufacturing process. To put it in the historical context, in 2001, Vietnam and America signed the Bilateral Trade Agreement (BTA). In an effort to help Vietnam build up its competitiveness, the United States Agency for International Development (USAID) has funded the Vietnam Competitiveness Initiative (VNCI) on evaluating the feasibility of software cluster in Vietnam (ITU, 2002). QTSC is in fact not the first software cluster in operation in Vietnam; but it has grown to become the largest software cluster now.

Notably, IT concentrated zones are amongst the key national projects to promote the development of IT industry (Resolution 26/NQ-CP). According to Decision 392/QD-TTg issued in 2015, regarding the development of IT concentrated zones, the government will support by investment in infrastructure, research facilities, and incubator following the National Hi-Tech Development Program based on Decision 2457/QD-TTg in 2010). Besides, there will be trade promotion activities such as trade affairs, conference and seminar to support firms within the IT concentrated zones. In addition, Decision 392/QD-TTg focuses on the improvement of state management at these zones, and sets the target to establish a chain of IT concentrated zones – which are finally legalized into Decision 333/QD-TTg on approval of the pilot project of QTSC chain in 2016 (Table 4.1). Of which, QTSC is the core member. The overall objective of the QTSC chain is to facilitate the cooperation between its members based on their individual competitiveness and complementary capacity (Decision 1766/QD-BTTTT). Yet, the cooperation framework between members of this chain is still developing.

**Table 4.1: Members of QTSC Chain**

| Name of member | Specialisation | Geographical Location |
|---|---|---|
| QTSC | ICT Outsourcing Centre | District 12, Ho Chi Minh city |
| VNU-ITP | Start-up Ecosystem in the University/Incubation Centre | Thu Duc District, Ho Chi Minh city |
| Hue CIT | IT Application in Culture - Tourism | Hue province |
| Mekong Software Park | IT Application in Agriculture and Business Process Outsourcing (BPO) | Tien Giang province |

Source: QTSC's official website

The Law on Information Technology 2006 define 'IT concentrated zone' as:

> A type of hi-tech park, with the concentration or connection of activities in research and development, production, business and training on IT. Organisations and individuals investing and operating in IT concentrated zones are entitled to the same preferential treatment of the State as those applicable to hi-tech parks. (Article 51)

The two specific legal documents relevant to IT concentrated zones in Vietnam are Decision 2407/QD-TTg and Decision 154/2013/ND-CP. Decision 154/2013/ND-CP serves as the first legal document specifically regulating the IT concentrated zones in Vietnam. Accordingly, the definition of 'IT concentrated zone'[viii] is as following:

> A concentrated area of activities in research & development, training, production and sales of IT products and services, infrastructure provision and IT services provision for organisations, businesses and other IT-related activities. (Article 2)

Notwithstanding the name of 'IT concentrated zone', most of the existing and recognized IT concentrated zones are specialised in software and IT service outsourcing. Typically, only three existing IT clusters, i.e. Cau Giay, Da Nang and QTSC, are certified as legitimate IT concentrated zones, and therefore to be entitled for a range of the same preferential treatment as in hi-tech parks, such as tax, credit and land incentives. This shows that the government perceives the benefits of export-driven IT parks are comparable to those of hi-tech parks.

One of the outstanding criteria as regulated by Decision 154/2013/ND-CP is that an IT concentrated zone needs to have at least 2,000 IT-specialised employees. To some extent, this requirement could help the government to filter only large-scale clusters for their investment

given the limited financial resource. Recently, the government of Vietnam initiated the construction of another IT concentrated zone in Hanoi in 2016 (Decision 491/QD-TTg). Accordingly, this new zone will be entitled for all incentives applied to other recognized IT concentrated zone even when it does not reach the threshold of 2,000 employees yet. On the other hand, setting the minimum threshold of employee in a recognized IT concentrated park may lure the cluster managers to attract large outsourcing firms rather than micro and small innovative start-ups.

According to Decision 154/2013/ND-CP in 2013, the objectives of IT concentrated zones are multi-fold, but quite general and they show little change compared with previous policy document since the early 2000s. For example, apart from contribution to economic growth, and attracting investment, the establishment of IT concentrated zones aim to create products and services in substitutions for imported ones from abroad. Besides, the other unchanged targets include to exploit technology transfer, and to establish research and development centre and incubation centre. However, these objectives are lacking measurable indicators to evaluate the performance of IT concentrated zones. Even, Decision 2407/QD-TTg on approval of the overall plan for the development of IT concentrated zones until 2020 with vision to 2025 show no measurable indicators, except for the number of IT concentrated zoned to be newly established. To some extent, the broad guidance from national policy document could grant provincial government greater authority in designing their own policies based on their capacity to execute the national objectives. However, in Vietnam, the rent-seeking issue such as corruption and misuse of public resources are so pervasive. Hence, the lack of measurable objectives from national policy document in this case could result in inefficient policy implementation when it comes to the provincial levels. As a result, there is evidently a race amongst provincial governments in building IT concentrated zones regardless of their human and physical capital base. Not only three central cities in Hanoi, Da Nang and Ho Chi Minh City, but other cities such as Hai Phong, Ha Tinh, Can Tho have also approved their plans to construct their own IT concentrated zones.

#### *4.3.2.2. QTSC*

The establishment and development of QTSC associates with the regional economic development, and with the establishment and development of the economic zone models led by the government in Vietnam.

*Within the regional economic development in Vietnam*

Vietnam is located in the South East Asia; it is an S-shape, long and thin country. Due to quite a unique geographical shape, the regional economic development in Vietnam is divided into four main regions including the Northern, the Central, the Southern and the MeKong Delta River with key cities and provinces as shown in Table 4.2. Such division and focus on key cities and provinces presume and expect spillover effects from key economic areas to their less-developed neighbourhood.

**Table 4.2: Key economic cities and provinces in Vietnam**

| **The Northern** | **The Central** | **The Southern** | **The Mekong Delta River** |
|---|---|---|---|
| Hà Nội | Huế | Hồ Chí Minh | Cần Thơ |
| Hải Phòng | Đà Nẵng | Bình Phước | Cà Mau |
| Quảng Ninh | Quảng Nam | Tây Ninh | An Giang |
| Hải Dương | Quảng Ngãi | Bình Dương | Kiên Giang |
| Hưng Yên | Bình Định | Đồng Nai | |
| Vĩnh Phúc | | Bà Rịa | |
| Bắc Ninh | | Vũng Tàu | |
| | | Long An | |
| | | Tiền Giang | |

Each socio-economic region in Vietnam is assigned with a strategic socio-economic development plan. For example, the Northern region - with Hanoi as the core - is the head of political, economic and cultural matters in Vietnam. There is a majority of research institutes and universities located in Hanoi (see Table 4.3 & 4.4).

**Table 4.3: Number of research institutions* by region in Vietnam in 2014**

| Region | Number of institutions | Proportion |
|---|---|---|
| Hanoi | 262 | 51.88% |
| Ho Chi Minh city | 90 | 17.82% |
| Red River Delta (excluding Hanoi) | 24 | 4.75% |
| Northern Midlands and Mountains | 34 | 6.73% |
| North and South Central Coast | 46 | 9.11% |
| Central Highlands | 14 | 2.77% |
| Southeast (excluding Ho Chi Minh city) | 18 | 3.56% |
| Mekong River Delta | 23 | 4.55% |
| ***Total*** | ***505*** | ***100%*** |

*Source:* Ministry of Science and Technology, Vietnam

* Scientific Research & Technological Development Institutions

**Table 4.4: Number of universities of by region in Vietnam in 2014**

| Region | Number of universities | Proportion |
|---|---|---|
| Hanoi | 55 | 16.22 |
| Ho Chi Minh city | 38 | 11.21 |
| Red River Delta (excluding Hanoi) | 40 | 11.80 |
| Northern Midlands and Mountains | 71 | 20.94 |
| North and South-Central Coast | 60 | 17.70 |
| Central Highlands | 13 | 3.83 |
| Southeast (excluding Ho Chi Minh city) | 22 | 6.49 |
| Mekong River Delta | 40 | 11.80 |
| ***Total*** | ***339*** | ***100*** |

*Source:* Ministry of Science and Technology, Vietnam

The Central region are specialised in ocean and coastal economies targeting service industries such as tourism, fishing and sea transport apart from oil and gas industry. The Mekong Delta River region is specialised in production of agriculture products such as food, seafood and fruits. Meanwhile, the Southern region - with Ho Chi Minh City as the core - is the economic hub of Vietnam in a range of key industries such as manufacturing of electronic components, software production, and other services in commerce, tourism, logistics, finance and telecommunications. This is also the leading centre of technology transfer and technology application in Vietnam.

Likewise, following the principle of regional economic development in Vietnam, the first models of IT concentrated zones were established in three key cities namely Ho Chi Minh City, Hanoi and Da Nang in the early 2000s.

*Within the establishment and development of state-led economic zone models in Vietnam*

IT concentrated zone is one of the eight economic zone models led by the State in Vietnam after the Doi Moi policy reform (Table 4.5)

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**Table 4.5: Economic zone models in Vietnam after Doi Moi policy reform**

| Period | State-led economic zone model |
|---|---|
| 1991-1994 | Export Processing Zone |
| 1994-1997 | Industrial Zone |
| 1997-2003 | Hi-Tech Zone<br>Border-Gate Economic Zone |
| 2003-now | Open Economic Zone<br>Coastal Economic Zone<br>**IT Concentrated Zone**<br>Hi-tech Agricultural Zone |

The IT concentrated zones as well as hi-tech agricultural zones differ with the other models. Particularly, the purpose of these zones focuses on the application of high technology in specific industries like IT and agriculture. In general, the utmost purpose of IT concentrated zones in Vietnam is to build up the endogenous capacity in science and technology of Vietnamese enterprises (MIC, 2017); and to approach modern technology from foreign sector (Decree 13/NQ/TW). Yet, similar to other economic zone models in Vietnam, IT concentrated zones are export-oriented and they seek to attract foreign direct investment. The core competitiveness is still relying on cheap labour cost and other financial incentives, e.g. credit, tax and land preferences.

*QTSC*

This section presents legal foundation and some basic characteristics of QTSC.

Regarding the legal foundation, Quang Trung Software City (QTSC) was founded in March 2001. QTSC is the first recognized concentrated ICT cluster in Vietnam. Quang Trung Software City Development Company Limited (hereby referred as QTSC Development Company) is in charge of the administration and management of QTSC. In term of legal establishment, it is registered as a wholly state-owned enterprise, and to be a subsidiary company of Sai Gon Industry Corporation (CNS) – a wholly state-owned Company Group belongs to Ho Chi Minh City People's Committee. CNS operates on four key industries, namely (i) food processing, (ii) electronics, IT, semi-conductors and automation, (iii) chemical, rubber and plastic, and (iv) mechanical and machinery engineering industry. Besides, CNS is also in charge of developing

industrial zones, and of providing infrastructure for hi-tech parks. QTSC Development Company is the only subsidiary company in the electronics, IT, semi-conductors and automation category. Its revenue mainly comes from the provision of infrastructure and relevant services.

According to the approved charter of QTSC Development Company by Ho Chi Minh City People's Committee, the local Department of Science and Technology is the direct state management agency of QTSC Development Company. Also, this charter also regulates on the obligations and rights of QTSC Development Company. While their obligations are to report to the state agency and to govern and support the member companies inside QTSC; their main rights dominantly involve basic infrastructure provision and management, such as land, electricity, and water.

QTSC also operate one-stop shop to support member companies, especially foreign invested ones, in dealing with a number of public administrative procedures, from business and investment license registration to working permit. In addition, QTSC is the only IT concentrated zone under the administration of a state-owned company rather than a general board of management like the other two zones in Hanoi and Da Nang. This legal foundation certainly allows QTSC Development Company much more room of autonomy to support its clustered firms beyond infrastructure provision and state administration. For instance, QTSC Development Company in association with three other institutions establishes a vocational training centre within QTSC. In addition, relevant to trade promotion, it has organised a large number of annual visit tours abroad for its member firms. Furthermore, QTSC Development Company plays a significant role in the foundation of Vietnam Information Technology Outsourcing Alliance (VNITO) – an effort to promote the branding of Vietnam as an attracting location for offshore software outsourcing.

According to KPMG’s report in 2017, about one-third of firms inside QTSC, equivalent to 49 firms, are foreign invested ones. Of which, the largest number of firms comes from Japan, with the second place goes to Germany (Table 4.6). This is in coincidence with the increasing investment flow from Japan in literature (Hirakawa & Nguyen, 2017).

**Table 4.6: Number of FDI firms & registered capital at QTSC by country in 2017**

| Origin of investor | Number of firms | Registered capital (unit: billion Vietnam dong) |
|---|---|---|
| Japan | 14 | 50.2 |
| Germany | 10 | 169.4 |
| USA | 5 | 256.8 |
| South Korea | 3 | 109.6 |
| Thailand | 3 | (missing data) |
| Other countries | 14 | 35.8 |

Source: KPMG's report based on data by QTSC Development Company

Out of three recognized IT concentrated zones in Vietnam, QTSC is the largest one with 160 firms and 20,755 employees and students according to the figures provided by QTSC Development Company. There are in total eight institutions inside QTSC, including one public research institute, two universities, two colleges, two vocational institutions, and one Japanese teaching centre. Especially, within QTSC Development Company, there is one business incubator established since 2005, namely QTSC Incubator (known as SBI). SBI had received funding from EU Commission until 2011, and from the Department of Science and Technology, Ho Chi Minh City since then. However, the performance of the incubator is not as expected.

According to the press release from this incubator, until the end of 2017, it has supported 62 firms; there were about 15 graduated enterprises currently operating in QTSC, 42 firms still under training. Of which, only three (3) firms have succeeded in fund raising, and typically one firm has opened a representative office in Silicon Valley, California, USA. In particular, the objective from the beginning is to nurture and support innovative enterprises in IT sector, especially with small and medium size. Yet, it ends up with the majority of new enterprises still working in low-valued added software outsourcing sector (Table 4.7).

**Table 4.7: Business activities of spin-offs from QTSC Incubator (SBI)**

| Field of business | Percentage |
|---|---|
| Software outsourcing | 36% |
| ICT services | 17% |
| Business management solutions | 10% |
| Smart health | 7% |
| Hi-tech agriculture | 5% |
| Corporate finance solutions | 5% |
| Digitalization | 5% |
| Education | 3% |
| Cloud computing | 2% |
| Smart barcode | 2% |
| Smart housing | 2% |
| ICT Consultancy | 2% |
| Community | 2% |
| Smart transportation | 2% |

*Source: Press release by QTSC Incubator (2017)*
https://www.qtsc.com.vn/uploads/files/2018/01/18/TCBC-TK-2017-v4.pdf

Besides, the distance from city centre, about 16 km associates with higher cost and time of travelling. For this reason, SBI is partly less attractive than other incubators in the city centre, or near the universities. But, the even challenging issues are relevant to governance – state-run incubators generally maintain lots of bureaucratic features, and to the lack of full-time staffs and experts to operate the incubator efficiently. As a result, the revenue from its incubating activities is insufficient for SBI to operate independently after the sponsorship from EU Commission ended in 2011.

There is limited public information on the innovation activities at firm level within QTSC. For QTSC Development Company, it has currently focused more on organisational innovation in its own cluster management activities, and on upgrading the cluster infrastructure. For example, in an attempt to pilot the first smart city model in Vietnam, since 2016, QTSC has implemented a number of advanced ICT applications, especially Internet of Things (IoT) with modern ICT infrastructure[ix]. Recently, it has opened an R&D lab in 2018 with some specialised facilities and machines targeting start-ups in new technologies.

### 4.4. Chapter summary

This chapter has provided with macroeconomic conditions of the research country – Vietnam, and the IT cluster development and policy framework supporting IT industry in general and software in particular. It has demonstrated the transformation of Vietnamese economy through periods together with some unique characteristics of this transition economy from central planning to market-oriented one. Overall, the private sector has been treated less equal than the

state and foreign sectors for a long time. This could damage the entrepreneurial spirits essential for innovation in software sector. Apart from this, Vietnam as a lower middle-income country possesses some advantages to move toward productivity and innovation –led growth, namely its young population as well as macroeconomic and political stability. However, at the current stage of economic development, the country confronts some challenges such as weak science and technology capacity, and an under-developed national and regional innovation system.

The software industry has continuously received considerable support from the government. The principle of relevant industrial policy is to take advantage of software outsourcing, and software clusters as leverage to promote the domestic software industry. The state-led cluster initiative for software in Vietnam started since early 2000s, and it is embedded within the regional economic development. Furthermore, this chapter also provides a description of the research cluster – QTSC – the largest software cluster in Vietnam.

The next chapter will move on with the first chapter of data analysis.

# Chapter 5: QUANTITATIVE ANALYSIS & RESULTS

## 5.1. Chapter overview

This chapter presents the results from quantitative analysis. In the first strand, the research will use Social Network Analysis (SNA) to investigate the structure and composition of social network within QTSC. By doing so, it deals with research question RQ2 seeking to understand the nature and patterns of LKS via social interaction.

In the second strand, this chapter will employ Multivariate Linear Regression Analysis with robust techniques to address research question RQ 3. Particularly, the regression model will use the degree centrality as previously computed by SNA as an independent variable for LKS via social interaction. Also, it will partly deal with research question RQ4 via the correlation analysis.

Prior to the discussion of individual analysis methods, it is important to define the firm size. This thesis applies the rule according to the Law on supporting small and medium enterprises 2018 of Vietnam, i.e. based on number of employees for firms in IT sector. Accordingly, firms with less than 11 employees are micro; those ranging between 11 and 50 are small enterprises. Medium IT firms have more than 50 but less than 101 employees, leaving large IT firms with more than 100 employees.

## 5.2. Social Network Data Analysis & Results

The SNA will deal with RQ2 based on the data collected from both network and innovation surveys. This research question is then broken down into several sub-questions as following.

**RQ 2.** How do the structure and composition of social network within QTSC influence the nature and patterns of LKS?

- How dense is the social network within QTSC? (RQ 2.1)
- What are the most important connections (ties) and firms (nodes) in the informal network within QTSC? (RQ 2.2)
- Which type of attributes affect the level of involvement of a firm in the informal network within QTSC? (RQ 2.3)

This section includes two main parts. The first part explores the macro characteristics, namely the structural characteristics of the informal network inside QTSC (RQ 2.1 & RQ 2.2). Then, to delve into the micro features of network, the second part tests some hypotheses at node level (equivalent to firm level) (RQ 2.3).

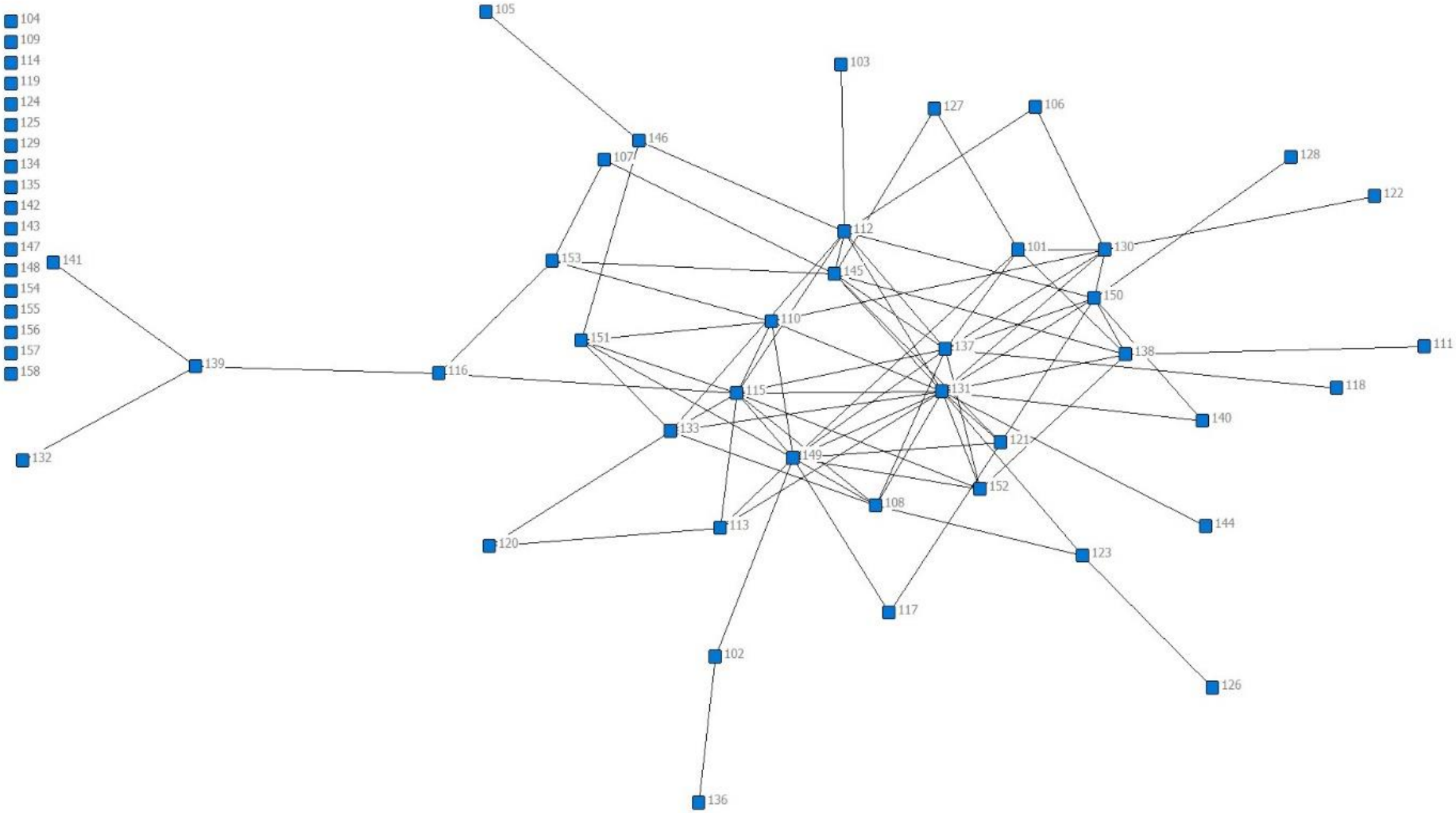
### *5.2.1. Macro characteristics of the informal network within QTSC*

This sub-section addresses some important structural properties of the network, such as cohesion, sub-groups, components and ego-network, after an overview of the network visualisation.

At first, Figure 5.1 presents an overview of the network visualisation by using the network visualisation generated by Netdraw. Technically, the most connected nodes are placed at the centre of the network. Meanwhile, the isolated nodes are on the left corner, i.e. 18 firm representatives reported they did not seek any advice from individuals and firms inside QTSC, if they encountered technical and/or technological difficulties in previous years.

**Figure 5.1: The informal network inside QTSC**

Source: The author



***Cohesion***

Cohesion or connectedness of a network refers to how well the set of entities (nodes) in a network is connected. The more connected the network is, the more favourably LKS will occur.

Network density could be used as an indicator to compare the network cohesion between networks of different size. It tells us how much the proportion of all possible ties[x] is present. Table 5.1 shows the comparable network density in different scenario. Accordingly, the value of network density for all ties in the dichotomous dataset is lower than that in the valued one. This may indicate that the availability of heterogeneously weighted ties is likely associated with higher network density and average degree, i.e. higher network cohesion, than the case of homogenous ties.

**Table 5.1: The network density[xi] of the informal network inside QTSC**

Source: The author

| Network | Network density |
|---|---|
| Dichotomous (all ties) | 0.051 |
| Valued (all ties) | 0.114 |
| Dichotomous (only local firms)<br>Size of network = 23 | 0.028 |
| Dichotomous (only local firms & institutions)<br>Size of network = 33 | 0.076 |
| Dichotomous (only local firms and foreign firms ~ without institutions)<br>Size of network = 48 | 0.031 |
| Dichotomous (only foreign firms and local institutions)<br>Size of network = 35 | 0.061 |
| Dichotomous (only institutions)<br>Size of network = 10 | 0.133 |

With regard to different binary datasets (dichotomous), the network density indicators are respectively 0.051, 0.028, 0.076 and 0.031 for networks of (i) all ties, (ii) only local firms, (iii) only local firms and institutions, and (iv) only local firms and foreign firms. The figure for the network of only local firms is much lower than that of all-tie-dataset. This suggests that the interaction of local firms with foreign firms and other institutions inside QTSC strongly

increases the network cohesion, which is more likely to facilitate LKS. Meanwhile, the figure for the case (iii) of only local firms and institutions is 2.45 times higher than the case (iv) of local firms and foreign firms. Correspondingly, the network between local firms and institutions is more cohesive that the network between local firms and foreign firms. The binary networks involving institutions both have higher values of network density than the other cases would be. This indicates the importance of institutions to facilitate network cohesiveness, and to enhance LKS via social interaction within QTSC.

**Table 5.2: Average geodesic distance in valued networks**

Source: The author

| Network | Network density | Average geodesic distance |
|---|---|---|
| All ties | 0.114 | 2.8 |
| Excluding micro firms<br>Size of network = 52 | 0.121 | 2.8 |
| Excluding small firms<br>Size of network = 32 | 0.165 | 2 |
| Excluding micro and small firms<br>Size of network = 26 | 0.222 | 2 |

To compare with the Montevideo software cluster in Uruguay by Kesidou (2007), this cited study uses a sample of 107 nodes, while the present research has 58 nodes. However, the network density in Montevideo, i.e. 0.34, is much higher than that number of QTSC, i.e. 0.114. Therefore, the Montevideo informal network in 2005, when Kesidou collected her data, is more cohesive than the QTSC informal network in 2018. Both of them are software clusters in developing countries.

Following Kesidou (2007), the non-response bias, i.e. referring to the non-participant of other firms and institutions inside QTSC, is highest amongst micro and small firms. This is also a reliable assumption given the fact that the majority of IT firms inside QTSC are micro and small enterprises[xii]. Hence, when removing micro-to-small firms from the valued network, the network density indicators both increase. For example, the figure for the valued networks of (i) without micro firms, (ii) without small firms, (iii) without micro and small firms, are respectively 0.121, 0.165 and 0.222, compared to the figure of the valued network with all ties, i.e. 0.114 (Table 5.2). This result suggests that micro and small firms in general have fewer connections (Kesidou,

2007). Notably, five out of six micro firms in the network are isolated, i.e. nodes numbered 119, 125, 129, 134 and 158.

**Table 5.3: Frequency of interaction**

Source: The author

| Weight | Frequency of interaction | Number of possible ties (1653) | Frequency of interaction By percentage | Type of ties |
|---|---|---|---|---|
| 0 | Never | 1564 | 94.6% | No tie |
| 1 | Rarely | 31 | 1.8% | Weak tie |
| 2 | Sometimes | 25 | 1.5% | Medium tie |
| 3 | Often | 18 | 1.1% | Strong tie |
| 4 | Very often | 15 | 0.9% | |

Table 5.3 illustrates the frequency of interaction amongst participant firms and organisation within QTSC. Accordingly, out of 1653 possible ties, 1.8%, 1.5%, and 2% are respectively weak ties, medium ties, strong ties and very strong ties.

***Sub-groups or Cliques***

This sub-section further examines some other structural properties of the informal network within QTSC, i.e. cohesive groups. To identify cohesive groups within a network is important since "*actors within cohesive groups tend to share norms and often have common goals and ideas*" (Borgatti et al., 2018, p. 212). As a result, members of a cohesive group tend to have similar behaviour and practices. In addition, cliques could provide information on the association between dyads[xiii] in the network. The researcher uses UCINET to identify cliques[xiv] with the minimum size of three nodes (triad); as a result, there are 22 nodes in 30 cliques. This represents 38% of participant firms and institutions within QTSC as member of cliques.

In addition, nodes 115 and 149 are the most active actors, since they share seven (7) clique memberships in common. Therefore, the tie between 115 and 149 is important within the existing cliques, and these two nodes may play the leading roles in the network. In fact, these two are amongst top five nodes with the highest degree centrality[xv].

***Components***

While clique approach is a bottom-up approach allowing us to identify maximal fully connected subgroups, component approach is a top-down approach, aiming to find parts that are connected-within but disconnected from other parts of the graph.

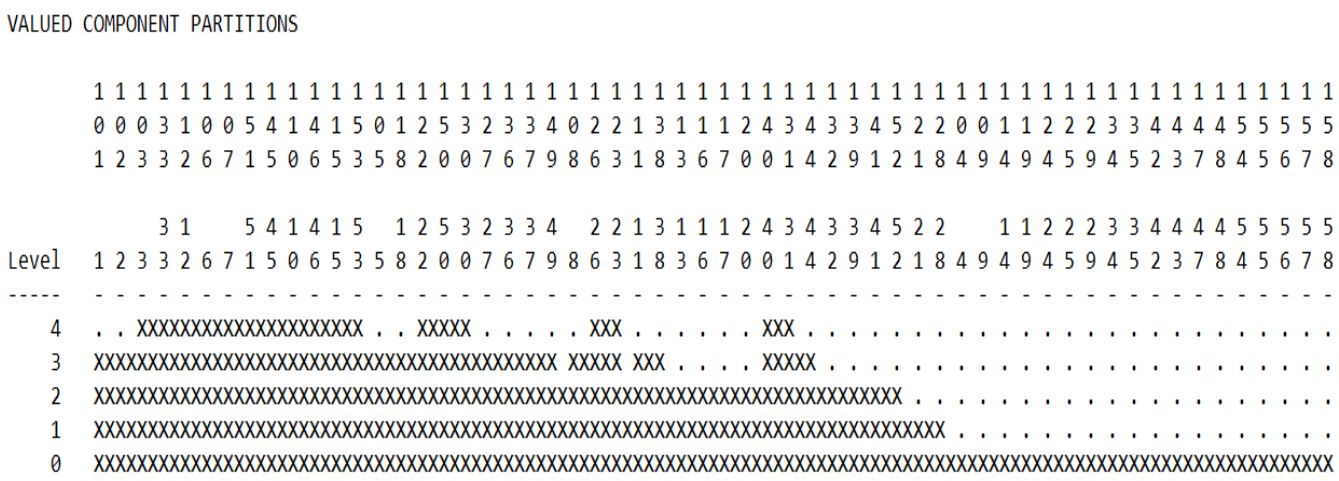



**Figure 5.2: Valued component partitions**

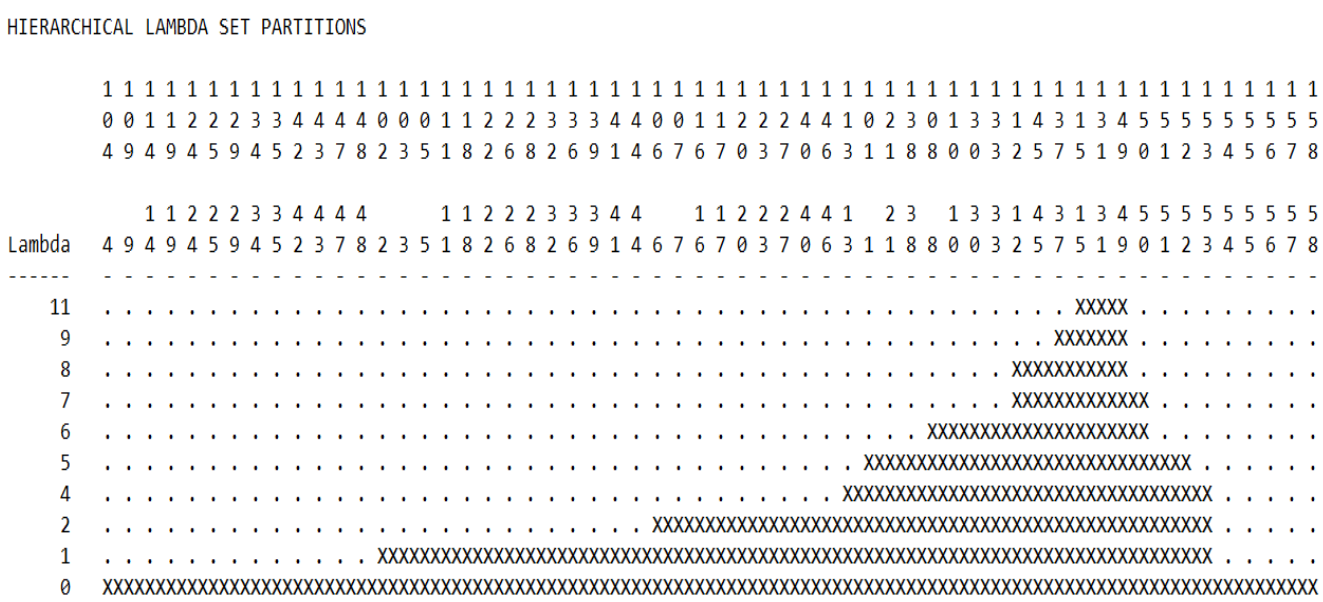
Source: The author

Using the valued dataset, the level in Figure 5.2 indicates the tie strength, from zero to four. If we choose the cut-off value at the highest level of tie strength, i.e. 4, there are four non-isolate components. It could be interpreted that, there are four components based on the highest level of connection between participant firms and institutions within QTSC. These components include (103, 133, 112, 106, 107, 151, 145, 110, 146, 115, 153), (122, 150, 130), (126, 123) and (140, 131). In the first set of nodes, except for node 145 - a domestic firm and node 112 – an educational institution, all other nodes are foreign invested firms. Meanwhile, all nodes in the second and third sets are domestic firms, and the fourth set includes the connection between the IT training centre and a college. This indicates that firm ownership might associate with the pattern of socialization behaviour of firms.

Besides, the Lambda sets and bridges measure in SNA help to detect critical ties of the network. Removing these ties could cause severe damage to the structure of the whole network, e.g. the network turns to be segregated parts.

**Figure 5.3: Hierarchical Lambda set partitions**

Source: The author




The hierarchical Lambda set partitions (Figure 5.3) highlights the most important ties between the set of three nodes, namely 115, 131 and 149. These connections convey most of knowledge and information within the informal network of QTSC. In other words, a node that connects with either one of these three nodes could gain valuable information and knowledge from the informal network. The left column represents the level of connectivity; for example, at the level of connectivity at 11, it means that the Lambda set of (115, 131, 149) has a minimum of 11 independent paths linking one node to the other in this subset (Borgatti, Everett, & Shirey, 1990). This set represents connections between a large foreign firm, a large domestic firm and the IT training centre. In smaller levels of connectivity, the Lambda sets still surround the above three nodes.

***Ego network***

An ego network refers to an internal part of the network, where the node of our interest is called ego, all other nodes in the ego network must be directly connected to the ego, and these nodes are called ‘alters’. So, in the given whole network, there are many ego networks (sub-networks) to be formed. In the ego network analysis, this research concerns structural holes, and brokerages.

*Structural holes*

Structural holes refer to “*the lack of a tie between two alters within an ego network”* (Borgatti et al., 2018, p. 319). These holes are potential places to be filled with brokerages in order to

increase the network cohesion, thus to further facilitate the flow of knowledge and information (Burt, 2004). Effective size in the binary data is a measurement of structural holes, equal "*the ego's degree …minus the average degree of her alters within the ego network"* (Borgatti et al., 2018, p. 319). The higher value of effective size a node has, the more likely it holds greater brokering power. The top three nodes with highest values of effective size are nodes 131, 149 and 137.

*Brokerages*

The Fernandez and Gould (F&G) Brokerage analysis from UCINET helps to investigate the role of ego as connector or broker amongst different groups.

**Table 5.4: Brokerage scores**

Source: The author

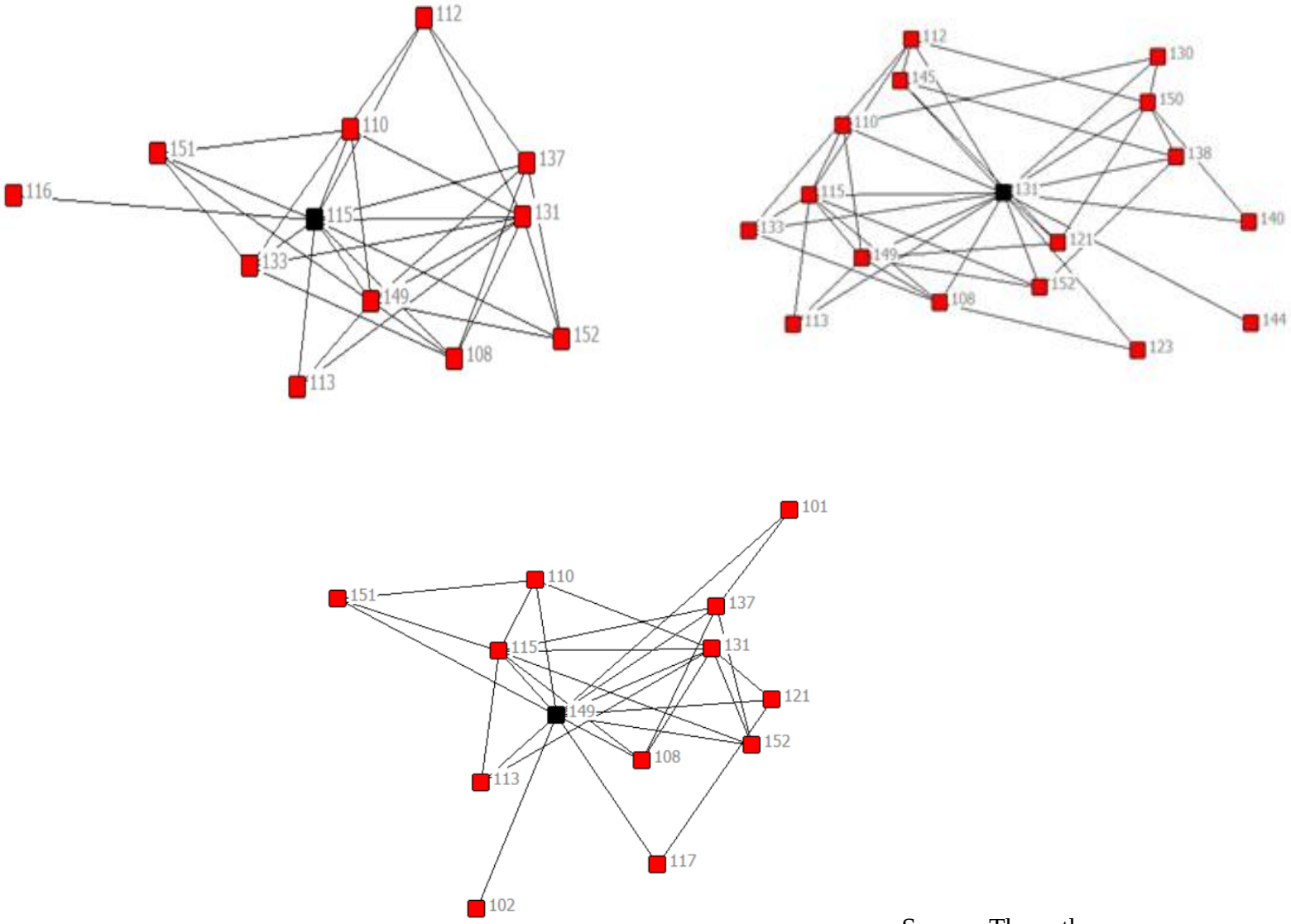
| Groups | Total Brokerage score |
|---|---|
| **Spin-off**<br>Of which, node with the highest score: node 145 | 122 |
| **Non-spin-off**<br>Of which, node with the highest score: node 149 | 292 |
| **Domestic firms**<br>Of which, node with the highest score: node 149 | 258 |
| **Foreign firms**<br>Of which, node with the highest score: node 115 | 156 |
| **Institutions**<br>Of which, node with the highest score: node 131 | 358 |

The brokerage score simply counts the number of times each node - divided into different groups, namely spin-off firms, non-spinoff firms, domestic firms, foreign firms and institutions - acts as one of the five roles, i.e. coordinator, gatekeeper, representative, consultant and liaison[xvi]. For the role of coordinator, which facilitates the flow of information exchange within the ego networks, node 131 has the highest score, i.e. 104. For gatekeepers, who receive information from nodes in other ego network to transfer back to other nodes in their belonging ego network, node 131 has the highest score. Node 131 also plays a significant role of a representative, who theoretically could distribute information of their belonging ego networks to other nodes in other ego networks. Node 149 is the most important 'consultant', referring to who stands outside an ego network, but helps to spread information and knowledge to other nodes in that ego network.

There is no liaison, which connects nodes in different ego networks in the informal network of QTSC.

Despite the fact that only 10 institutions are involved in the network, the total number of times they play brokerage role in the network is the highest by comparison with the other groups. Spin-off firms, theoretically plays an important role in facilitating LKS; yet, this category gains the smallest total brokerage score. In particular, there are only 12 spin-off firms in the network, ten out of them are domestic, and all of them are micro and small firms (the size is equal or less than 50 employees).

Three nodes with the highest brokerage scores are node 115, 131 and 149. Of which, node 131 has the highest brokerage scores; this is an IT training centre partly established by VNITO. Hence, it has a well-connected network with other firms inside QTSC. Apart from node 131, node 115 is a large foreign firm, and node 149 is a large domestic firm. Recalling from the Lambda set analysis, the connections between these three nodes, i.e. 115, 131 and 149 are also the most critical ones in the network. Figure 5.4 illustrates the three ego networks of three nodes/egos with the highest brokerage scores.




Source: The author

**Figure 5.4: Ego networks of nodes 115, 131 and 149**

In summary, the informal network within QTSC is quite sparse compared with some other networks of software clusters in developing countries, such as the Montevideo cluster in Uruguay. Three actors, namely a training centre (131), a large domestic pure outsourcing firm (149) and a large foreign pure outsourcing firm (115) are the most important nodes; similarly, their connections are the most crucial ties in the informal network within QTSC.

### *5.2.2. Micro analysis (node level)*

The researcher uses UCINET software to calculate the degree centrality indicator of the informal network within QTSC. Degree centrality refers to how a node is connected in terms of its direct connection. This indicator is calculated as the number of ties that a node has.

In this section, t-test is used to test the difference in mean of degree centrality between two different groups of firms based on three types of attributes, i.e. by ownership, by size, and by VNITO[xvii]-membership.

**H1:** Foreign firms are more likely to exchange information than domestic firms in the informal network within QTSC;

**H2:** Large & medium firms (more than 50 employees) are more likely to exchange information than micro & small firms (equal or less than 50 employees) in the informal network within QTSC;

**H3:** VNITO-member firms are more active than non-VNITO-member firms are in the informal network within QTSC.

The below part illustrates and explains the t-test results.

***H1: Foreign firms are more likely to exchange information than domestic firms in the informal network within QTSC.***

Group 1: Foreign firms
Group 2: Domestic firms
Basic statistics on each group.

| | | 1<br>Group 1 | 2<br>Group 2 |
|---|---|---|---|
| 1 | Mean | 5.960 | 5.522 |
| 2 | Std Dev | 6.465 | 7.336 |
| 3 | Sum | 149.000 | 127.000 |
| 4 | Variance | 41.798 | 53.815 |
| 5 | SSQ | 1933.000 | 1939.000 |
| 6 | MCSSQ | 1044.960 | 1237.739 |
| 7 | Euc Norm | 43.966 | 44.034 |
| 8 | Minimum | 0.000 | 0.000 |
| 9 | Maximum | 26.000 | 23.000 |
| 10 | N of Obs | 25.000 | 23.000 |
| 11 | N Missing | 23.000 | 25.000 |

SIGNIFICANCE TESTS

| Difference in Means | ...One-Tailed Tests... Group 1 > 2 | Group 2 > 1 | Two-Tailed Test |
|---|---|---|---|
| 0.438 | 0.434 | 0.584 | 0.8435 |

**Figure 5.5: T-test result for difference in mean degree centrality of two groups of firms by ownership**

Source: The author

The p-values of one-tailed and two-tailed tests are much higher than 0.05 (Figure 5.5). In this situation, we do not have sufficient evidence to reject the null hypothesis. In other words, we cannot reach any conclusion on whether the legal ownership of a firm, i.e. foreign or domestic invested, is positively or negatively associated with its participation into the informal network.

***H2: Large & medium firms (more than 50 employees) are likely to be more active than micro & small firms (equal or less than 50 employees) in the informal network within QTSC.***

```
Group 1: Micro & Small firms (less than or equal 50 employees)
Group 2: Medium & Large firms (larger than 50 employees)

Basic statistics on each group.
```

| | | 1<br>Group 1 | 2<br>Group 2 |
|---|---|---|---|
| 1 | Mean | 1.818 | 3.600 |
| 2 | Std Dev | 2.480 | 3.648 |
| 3 | Sum | 60.000 | 54.000 |
| 4 | Variance | 6.149 | 13.307 |
| 5 | SSQ | 312.000 | 394.000 |
| 6 | MCSSQ | 202.909 | 199.600 |
| 7 | Euc Norm | 17.664 | 19.849 |
| 8 | Minimum | 0.000 | 0.000 |
| 9 | Maximum | 8.000 | 12.000 |
| 10 | N of Obs | 33.000 | 15.000 |
| 11 | N Missing | 15.000 | 33.000 |

```
SIGNIFICANCE TESTS
```

| Difference in Means | ...One-Tailed Tests... Group 1 > 2 | Group 2 > 1 | Two-Tailed Test |
|---|---|---|---|
| -1.782 | 0.968 | 0.039 | 0.0617 |

**Figure 5.6: T-test result for difference in mean degree centrality of two groups by size of employees**

Source: The author

Figure 5.6 displays the statistically significant result of one-tailed test, i.e. p-value is equal 0.039, which is less than 0.05. It is interpreted that medium & large firms tend to be more active than micro and small firms are in the informal network within QTSC.

***H3: Whether VNITO-member firms are more active than non-VNITO-member firms are in the informal network within QTSC.***

The VNITO membership is noteworthy due to its foundation history and its organisation. Strikingly, the director of QTSC Development Company is currently the president of VNITO. Typically, members of the Board of Director of VNITO include the directors of some large firms within QTSC.

**Table 5.5: VNITO Alliance membership of firms participating in the surveys**

Source: The author

| | Number | Proportion (%) |
|---|---|---|
| Member of VNITO | 27 | 56.25% |
| Non-member of VNITO | 21 | 43.75% |
| Total | 48 | 100% |

To obtain the VNITO membership information, the author has searched on the directory website of this association[xviii]. Amongst 48 firms in the network, there are 27 members of VNITO, and 21 non-VNITO members. Common network membership in VNITO may indicate the degree of relatedness amongst firms within QTSC to some extent.

```
Group 1: Non-member of VNITO
Group 2: Member of VNITO
Basic statistics on each group.

                      1       2
                Group 1 Group 2
                ------- -------
 1       Mean     1.524   3.037
 2    Std Dev     2.322   3.305
 3        Sum    32.000  82.000
 4   Variance     5.392  10.925
 5        SSQ  162.000 544.000
 6      MCSSQ  113.238 294.963
 7   Euc Norm   12.728  23.324
 8    Minimum    0.000   0.000
 9    Maximum    8.000  12.000
10   N of Obs   21.000  27.000
11  N Missing   27.000  21.000


SIGNIFICANCE TESTS

     Difference        ...One-Tailed Tests...     Two-Tailed
       in Means    Group 1 > 2    Group 2 > 1           Test
 ============== ============== ============== ==============
         -1.513          0.961          0.048         0.0944
```

**Figure 5.7: T-test result for difference in mean degree centrality of two groups based on VNITO membership**

Source: The author

Figure 5.7 shows the statistically significant result of the one-tailed test of 'group 2 > group 1'; the p-value is 0.048, which is smaller than the threshold of 0.05. Hence, members of VNITO are likely to be more active than non-VNITO members in the informal network within QTSC. This indicates that the membership of business association, i.e. VNITO, is associated with the participation into the informal network within the cluster. It probably reflects the networking propensity of firms, those who are likely to exchange information and knowledge in the specialised community and those who are unlikely.

In summary, the t-test has demonstrated that only firm size and VNITO membership are statistically associated with the socialization behaviour of firms within QTSC. Typically, large-and-medium firms and firms with VNITO membership tend to be actively participate into the informal network; therefore, those firms with these two types of attributes are more likely to be beneficial from LKS via social interaction that the otherwise the case would be.

Overall, the SNA has dealt with RQ 2, particularly LKS via social interaction. Now, it moves to the next section with regression analysis in order to testify the quantitative significance of LKS via different channels on innovation at firm level.

## 5.3. Regression Analysis & Results

This sub-section will address RQ 3 based on the data collected from both innovation and network surveys.

> **RQ 3.** How significant LKS via different channels are to innovation at firm level within QTSC? (Chapter 5 & 6)

At first, the researcher provides some descriptive statistics. Typically, the correlation matrix will describe how the idiosyncratic characteristics of firms, i.e. via control variables of firm size, firm age and absorptive capacity captured by the average level of education, associate with channels of LKS (section 5.3.1). Then, section 5.3.2 moves to discuss the details of analysis including the linear regression diagnosis and robust techniques. At last, the results from these regression analysis techniques will be presented (section 5.3.3).

### *5.3.1. Descriptive statistics*

In terms of LKS via entrepreneurship, out of 42 firms, there are 12 spin-offs, equivalent to 28.6%. The firm owners of spinoff had worked in another firm or institution within QTSC before setting up their own business.

**Table 5.6: LKS via spin-offs**

| 1 = Yes, it is a spin-off<br>0 = NO | Frequency | Percentage |
|---|---|---|
| 0 | 30 | 71.4 |
| 1 | 12 | 28.6 |
| Total | 42 | 100 |

In term of firm size, the majority of firms fall into the category of micro and small firms (Table 5.7).

**Table 5.7: Proportion of firms by firm size**

| | | **Number of firms** | **Percentage (%)** |
|---|---|---|---|
| **Micro enterprise** | ≤10 employees | 5 | 11.9 |
| **Small enterprise** | 11-50 employees | 26 | 61.9 |
| **Medium enterprise** | 51-100 employees | 5 | 11.9 |
| **Large enterprise** | >100 employees | 6 | 14.29 |
| Total | | 42 | 100 |

Now, turning to the correlation analysis, Figure 5.8 demonstrates the significantly positive correlation between INN_ORG and Size & Degree, which inform our regression of INN_ORG on these variables. Also, Spinoff has a significant negative correlation with AGE, meaning new firms tend to be younger. EDU is negatively correlated with SIZE, indicating that on average, smaller firms tend to outweigh larger firms in terms of the average educational level. SIZE and Degree are also positively correlated. This is in agreement with the finding from SNA, i.e. medium-and-large firms tend to be more sociable than micro-and-small firms. Surprisingly, EDU – an indicator of absorptive capacity do not have any significant correlation with either INN_ORG – organisational innovation at firm level and any channels of LKS against the findings from previous studies such as (Kesidou, 2007).

| | INN_ORG | AGE | SIZE | EDU | Spinoff | Inflow | Degree |
|---|---|---|---|---|---|---|---|
| INN_ORG | 1.0000 | | | | | | |
| AGE | 0.1528<br>0.3339 | 1.0000 | | | | | |
| SIZE | 0.6785*<br>0.0000 | 0.3070*<br>0.0480 | 1.0000 | | | | |
| EDU | -0.2736<br>0.0795 | -0.1926<br>0.2217 | -0.3108*<br>0.0451 | 1.0000 | | | |
| Spinoff | 0.0485<br>0.7606 | -0.4696*<br>0.0017 | -0.1826<br>0.2472 | 0.1045<br>0.5100 | 1.0000 | | |
| Inflow | -0.0778<br>0.6241 | -0.0838<br>0.5979 | -0.0719<br>0.6508 | -0.1864<br>0.2372 | 0.0065<br>0.9673 | 1.0000 | |
| Degree | 0.6259*<br>0.0000 | 0.0379<br>0.8115 | 0.5572*<br>0.0001 | -0.1570<br>0.3208 | 0.0929<br>0.5583 | -0.0812<br>0.6092 | 1.0000 |

**Figure 5.8: Correlation matrix of all variables at 5% significant level**

### *5.3.2. Regression analysis*

This study uses Multivariate Linear Regression Analysis methods to investigate the effects of LKS via three mechanisms on organisational innovation at firm level within QTSC. The regression model is the following:

$$INN\_ORG = \beta_0 + \beta_1*AGE + \beta_2*SIZE + \beta_3*EDU + \beta_4*Spinoff + \beta_5*Inflow + \beta_6*Degree + \varepsilon$$

### *Linear regression diagnosis*

Linear regression estimator is a common regression analysis method in academia. However, the linear regression estimator requires strict assumptions on the properties of dataset in order to obtain valid results. Therefore, at first, the researcher tests the assumptions of multiple linear regression analysis (Hair et al., 2018). These include:

- Linearity
- Constance variance of the error terms (Homoscedasticity)
- Normality of the error term distribution
- Independence of the error terms

Apart from the above assumptions, multi-collinearity and outliers are also examined to understand the properties of dataset.

*Linearity*

To check for linearity, visualisation via plots would be helpful. The residual-versus-fitted-value plot is used to detect any non-linearity, unequal error variance and outliers (Figure 5.9). We could see there are several outliers on the extreme right and top of the chart. Apart from these outliers, the residuals are placed equally around the zero-horizontal line, which indicates that the assumption of linear relationship is possible and the variance of error terms are equal.

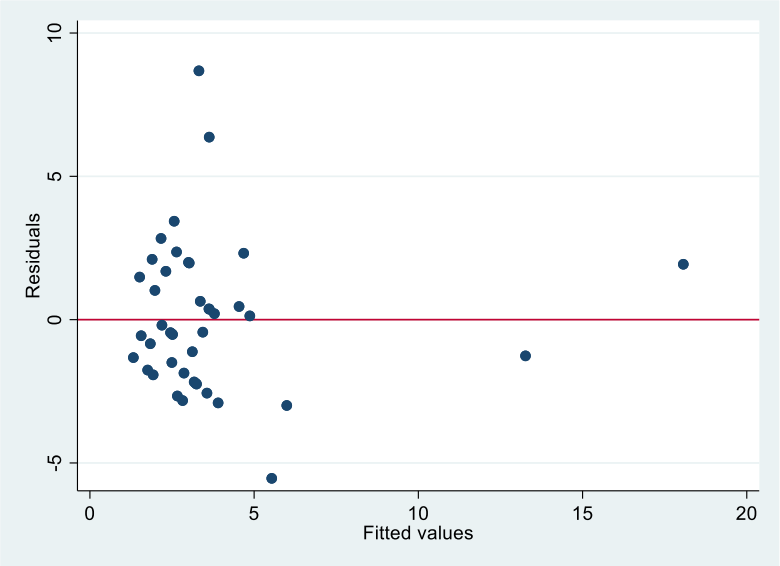



**Figure 5.9: Residual-versus-fitted-value plot**

Another useful plot to examine the linear relationship between dependent and independent variables is partial regression plot. According to the partial regression plots, several outliers could be detected (Figure 5.10). For example, the Degree plot shows that the regression line has to adjust to fit with the outliers, i.e. observations number 30 and 42.

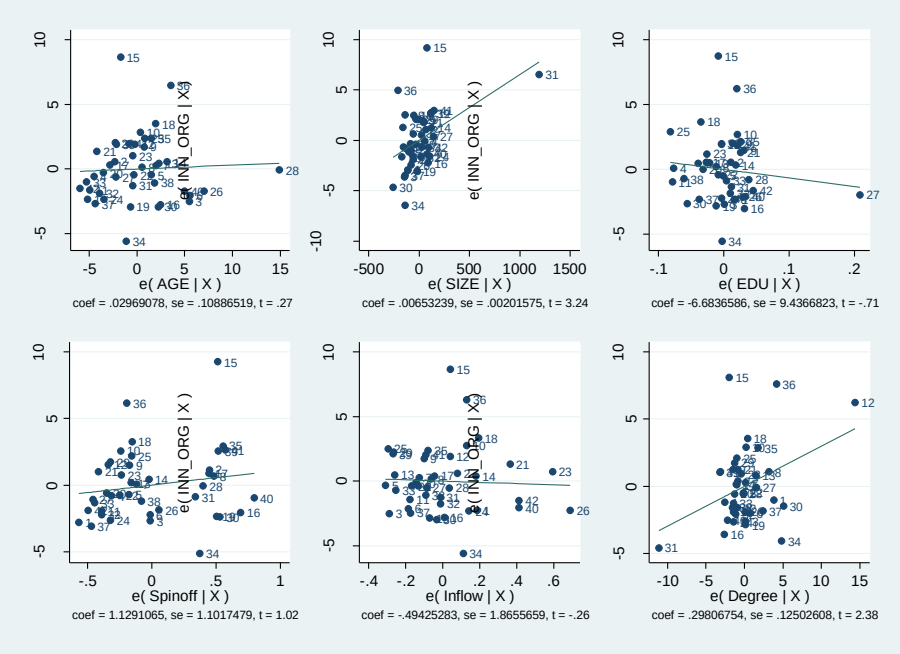



**Figure 5.10: Partial regression plots**

*Multi-collinearity*

To check for multi-collinearity, the variance inflation factor (vif) is computed in STATA after the regression. As a rule of thumb, a variable whose vif values are greater than 10 merit further investigation (Chen, Ender, Mitchell, & Wells, 2003). As can be seen from Figure 5.11, the multi-collinearity is not a problem for the present research.

| Variable | VIF | 1/VIF |
|---|---|---|
| SIZE | 1.77 | 0.563530 |
| Degree | 1.55 | 0.644876 |
| AGE | 1.41 | 0.710855 |
| Spinoff | 1.33 | 0.750449 |
| EDU | 1.18 | 0.845995 |
| Inflow | 1.07 | 0.934211 |
| Mean VIF | 1.39 | |

**Figure 5.11: The variance inflation factor for multi-collinearity testing**

*Influential points and outliers*

There are numerous approaches to identify outliers. Table 5.8 lists top 10 extreme cases, which are influential points and outliers according to their measurements via residuals, Cook's d and dfit, leverage, and dfbeta. These indicators both measure the influence of individual observations in the dataset.

**Table 5.8: Influential points and outliers in the research dataset**

Source: The author

| id | r | d | dfit | lev | Dfbeta (AGE) | Dfbeta (SIZE) | Dfbeta (EDU) | Dfbeta (Spinoff) | Dfbeta (Inflow) | Dfbeta (Degree) |
|---|---|---|---|---|---|---|---|---|---|---|
| **34** | -2.257 | 0.105 | -0.907 | 0.139 | 0.105 | 0.242 | 0.021 | -0.361 | -0.178 | -0.527 |
| **30** | -1.191 | 0.044 | -0.559 | 0.181 | -0.113 | 0.245 | 0.250 | -0.276 | 0.029 | -0.299 |
| **31** | -1.152 | 1.019 | -2.683 | 0.844 | 0.051 | -2.513 | -0.110 | -0.393 | 0.026 | 1.457 |
| **19** | -1.090 | 0.016 | -0.336 | 0.087 | 0.031 | 0.019 | 0.044 | -0.226 | 0.054 | -0.006 |
| **16** | -1.078 | 0.022 | -0.394 | 0.118 | -0.111 | -0.074 | -0.122 | -0.313 | -0.006 | 0.134 |
| **10** | 1.041 | 0.008 | 0.234 | 0.048 | 0.015 | -0.039 | 0.075 | -0.100 | 0.091 | 0.008 |
| **18** | 1.297 | 0.022 | 0.393 | 0.084 | 0.103 | -0.137 | -0.161 | -0.081 | 0.174 | 0.024 |
| **12** | 1.544 | 1.242 | 3.006 | 0.791 | -0.029 | 0.297 | -0.044 | -0.451 | 0.088 | 2.175 |
| **36** | 2.577 | 0.083 | 0.820 | 0.092 | 0.372 | -0.413 | 0.183 | -0.206 | 0.233 | 0.503 |
| **15** | 3.867 | 0.164 | 1.268 | 0.097 | -0.272 | 0.230 | -0.117 | 0.824 | 0.114 | -0.357 |

*Constant variance of the error terms (homoscedasticity)*

Homoscedasticity refers to the assumption of dependence relationship between variables, namely dependent variable exhibits equal levels of variance across the range of predictor (or independent) variables (Hair et al., 2018). Two statistical tests are conducted to check the assumption of homoscedasticity, namely the White's test, and the Breusch-Pagan test.

The White's test:

```
Cameron & Trivedi's decomposition of IM-test
```

| Source | chi2 | df | p |
|---|---|---|---|
| Heteroskedasticity | 22.26 | 26 | 0.6741 |
| Skewness | 3.26 | 6 | 0.7756 |
| Kurtosis | 1.59 | 1 | 0.2071 |
| Total | 27.12 | 33 | 0.7546 |

**Figure 5.12: The White's test results for heteroscedasticity**

The Breusch-Pagan test:

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of INN_ORG

         chi2(1)      =     0.05
         Prob > chi2  =   0.8214
```

**Figure 5.13: The Breusch-Pagan test results for heteroscedasticity**

The null hypothesis in two tests is that the variance of the residuals is homogenous. The p-values from two tests both inform that we cannot reject the null hypothesis (Figure 5.12 & 5.13). Hence, the heteroscedasticity (as opposed to homoscedasticity) is not a major problem for the regression model (H4).

*Normality of the error term distribution*

To check the normality of residuals, this study employs two approaches, graphical visualisation and statistical tests.

- **Graphical visualisation**

The graphical visualisation provides an intuition on the properties of the residuals. The kernel density plots compare the observed distribution of residuals with the normal distribution. As shown in Figure 5.14, the distribution of residuals is not normal distribution, with higher peak and heavier right tails.

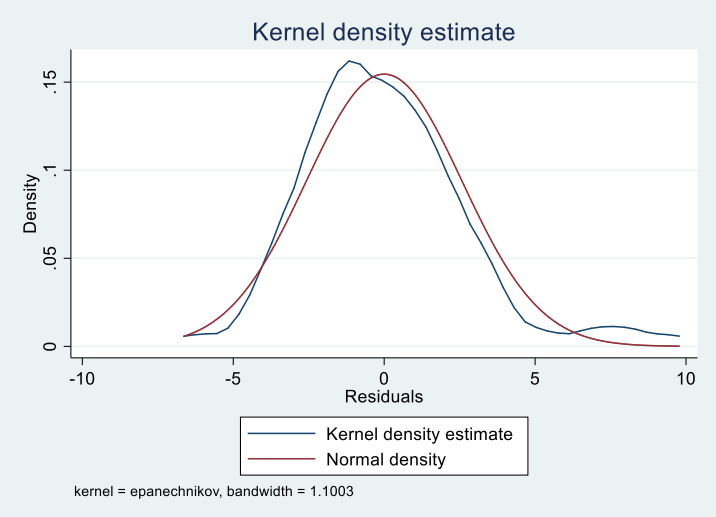



**Figure 5.14: Kernel density plot of residuals**

Other plots test the normal distribution of residuals including P-P and Q-Q plots. In particular, the standardised normal probability (P-P) plot detects any non-normality in the middle range of data, while the normal quantile (Q-Q) plot diagnoses any signs of non-normality in the tails of data.

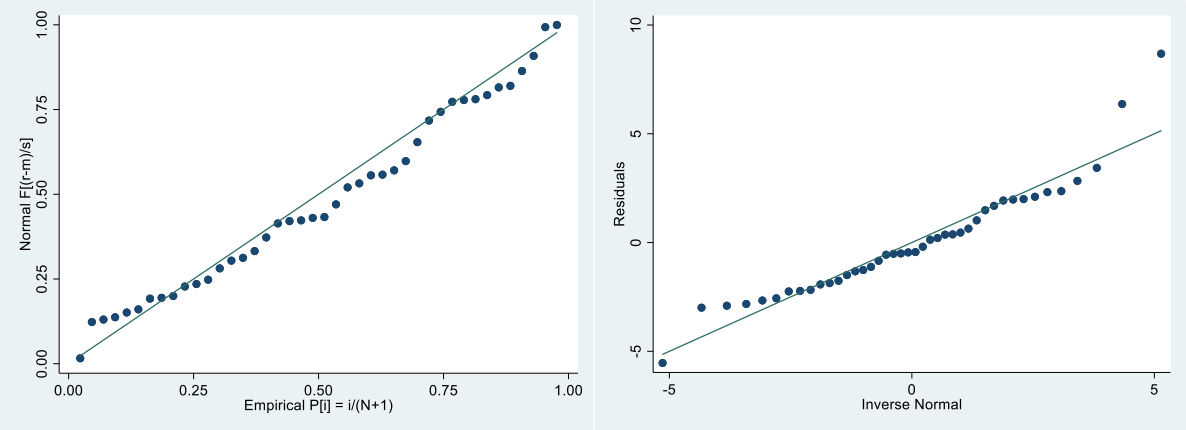



**Figure 5.15: The P-P plot (left) and Q-Q plot (right)**

All plots confirm that the residuals are not normally distributed (Figure 5.15). Next, the researcher conducts other statistical tests to examine the normality of residuals, i.e. via skewness and kurtosis tests.

- **Statistical tests to check skewness and kurtosis**

There are three statistical tests in use to check skewness and kurtosis, namely Shapiro-Wilk, Shapiro-Francia, and the Skewness and kurtosis tests. The null hypothesis in these tests is that residuals are normally distributed.

Shapiro-Wilk W test for normal data

| Variable | Obs | W | V | z | Prob>z |
|---|---|---|---|---|---|
| r | 42 | 0.93293 | 2.753 | 2.137 | 0.01629 |

**Figure 5.16: Shapiro-Wilk test of normality of residuals**

Shapiro-Francia W' test for normal data

| Variable | Obs | W' | V' | z | Prob>z |
|---|---|---|---|---|---|
| r | 42 | 0.92144 | 3.575 | 2.382 | 0.00861 |

**Figure 5.17: Shapiro-Francia test of normality of residuals**

Skewness/Kurtosis tests for Normality

| Variable | Obs | Pr(Skewness) | Pr(Kurtosis) | joint chi2(2) | joint Prob>chi2 |
|---|---|---|---|---|---|
| r | 42 | 0.0076 | 0.0176 | 12.77 | 0.0017 |

**Figure 5.18: Skewness and kurtosis tests for normality of residuals**

In common, the p values (Prob>z) in all the statistical tests are smaller than 0.05 (Figures 5.16, 5.17 & 5.18). Hence, the null hypothesis on the normal distribution of residuals should be rejected. In other words, according to the statistical tests, the non-normality of residuals is likely caused by both skewness and kurtosis issues.

All into consideration, both graphical visualisation and statistical tests show that the residuals are not normally distributed.

*Independence of the error terms*

This assumption requires that "*the errors associated with one observation are not correlated with the errors of any other observation cover several different situations*" (Chen et al., 2003, p. 1). A violation of this assumption causes serial correlation amongst error terms in the model. Since the dataset of this study is cross-sectional data, there would be no chance for autocorrelation, which often results from time-series data. Hence, the major concern is with the network variable, Degree, since these are measurements on related subjects. As a matter of fact, in the literature of SNA, the problem of dependence of error terms has been warned (Borgatti et al., 2018).

*Summary*

In brief, most of the assumptions of the classical least square estimator are satisfied except for the assumptions on residuals, i.e. independence of error terms and normal distribution of residuals.

Theoretically, the above violation of least square assumptions does not affect the 'unbiased' property of the least square estimator, but the calculation of standard errors. In other words, the least square estimator in this situation is still unbiased, but no longer the best, i.e. with the smallest variance. As a result, such violation on residuals makes the statistical results from t-test and F-test invalid.

Another striking thing to note is the existence of several outliers in the dataset, as mentioned in the linearity section. The principle of the least square estimator is to minimize the sum of

squared residuals; hence, the predicted regression line is extremely sensitive with the outliers. For this research, the presence of outliers is likely to be the main source of non-normality of the residual distribution. Therefore, other alternative estimators than the least square estimator are required to deal with outliers and to obtain consistent estimates of standard errors.

There are numerous methods to deal with non-normality of residuals and outliers. For non-normality, ones could transform the variables, e.g. log transformation, to achieve the normality of residuals. However, it is not desirable for the current research since once the variables are transformed, they no longer represent the initial concepts of our interest. Even when the data transformation may help to produce valid statistical results; nevertheless, making inference from the transformed dataset to the original dataset is questionable.

For outliers, technically, those outliers beyond the research interest could be deleted until we achieve the normality, and therefore valid statistical results from t-test and F-test. However, this option is not desirable for a couple of reasons. *First*, if we reduce the sample size, given the number of independent variable, we may lose the generalization power of the regression analysis (Hair et al., 2018). *Second*, the researcher does not aim to adjust the research interest for the sake of valid statistical results. Outliers are the potential source of innovators; and by excluding those, the current study may lose important information on some innovative firms within the research cluster. All into consideration, the present research will use robust regression analysis methods. The next section will discuss different robust regression analysis methods.

***Robust regression analysis methods***

There are a number of robust regression analysis methods to deal with the violations of least square estimator assumptions. Their principles are presented in Table 5.9.

**Table 5.9: Robust regression analysis methods**

| Robust regression methods | Principle |
|---|---|
| **Robust standard errors** | The coefficients remain the same as those of linear square estimator; however, the standard errors are adjusted to deal with heteroscedasticity and non-normality. |
| **Regression with the cluster option** | The coefficients remain the same as those of linear square estimator; however, the standard errors are adjusted to particularly deal with the violation of independent error terms. |
| **Median regression**<br>Proposed by Edgeworth (1887, cited in Verardi & Croux, 2009) | It minimizes the sum of the absolute values of residuals instead of the sum of squared residuals. |
| **Regression using M-estimator**<br>Proposed by Huber (1964, cited in Verardi & Croux, 2009) | It uses the iteratively reweighted least square, and treats extremely deviant cases (according to Cook's distance-d values) with lower weights. |
| **Regression using MM-estimator**<br>Proposed by Yohai (1987, cited in Verardi & Croux, 2009) | It minimizes the sum of standardised residuals (known as the spread of residuals) instead of the sum of squared residuals. |

Theoretically, the MM-estimator achieves higher efficiency and higher breakdown points, e.g. deal with a high level of outliers (Verardi & Croux, 2009). In terms of efficiency, referring to the quality of estimator, the current research uses two levels of efficiency, i.e. at 70% and 95%. In addition, there are two estimation steps embedded within the MM-estimator. At first, the MS-estimator will be executed to estimate the optimal scale parameter. This MS-estimator deals with dummy variable in the model more appropriately than the alternative S-estimator does. In the second step, the MM-estimator will use the previously estimated scale parameter to produce the statistical results. In STATA, there are two different command packages for the MM-estimator; one created by Jann (2012) (*robreg*), and the other by Verardi and Croux (2009) (*mmregress*). These two STATA packages are different in terms of its initial estimator. While **robreg** uses an improved version of S-estimator, **mmregress** uses the MS-estimator to deal with dummy variable.

Regarding the cluster option, the researcher generates a dummy variable, which takes value of 1 if the firm is connected within the informal network, and 0 otherwise (Table 5.10).

**Table 5.10: Creation of dummy variable for the cluster option in STATA**

| Dummy variable | Meaning | Number of firms |
|---|---|---|
| 0 | Isolated firms in the network | 18 |
| 1 | Connected firms in the network | 24 |

The following section will compare the results from different robust regression analysis methods.

### *5.3.3. Results*

This section compares the statistical results from different robust regression analysis methods on the proposed regression model (Table 5.11).

In terms of statistical power and sample size, Hair, et al. (2018) suggests that as a rule of thumb, the ratio of observations to independent variables should be at least 5:1. For the proposed regression model, the sample size is 42, and the number of independent variables is 6, so the acceptable value of R-square at the significance level $\alpha = 0.05$, should be at least 0.23. Table 5.11 confirms that all regression techniques except for M-estimator satisfy this threshold.

One thing worth of mentioning is that the M-estimator has only 40 observations. For the reason, technically, this method of analysis deletes observations with Cook's distance values greater than 1. To remind of the table of extreme values in the previous section, the M-estimator analysis has deleted observation 12 and 31, which have Cook's distance greater than 1 (Table 5.8). Besides, the R-square value produced by M-estimator is far below the acceptable value. Hence, this estimator is not reliable.

Regarding the absolute values of standard errors, in general, the robust regression methods both yield less variance than the least square estimator does.

Now, to examine the statistically (non)-significant results, three independent variables, i.e. AGE, EDU and Inflow, do not gain any statistically significant results through all regression methods. This result suggests that firm age, absorptive capacity represented by the average level of education, and LKS via labour mobility captured by the inflow rate of new employees do not significantly influence organisational innovation of co-located firms within QTSC.

Except for M-estimator, all estimation methods point out that SIZE has statistically significant results, typically in the MM-estimator, this variable is significant at the level of 1%. This means that firm size positively affects the organisational innovation at firm level. The coefficients of SIZE range from 0.006 to 0.0154. As a result, assuming other variables remain the same, this indicates a gap in terms of organisational innovation between a large firm and a micro firm. Or,

to translate into practice, a firm who expands its business may recruit more employees, but it does not always mean that that firm will automatically apply new organisational methods in their firms. However, up to some points of the scaling up, for example, recruiting one hundred employees more, that firm tends to seek new organisational methods to support their operation.

| Table 5.11: Regression analysis results | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Least square** | **Robust standard error** | **Cluster option** | **Median regression** | **M-estimator** | **MM-estimator** | **MM-estimator** | **MM-estimator** | **MM-estimator** |
| | | **reg** | **robust** | **cluster** | **qreg** | **rreg** | **robreg70** | **robreg95** | **mmreg70** | **mmreg95** |
| **AGE** | coeff | 0.03 | 0.03 | 0.02978 | 0.034 | 0.016 | -0.011 | 0.03 | 0.0145 | -0.009 |
| | std.err | 0.109 | 0.078 | 0.08 | 0.144 | 0.095 | 0.046 | 0.06 | 0.0507 | 0.0474 |
| **SIZE** | coeff | 0.007*** | 0.007*** | 0.0065** | 0.006** | 0.006 | 0.015*** | 0.006*** | 0.0154*** | 0.0144*** |
| | std.err | 0.002 | 0.002 | 0.0000165 | 0.003 | 0.007 | 0.004 | 0.001 | 0.0031 | 0.0036 |
| **EDU** | coeff | -6.684 | -6.684 | -6.683 | -10.12 | -6.639 | -4.48 | -6.726 | -1.101 | -4.918 |
| | std.err | 9.437 | 5.337 | 3.67 | 12.493 | 8.218 | 5.071 | 4.451 | 4.651 | 4.433 |
| **Spinoff** | coeff | 1.129 | 1.129 | 1.129 | 0.998 | 1.374 | 1.677 | 0.66 | 3.12*** | 1.557 |
| | std.err | 1.102 | 1.18 | 0.398 | 1.459 | 1.006 | 1.337 | 0.923 | **0.792** | 0.993 |
| **Inflow** | coeff | 0.494 | -0.494 | -0.494 | -1.893 | -1.261 | -1.519 | -0.821 | -2.389 | -1.437 |
| | std.err | 1.866 | 1.353 | 2.883 | 2.47 | 1.616 | 1.467 | 1.278 | 2.105 | 1.32 |
| **Degree** | coeff | 0.298** | 0.298** | 0.298** | 0.425** | -0.043 | 0.013 | 0.324*** | 0.0146 | 0.169 |
| | std.err | 0.125 | 0.125 | 0.0024 | 0.166 | 0.188 | 0.163 | **0.099** | 0.134 | 0.161 |
| **_cons** | coeff | 3.069 | 3.069** | 3.069 | 3.556 | 3.52 | 2.669* | 2.999** | 1.63 | 2.775*** |
| | std.err | 2.343 | 1.481 | 2.212 | 3.102 | 2.084 | 1.397 | 1.2 | 1.184 | 1.216 |
| **R-squared** | | 0.569 | 0.569 | 0.569 | 0.555 | 0.103 | 0.549 | 0.56 | 0.492 | 0.498 |
| **N** | | 42 | 42 | 42 | 42 | 40 | 42 | 42 | 42 | 42 |

**Significant at ***1%, **5%, *10%**

**Absolute values of standard errors are used**

**Model:** $INN\_ORG = \beta_0 + \beta_1*AGE + \beta_2*SIZE + \beta_3*EDU + \beta_4*Spinoff + \beta_5*Inflow + \beta_6*Degree + \varepsilon$

LKS via Spinoff gains its statistically significant result for one time only at the level of efficiency of 70% with the MM-estimator, which uses the **mmregress** command package. This estimator also yields the smallest absolute value of standard errors for Spinoff variable, i.e. 0.792, at the significance level of 1%. Its respective coefficient is 3.12. This indicates that assuming others remain constant; a spin-off tends to be more innovative with regard of organisational innovation. In fact, most of the spin-offs within QTSC are young firms, and derived from foreign invested firms and large firms inside QTSC. This could provide new evidence on KS from FDI to the domestic sector. Yet, such interpretation may need further evidence to support since Spinoff only results in significant result one time only. Also, the correlation analysis earlier points out that Spinoff does not have significant correlation with INN_ORG.

Meanwhile, the variable representing LKS via network, i.e. Degree, obtains the statistically results in 5 out of 9 scenarios. This is also the only channel of LKS has a significantly positive correlation with INN_ORG (Figure 5.8). Notably, in MM-estimator, only the one produced by **robreg** command package, which uses an improved version of S-estimator, produces the statistically significant result for Degree. Similarly, this method comes with the smallest absolute value of standard errors compared with those by other methods, i.e. 0.099. Notably, the MM-estimator with statistically significant result at the level of 1% on Degree is the one with higher level of efficiency, i.e. 95%. The respective coefficient is 0.324. It is quite reasonable to argue that LKS via social interaction exerts positive influence on organisational innovation of co-located firms inside QTSC.

Overall, according to the regression analysis results, only LKS via social interaction and spin-off obtain significantly positive results on organisational innovation at firm level. Yet, these results were not consistent through all regression analysis methods; hence it may require further qualitative evidence to enlighten the relation between LKS via different channels and innovation at firm level.

### 5.4. Chapter summary

This chapter has particularly deal with research questions RQ2, RQ3 & RQ4. The research has used SNA and regression analysis methods respectively to address these questions.

According to the SNA, the informal network inside QTSC is quite sparse, and less connected compared with some other software clusters in developing countries. The three most important actors, who also obtain the most crucial connections in the network, include an IT training centre, a large foreign pure outsourcing firm and a large domestic pure outsourcing firm. Also,

firm size and business association membership (VNITO) are found to be positively associated with the level of socialization of co-located firms inside QTSC; while legal ownership do not obtain statistically significant result to infer its association with the involvement of a firm in the network.

Also, the correlation analysis suggests the significance between the idiosyncratic characteristic of firms, i.e. firm age, firm size, and channels of LKS. In particular, the negative correlation between firm age and LKS via spin-off signals that spin-off tends to be younger. In addition, in agreement with the SNA results, firm size positively correlates with LKS via social interaction, meaning that larger firms tend to benefit more from LKS via social interaction. Surprisingly, absorptive capacity, represented by the average level of education, does not incur any statistically significant association with any channels of LKS, neither with organisational innovation at firm level.

Meanwhile, the regression analysis with robust techniques provides evidence on the positive influence of LKS via two channels, namely social interaction and spin-off, on organisational innovation at firm level. As opposed, LKS via labour mobility does not significantly contribute to organisational innovation of co-located firms inside QTSC.

The next chapter will provide complementary qualitative evidence to the quantitative results.

## Chapter 6: QUALITATIVE ANALYSIS & RESULTS

### 6.1. Chapter overview

This chapter will present qualitative findings from the template analysis on the collected semi-structured interviews under the light of relevant literature. By doing so, this chapter provides answers to most research questions. On the one hand, it supplies additional and complementary evidence for the findings from chapter 5 with respect to research questions RQ2, 3 & 4. On the other hand, by focusing on the localised institutional setting, this chapter is inter-related with chapter 4 of research context to address research question RQ1.

**Figure 6.1: Final template (short version)**

**1. Firm's intra-firm factors**
- ***1.1. Human capital***
  - *1.1.1. Quality*
  - *1.1.2. Quantity*
- ***1.2. Business Strategy***
  - *1.2.1. Knowledge searching behaviour: inward versus outward strategy*
  - *1.2.2. Leader's initiatives: fixed mind-set versus growth mind-set*
- ***1.3. Absorptive capacity***
  - *1.3.1. To locate and identify external knowledge*
  - *1.3.2. Internal absorption process*
  - *1.3.3. Means to upgrade absorptive capacity*

**2. Local linkage**
- ***2.1. Networking within QTSC***
  - *2.1.1 Relevance of networking events' topics*
  - *2.1.2. Frequency of networking events*
  - *2.1.3. Roles of relevant economic actors*
- ***2.2. Cooperation within QTSC***
  - *2.2.1. Forms of cooperation: recruitment and sub-contract*
  - *2.2.2. Reasons for weak cooperation within QTSC: relatedness,* problems regarding cooperation contracts, lack of an effective communication system, and lack of a cooperation culture
- **2. 3. Other forms of knowledge exchange**

**3. Global linkage**
- ***3.1. Type of linkage:*** *based on ownership, with clients, and partnership*
- ***3.2. Benefits of global linkage:*** *financial capital accumulation, knowledge accumulation and professional working skills*

As a result of the template analysis, Figure 6.1 presents the final template (a longer version can be found in Appendix B). This chapter structure will follow three top-level themes, namely intra-firm factors, local linkage and global linkage. The quotations in English will be used sometimes to support the arguments made in this chapter. In these quotations, words in the parentheses are of the researcher to summarise the opinion of participants.

## 6.2. Intra-firm factors

The theme of intra-firm factors consists of three sub-themes, namely human capital, business strategy and absorptive capacity.

### *6.2.1. Human capital*

The participants commonly report the challenges in human capital in terms of both quality and quantity; these challenges could directly influence the absorptive capacity of firms.

In terms of quality, a strong theme to emerge amongst participants is that the available labour force is not ready to work; hence, most of firms have to conduct training activities for their own employees.

The labour input evidently does not meet the expectation of firms inside QTSC. In particular, four outstanding types of knowledge and skills, that the labour force in the software industry is currently in short of, are technical/technological knowledge, business mind-set, transferable skills and language skills. Probably, this problem is the most acute amongst fresh graduates. For example, Participant 156 stated that fresh graduates struggled with practical issues at work:

> …I only gave them (fresh graduates) a small piece of programming, but they could not do it, it means even they finish their study at school, but they know nothing … (Participant 156, 24:45)

One possible reason in explanation for the low quality of labour force in the IT sector could be due to the rapid technological changes. While global technology changes every day, the study syllabus in schools may take years to catch up (Participants 118, 126).

Another contributing factor to the outdated knowledge provided at higher educational institutions is associated with the capability of these institutions. There is evidence that even lecturers are far away from practical knowledge, especially knowledge about modern technology (Participant 143). In addition, the research facilities of these institutions are not comparable to those of some large firms, adding up to barriers against the accessibility of practical knowledge to both lecturers and students at these institutions (Participant 121).

Nevertheless, it does not mean that every participant complains about the technological knowledge of labour. In fact, Vietnam has currently enjoyed a benefit due to its demographic golden age, i.e. there is an abundant source of young and fast-learning IT labour force (VINASA, 2017). Some interviewees appreciate the learning attitude of young employees (Participant 134) and focus on improving the business mind-set of their employees besides technological knowledge (Participant 101).

Apart from the limited quality of the labour pool, firms inside QTSC confront a common problem of the Vietnamese ICT industry, i.e. labour shortage (MIC, 2019). Like firm 111 below, the industry lacks skilled labour in new technologies:

> …when we are requested to work with new technology …we need to make sure to recruit appropriate employees with knowledge about new technology, but we could not always find such qualified employees… (Participant 111, 12:05)

As a result, a recurrent theme in the interviews regards the recruitment problem. Theoretically, the geographical proximity to higher educational institutions and job training centres will grant clustered firms an advantage in recruitment (Manning, 2013). However, the labour supply from institutions and firms inside QTSC plays a minor role for two reasons (Participant 103). *One*, the training subjects of these higher educational institutions are not always relevant to software industry. *Two*, the internal labour mobility amongst firms inside QTSC does not emerge to be of significant importance. As a consequence, many firms mostly recruit from universities and colleges outside QTSC.

For the labour mobility within QTSC, as mentioned earlier, firms do not record any statistic data on previous working place of their employees. Notably, according to the interview data, labour mobility amongst co-located firms is not particularly prominent. Evidently, workers previously working inside QTSC apparently obtain few outstanding qualities compared with their colleagues from outside:

> …I think there is no difference (between employees inside and outside QTSC)…and our employees are treated equally regardless from other companies inside or outside QTSC … (Participant 107, 23:38).

> …for employees from other companies inside QTSC, there are only a few… (Participant 133, 9:59).

> …we post on Vietnamworks to recruit new employees, we do not concern whether it comes from inside or outside QTSC… (Participant 119, 16:54).

As a result, the wage of IT employees increases but mainly due to the shortage of quantity rather than the equivalent increase of labour quality (Vu & Austin, 2014). This is also confirmed in the interview with firm 133:

> …fresh graduates in ICT sector now have many options, the demand for ICT human resource is bigger than its supply, meanwhile their capability is limited … (Participant 133, 10:37).

Besides, the agglomeration externalities are unequal amongst firms; of which medium-to-large firms with wealthier financial resource have advantage to tap into the scarce human resource

(Participant 108). As opposed, micro-to-small enterprises (MSEs) are likely to suffer most in the recruitment matter, like Participant 150 mentioned below:

> …many fresh graduates with little working experience request us a high level of salary, meanwhile their expertise is insufficient to meet our requirement … (Participant 150, 12:32).

Another striking point to note is that given the shortage of skilled IT employees, and the majority of firms inside QTSC are outsourcing vendors, a large number of IT workers are being drawn to the outsourcing industry with limited innovativeness (Participant 117). Also, the insufficient labour quality and quantity cause challenges for firms inside QTSC. Firms have to allocate their resources to train their own employees, which could have been spent in innovative activities. Consequently, it may reduce the competitiveness of firms in the market (Participant 133).

In this relevance, training is an integral part of co-located firms within QTSC to build up and improve their absorptive capacity. This matter will be discussed in the next section.

#### *6.2.2. Absorptive capacity*

This sub-theme is structured following the conception of absorptive capacity, referring to the ability to acquire, assimilate, transform and exploit external knowledge (Jiménez-Barrionuevo et al., 2011). At first, this section explains how co-located firms inside QTSC locate and identify the external sources of knowledge for their innovation. Then, it illustrates the internal absorption process before reporting means to upgrade absorptive capacity by firms.

*Firstly*, firms reported several ways to identify and locate the useful sources of knowledge for their innovation. Only a few firms rely on their specialised R&D departments with their own innovation centre (Participant 149). The rest mainly counts on personal network (Participant 107) or expertise of their senior staffs (Participant 111)

*Secondly*, with regard to the internal absorption process, some interviewees explain the process how they work out external knowledge and information to make use of them. For example, Internet is a rich and diverse source of useful knowledge; however, to exploit knowledge from Internet requires critical thinking and problem-driven mind-set.

The internal absorption of external knowledge principally consists of trial and implementation process. This is the process when firms combine their own knowledge with their external sources of knowledge to make something of their own; this also represents the internal knowledge creation process. For example, one interviewee shares that, given the public availability of relevant knowledge in new technologies is limited, his firm has to self-study and develop their own knowledge in this area (Participant 155).

*Lastly*, due to the inferior quality of labour input, and the rapid changes in technology development, the participants also report on activities conducted at their firms to upgrade their absorptive capacity. There are three emerging forms of upgrading absorptive capacity, namely training activities, improving working methodology and developing a learning culture.

Of which, as the most popular code found across the transcripts, the training activities involves online courses, inviting teachers, experts come to train employees at firms, and sending staffs to abroad. Regarding online courses, firms encourage and sponsor their employees to participate in the mass open online courses to self-study. Those firms who are able to send their staffs abroad are those with global linkages, i.e. either with their parent companies or their partners (Participants 103, 114). While this form of training is mostly at individual level, there are other activities at larger scale such as inviting teachers, lecturers and experts to the company office for training. Typically, in the interview with one of the colleges inside QTSC, evidence of cooperation in training activities has been found:

> …we provide training for some companies, we signed many contracts and from next week, we will train Photoshop skills for some companies in Anna Building. This is the 2nd contract we have won to train in Photoshop skills for companies (inside QTSC)… (Participant 112, 10:38).

Beyond that, several firms strengthen their absorptive capacity with more strategic approaches, i.e. improve working methodology and developing learning culture. Especially, regarding the working methodology, the qualitative analysis finds evidence to support the quantitative findings. In particular, some MSEs acknowledged that to scale up, they need a professional working methodology. Like one interviewee expresses his concern that without a working methodology, all employees are afraid to make decision on their own initiatives, but rather come to seek approval from the firm owner (Participant 108). Likewise, some micro firms do not apply any standardised working process at the moment, but will intend to do so in near future considering it as an indispensable requirement to expand their business (Participant 120). A standardised and professional working methodology involves working methods to improve the efficiency and productivity of individual employees and a firm as a whole (OECD, 2005); this is likely to lead to organisational innovation. In other words, once firms expand their size of employees, there is a high possibility that they become more organisationally innovative.

In relevance to the learning culture, it consists of self-study at individual level and collective learning at a larger scale inside firms. In the first strand, regular training activities help to establish a learning habit and learning interest of individual employees. In the second strand, a few firms, those with potential innovative capability, promoting collective learning is a mean to

build up their learning culture - an integral part of their business culture. Some practices to promote learning culture are shared, such as the weekly knowledge exchange event at firm 101.

The collective learning activities do not necessarily happen at one physical place. With the support of advancements in communication technology, one participant mentions about the weekly online meetings at his firm as below:

> …one basic training we conduct every Saturday morning involves employees from three offices in the North, Central and South of Vietnam, via online meetings to share the most updated information… (Participant 143, 21:19).

The frequency of these learning events would help firms to foster their learning culture. In turn, this will improve their absorptive capacity. As opposed to the popularity of training activities, other means of upgrading absorptive capacity, namely improving working methodology and developing a learning culture, are not particularly common amongst firms. Probably, these practices require a more strategic vision of the firm leaders; these practices would gradually form new organisational routines which help to distinguish innovative firms from the rest. The next section moves on to discuss the business strategy.

### *6.2.3. Business strategy*

There are two dominant sub-themes on business strategy, namely knowledge searching behaviour and leader's initiatives. Each sub-theme is divided into two codes, reflecting two divergent aspects. Table 6.1 demonstrates the colour coding for codes under the business strategy theme by business activities of firms participating in the research.

**Table 6.1: Colour coding for codes under the business strategy theme**

**Knowledge searching behaviour**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inward strategy | 101 | 103 | 104 | 105 | 107 | 111 | 114 | 115 | 119 | 126 | 150 | 156 | | |
| Outward strategy | 108 | 117 | 118 | 120 | 123 | 133 | 134 | 143 | 145 | 149 | 151 | 152 | 153 | 155 |

**Leader's initiative**

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fixed mind-set | 103 | 104 | 105 | 107 | 111 | 115 | 119 | 150 | | | | | | | | |
| Growth mind-set | 101 | 108 | 114 | 117 | 118 | 120 | 123 | 126 | 133 | 134 | 143 | 149 | 151 | 152 | 153 | 155 |

**Colour coding:**

| |
|---|
| Production |
| Mixed (both outsourcing and production) |
| Outsourcing |
| Others activities than software |

**Missing cases:**

The leaders' initiative in firms 145 & 156 are unclear.

To testify the correlation between software business activities with knowledge searching behaviour and leader's initiatives, the independence testing by two equivalent chi-square tests is conducted. The null hypotheses are that knowledge searching behaviour and leader's initiatives are independent of software business activities. The p-values in the respective tests are 0.037 and 0.005, which are both less than 0.05. Hence, we can reject the null hypotheses. This indicates that knowledge searching behaviour and leader's initiatives are distinctive amongst different groups of business domains.

As shown in Table 6.1, pure outsourcing firms tend to obtain inward strategy and fixed mind-set. Those firms in general do not have an internal department dedicated for market development. They are heavily dependent on either a few clients or their mother company only. Typically, these firms choose stability instead of sustainability. For a few firms, this strategy applies at least at this stage of their development. However, for the remaining outsourcing firms, those firm leaders expect to change nothing with the way their firms are currently operated in the foreseeable future.

Meanwhile, firms involving in software production tend to obtain an outward strategy and growth mind-set. Yet, it does not necessarily mean all firms with production activities obtain an outward strategy. Firms numbered 101, 126 and 156 are exceptional cases. These three participants provide different reasons. For instance, firm 126 was originally an outsourcing firm, but recently shifted to software production since 2017. As explained by the firm owner, the main reason for keeping knowledge internally within the firm only is the uniqueness of their business field in Vietnam, i.e. new technology - Block chain. The other two cases have been explained

earlier; for case 101, the inward strategy aims to build up their internal capability at this stage of development; while case 156 is afraid that their business secret is stolen if sharing knowledge with external actors.

Table 6.1 also shows a few exceptions. A couple of outsourcing firms appear in the outward and growth mind-set categories. This suggests that outsourcing firms are not necessarily less innovative. These firms potentially have high innovative capability. For instance, firm 123 is in a transitional stage, where they aim to shift beyond outsourcing to make their own software products. The firm owner constantly expresses his interest in cooperation and resource sharing but there are so many challenges against his will. Meanwhile, the firm owner numbered 145 actively makes use of his personal network to gain sub-contracts from other companies inside QTSC. To remind of the SNA results, firm 145 has the highest brokerage score amongst spin-off firms inside QTSC.

The following part will elaborate the codes of knowledge searching behaviour and leader's initiatives.

***Knowledge searching behaviour***

Knowledge searching strategy is important for firms to identify the sources of knowledge and exploit them to a commercial end (Roper & Love, 2017). This in turn enables firms to carve out the opportunities in competitive environment for their innovation. For knowledge searching behaviour, two emerging codes emerge from the analysis, i.e. inward strategy and outward strategy.

*Inward strategy*

For those firms categorized by inward strategy, knowledge is majorly circulated internally within the firms or between firms with their mother companies only. Some young firms make excuses for not actively seeking external knowledge from cooperation and networking due to their limited resources; hence, their firms focus on building the internal capability at this stage of development (Participant 101). Similarly, other small firms share a common thought. As can be seen below, participant 145 explains that his company needs to prioritize internal problems. Meanwhile, participant 150 argues that they need to build up their internal capability to a certain level in order to cooperate and share knowledge with external economic actors.

> …I have to solve other internal problems in my company, rather than putting the external linkages at first…
>
> (Participant 145, 26:53).

> …due to our less experience than theirs (other companies inside QTSC), we are only nearly 2 years old, and we are taking step by step to learn new thing and market, until when we feel confident, completed and … strong enough, then we will seek cooperation… (Participant 150, 8:09).

Some firms follow inward strategy since they seriously consider LKS as a cost so they tend not to share or publish their own knowledge. The case of firm 156 is an interesting example. This is a production firm, meaning that they create their own software for sales, but they are too afraid to open up for technological cooperation opportunities. One of the reasons being shared is due to weak IPRs protection systems in Vietnam. Thus, instead of registering copyright for their software, they choose to keep it as business secret. For the same reason, they turned down a technological cooperation opportunity with an Indian company. The quotation below illustrates their disfavour in sharing technological matters:

> …small companies like us are afraid of losing our competitive advantage in cooperation; for software development, the idea is important, if our idea is leaked, then if other company invest in about 10 good staffs, each person costs about 20 million VND, then they would have a similar product, so we are afraid that our ideas could be stolen. I know that some Vietnamese companies encountered in that situation… (Participant 156, 52:45).

*Outward strategy*

Meanwhile, those firms with outward strategy are evidently more active in reaching out for multiple sources of knowledge for the benefit of innovation and business development. Those appear to obtain a higher level of awareness of innovation as well as the importance of cooperation and learning to innovation at their firms. Typically, firm 149 – one of the biggest IT company in Vietnam with their own innovation centre inside QTSC – exemplifies this point.

> …innovation is the core of competitive capability so we have to invest a lot, like we invest in our own Innovation centre… recruit personnel who used to study abroad, and specialised in new technology... we send our employees for extra training courses… invest in training our employees about new technology… take part in conferences and trade affairs in relevant to new technology … (Participant 149, 8:22).

To remind, the above-mentioned firm also acts as one of the most crucial actors in the informal network (chapter 5). In addition, for firms with outward strategy, in exchange for mutual knowledge exchange, those express their willing to share and to contribute to the local community (Participant 151).

Another noteworthy point is that some firms are in favour of outward strategy but they seek no successful cooperation inside QTSC such as the case of firm 117:

> …within QTSC, we don't really collaborate with other firms, we are continuously investing in opportunities but it has never responded… (Participant 117, 6:50).

The reasons for such poor cooperation within QTSC would be addressed in details in section 6.3 of local linkage.

***Leader's initiatives***

In literature, firms with risk-taking attitude and proactive approach in seeking knowledge tend to be more innovative (Miller & Friesen, 1982). Similarly, the industrial cluster literature stresses that firms in developing countries need 'strategic intent' to deliberately innovate by the means of upgrading (Bell & Pavitt, 1993; Humphrey & Schmitz, 2002). Hence, for the code of leader's initiatives, two forms of mind-set are concerned, i.e. growth mind-set[xix] and fixed mind-set. Both of these two codes are scanned throughout each individual transcript to decide which type of mind-set the interviewee leans toward. While the growth mind-set associates with risk-taking attitude, the fixed mind-set associates with risk-averse attitude.

*Fixed mind-set*

Firm leaders identified with fixed mind-set are often associated with a risk-averse attitude. Especially, this type of mind-set is popularly found amongst foreign pure outsourcing firms. Those fixed mind-set leaders have cited the reliance on their mother companies as an excuse for their passive behaviour in making changes (Participant 105). There is a sense running through the whole transcripts of these interviewees that their hands are tied given current situation, such as the case below:

> …our company in Vietnam ***could not innovate ourselves***, but we are reliant on the mother company …we are ***completely dependent*** on the mother company (3:58) … we ***don't have to care*** (about finding clients) because the mother company will take charge of everything else (16:08)… we don't have any Vietnamese clients, and only have several staffs so we are quite isolated; I think we ***don't have any demand to change*** the way we operate in order to adapt with market demand or clients' needs... (17:32) (Participant 103) (emphasis added).

At the same time, firm leaders with fixed mind-set do not plan any significant and transformative changes in future with their firms; especially, many do not concern any long-term strategy at all. For example, the rejection of changing or improvement needs recur throughout the transcript of Participant 119 below:

> …we ***don't care*** about market information, because when we finish our job, and return the products to clients, they will sell the products (8:03) … there is ***no difficulty*** (in exchanging knowledge and information with the client) (9:33) …because ***we have done it over and over again*** (11:45) … we ***haven't thought about it*** (innovation), we only focus working to finish the orders from the client… (14:59) … I ***have not thought about that*** (cooperation with companies and institutions inside QTSC) (17:36)… I ***do not think of any benefits*** (of outsourcing) for innovation in our job and our company (19:27)... (Participant 119) (emphasis added).

*Growth mind-set*

As opposed, firm leaders with growth mind-set tend to obtain a risk-taker attitude. The outstanding characteristic of this group is dynamic, i.e. favouring continuous changes and learning, and daring to take risks in new technology, new market and new management method. For example, one interviewee stresses the demand for innovation at her firm in order to catch up with the technology trend in the market:

> …we have to ***constantly innovate*** … follows market trend ... so we ***must update and follow this trend***; we have to build our infrastructure and facilities so as to optimize the operational costs and to ***increase the efficiency of availability of our infrastructure***; ... we ***have to look for new technology*** (4:28)… we ***always find a way to innovate*** ... so we ***have to invest in facilities and equipment*** (14:51)… (Participant 152) (emphasis added).

The two-year-old and spin-off firm below candidly discusses his endeavour toward new technologies in niche markets despite the associated uncertainties and risks.

> …we would ***rely on market demand***, if there is huge market demand and the ***level of competition is high***, especially in new technology, … (like other young companies, we) will ***follow those dynamic industries with rapid changes***; ... innovation must depend on ***market demand***, and the ***innovative mind-set***... (Participant 155, 10:34) (emphasis added).

### *A comparison*

By comparing across cases, it can be seen that the divergent mind-set of firm leaders and knowledge searching behaviour strategies can influence LKS and innovation of co-located firm to varied extent. Two pairs of firms, i.e. (119, 143) and (119,118) are selected to demonstrate these nuances of influence.

*Case 119 versus case 143*

Firm 119 places itself to be an outsourcing firm; however, in fact, they create their own software integrated with chip products from an American company. This resembles the case of firm 143, which creates software integrated with air conditioner products from Japanese companies. However, firm 143 has produced additional products on their own; hence, they recognize themselves as a production firm. As a result, the two respective interviewees represent quite contrary mind-sets and strategies for their own firms. To describe the foreign companies whom they create the software for, firm 119 calls them 'client', whereas, firm 143 indicates them as 'partner'. While firm 119 is a passive learner and highly dependent on a single client, firm 143 takes a proactive learning approach and obtains a more balanced relationship with their foreign partners. Likewise, firm 119 could only absorb unintentional and passive knowledge flow due to the pressure from their clients:

> …every year they come up with a new electronic circuit, so we have to follow them... (Participant 119, 19:48).

Meanwhile, apart from the similar pressure from their partners, firm 143 actively seeks new knowledge from multiple sources and therefore to be able to intentionally accumulate knowledge from these sources. The below extract highlights the growth mind-set of the interviewee numbered 143:

> …if they (the foreign partners) change, we must follow, or even we must perform better than them (21:19) … ***We follow ISO and VCA (international standards)*** (30:55) ... we have to ***renew our mind-set and perception in customer relationship***, etc. The important point is that it helps to upgrade our brand name, we could be considered as the number 1 in our business field in Vietnam… (31:19) (Participant 143) (emphasis added).

In addition, while firm 119 is completely isolated and only works **for** their client abroad, firm 143 works **with** their foreign partner to jointly develop a combined product for sales in the Vietnamese market (emphasis added). The latter firm also maintains its close relationship with a variety of stakeholders, particularly not only with other branches of their company group in Hanoi and Da Nang, but also with Vietnamese universities and clients.

One final thing to note is that knowledge flows from foreign firm to domestic firm both occur in these two cases. However, in the case of firm 119, such knowledge and expertise fail to spread beyond the boundary of this domestic firm. Meanwhile, in the case of 143, with a growth mind-set of the leader and their outward strategy, such knowledge and expertise are more likely to

expand to other actors in Vietnam. This represents the transformation of knowledge flows from global linkages into local communities.

*Case 119 versus case 118*

While the cases of 119 and 143 share the commonality in terms of the nature of their software, both firms 119 and 118 are spin-offs from foreign invested outsourcing firms inside QTSC. Nevertheless, their divergent mind-sets distinguish the business development direction of their firms.

Despite the fact that these two firm owners both have more than 10 years of working experience before setting up their own business, their business journeys have turned disparate directions. In particular, while firm 119 continues with the outsourcing industry, firm 143 aims to create his own products.

When being asked about their entrepreneurial journey, i.e. how they decided to quit their jobs at foreign invested firms to establish their own business, the two interviewees answered completely differently. While firm-owner of case 119 only seek financial independence, the one in case 118 desire to create something new.

As mentioned earlier, firm-owner of case 119 does not plan any significant change with his firm and could not predict any changes in the market. In other words, he has no long-term strategy to deal with the future scenario, if his one and only client would abandon his firm to other outsourcing vendor. He rather chooses stability – continues what his firm is doing - rather than sustainability – changes to adapt with market demand. As a consequence, for them, there is no need to expand the business, and if nothing changes, firm 119, currently with a size of 10 employees, would become smaller and smaller. Again, in this case, spin-off in the mere form of outsourcing presents limited extent of LKS to other co-located actors – since there is no linkage with Vietnamese market and no knowledge sharing activities by this firm at all.

As opposed to firm 119, firm owner numbered 118 expresses his risk-taking but not reckless attitude. Before setting his own business, he knew what type of knowledge he was missing. This firm owner had a technical background with management experience after 10 years working for a Japanese outsourcing firm inside QTSC. Then, to open his own business – a start-up company, he has sought specialised knowledge in entrepreneurship and innovation from an incubator inside Ho Chi Minh City. At the same time, he has set up another outsourcing company to finance the research and development activities for his start-up. Especially, this firm owner recognizes the potential risks his firm may face, but still desire to move forward and to embrace the changes:

> …I prepare myself with a thought that 90% of start-ups fail …so there is only the concept of stage/phase of development for a start-up, rather than the concept of success… I will expand to other industries, like payment, delivery, food, plane ticket, restaurant, hotels, accommodation, catering services, and public services, etc. in order to create an ecosystem… (Participant 118, 28:50).

Strikingly, all the apps or software used for internal management inside his firm are written mainly by himself owning to his intensive working experience. Therefore, this outstanding case illustrates how spin-off can be a successful channel of LKS for innovation.

Overall, this section has illustrated the intra-firm factors theme including human capital, absorptive capacity and business strategy. The internal characertistics stress the idyosyncratic nature of firms, their resources, strategies and routines, which in turn affect the flow of LKS and innovation. The next section moves on to explain the theme of local linkage to unpack the critical points regarding knowledge exchange within QTSC.

### 6.3. Local linkage

The local linkage theme uncovers connections of co-located firms with a focus on the intra-cluster linkage without losing the narrative of other connections between clustered firms and external actors outside QTSC but still within Vietnam. It consists of three sub-themes, i.e. networking within QTSC, cooperation within QTSC, and other forms of knowledge exchange between firms inside QTSC with other economic actors. The codes inside this theme interactively shape the status quo of local linkage amongst co-located firms inside QTSC.

#### *6.3.1. Networking within QTSC*

The findings in this theme could be complementary to the findings from SNA earlier. Chapter 5 has spotted several isolated firms in the network; however, the reasons of such isolation remain unknown. This section will enlighten some of the reasons for the isolation problem inside the cluster.

Co-located firms inside QTSC in general only meet each other in the regular networking events organised by QTSC Development Company. These are the Chief Executive Officer (CEO) and Chief Technical Officer (CTO) club meetings, scheduled to occur every month. However, there is proof that these networking events are ineffective in facilitating LKS amongst clustered firms. The interviewees reported on the problems in association with the assigned role of participants, networking topics, and frequency of these events.

***Role of relevant actors & the relevance of networking events' topic***

QTSC Development Company acts as the focal contact point – an organiser, administrator and co-ordinator. They organise visit tours and other networking events allowing co-located actors inside and outside QTSC to meet and exchange information. Particularly, firms could have a chance to seek business opportunities in networking events organised by the QTSC Development Company. However, there is little evidence found in the transcripts on how these meeting events blossom into cooperation.

Meanwhile, medium-and-large firms act as the key presenters about organisational and technological topics in the monthly gathering events. Two important points are noteworthy here.

*First*, the key role of medium-and-large firms in networking events is in agreement with the finding relevant to hypothesis H2 from SNA. At the same time, despite the majority of firms inside QTSC are MSEs, and some MSEs are potentially innovative and capable of new technologies, firms from this group are absent in these networking events. To delve into the qualitative data, two reasons could be found to explain for their absence.

*One*, two groups based on size, i.e. medium-and-large versus and micro-and-small firms prioritize different matters in terms of organisational and technological issues. An interviewee helps to elaborate this point by referring to the matters of taxation and recruitment as following:

> …for example, regarding taxation, SMEs like our company usually encounter difficulties in taxation matter, but those seminars are ***irrelevant*** to taxation, or regarding human resource, the human resource concern for big companies are ***irrelevant to that for SMEs***… the problem is that we (small versus big companies) ***do not share much commonality*** in problems we are facing…. (Participant 123, 8:30) (emphasis added).

Admittedly, sometimes, there are common topics to all software firms, e.g. new regulations for the IT industry (Participant 105). Or there could be topics useful for MSEs, such as how to scale up from a small to a medium-and-large firm (Participant 108). Nevertheless, the majority of medium-and-large firms inside QTSC are working in the outsourcing industry. Hence, in general, MSEs, especially those not involving in outsourcing industry, find little useful information to apply at their firms from the presentations by medium-and-large firms. This argument connects with the code of 'relevance of networking events' topic' (Section 2.1.1 in Figure 6.1).

The topic of discussion serves the interest of main population of firms inside QTSC, which is software outsourcing. This in turn discourages the engagement of firms in the minority groups,

such as 3D laser scanning technology (case 153), advanced fibre optic components for telecom or Datacom applications (case 104), technologies in data centres (case 152). In common, these firms are working on very interesting areas in new technologies, which Vietnam is lagging behind the world; but unfortunately, there is no communication opportunities for these firms to share about their knowledge to the technical community inside the cluster.

*Two*, besides, to participate in the networking events, micro-and-small firms could not figure out a way to contribute to the networking events alike. Like the case of participant 145, for him, it would be humiliated to present in front of directors or managers of medium-and-large firms. A network should be based on mutual or reciprocal benefits; in other words, one needs to 'give' in order to 'take'. If a firm has nothing to share with their community, there is no sense of belonging to the community. This point can be illustrated through the quotation below:

> …I don't have many private conversations with any particular companies here, even in the CEO club, sometimes, I feel lost/isolated since there is no other company in my field except ours ... (Participant 103, 20:27).

Once firms feel lost amongst irrelevant discussion, they would finally give up their participation in such events (Participant 126).

*Second*, the analysis uncovers an important type of actor missing from networking events inside QTSC, i.e. academic institutions such as research institutes and higher education institutions. Knowledge is in nature a type of public goods; there is no way large firms voluntarily share their knowledge for free. That partly explains for the reason why some firms comment on the irrelevance of discussion topics, e.g. *"…their core technical issues, which I want to know, were not shared…*" (Participant 126, 10:20). The involvement of a research institute for example could have helped to balance the knowledge sharing relationship amongst co-located actors inside the cluster.

***Frequency of networking events***

Another reason which ruins the interest of co-located firm in joining the cluster community is the frequency of networking events, especially CTO club. At first, this club initiative was an extremely welcomed by clustered firms (Participant 108). It would be conducive to establish a technical community inside the largest software cluster in Vietnam. However, the club meetings have occurred irregularly and evidently failed the expectation of clustered firms (Participants 108, 123 & 151).

Again, one of the reasons is probably due to the assigned role of key presenters to medium-and-large firms. There is a propensity of firms not to share knowledge if they consider that as a cost for their firms, unless medium-and-large firms could earn any rewards or benefits from their sharing. In addition, the engagement of MSEs with knowledge about new technologies, and of academic organisations as key presenters could have saved the CTO clubs. The presenting role if to be shared amongst a variety of participants, and in a diversity of technological topics would help to build up a technical community. Of which, the frequency of such events would strengthen trust amongst participants and further promote LKS within the cluster.

Overall, to partly explain for the isolation problem within QTSC, this section has presented three main reasons. They are due to the unbalanced role of presenters in networking events, the irrelevance of discussion topics and the low frequency of these events. Tackling these problems would encourage the participation of currently isolated firms.

### *6.3.2. Cooperation within QTSC*

This theme turns to formal network inside QTSC, by reporting two sub-themes, namely forms of cooperation and reasons for the currently weak cooperation.

#### *Forms of cooperation*

The innovation survey reveals the sparse nature of cooperation network inside QTSC (section 3.4.4 in chapter 3). Findings from the qualitative data further confirm this fact. In general, the cooperation activities inside QTSC, are mostly for the recruitment purpose and for sub-contracting.

*Recruitment*

With regard to recruitment, the training and educational institutions inside QTSC can partly supply the human resource for firms, i.e. interns and graduates. Firms can sign contracts with higher educational institutions and the IT training centre inside QTSC to recruit interns and graduates. Nevertheless, as addressed in the theme of human capital, the supply of IT labour force from inside QTSC is quite marginal.

There is evidence that geographical proximity plays a role here, to enable some firms recruit students from surrounding institutions (Participants 120, 123). Yet, geographical distance from the cluster to the city centre is evidently a challenge in terms of recruitment to most firms; especially those could not find appropriate labour force from inside QTSC. Like participant 151, he prefers to relocate his firm to another technological concentrated park in closer proximity to the city centre or to the universities.

In the matter of recruitment, one striking case is noteworthy, namely the IT training centre, numbered 131, a spin-off institution from the joint initiative of QTSC Development Company, a private higher education institution and VNITO. According to the SNA result, this institution has the most crucial linkage inside the cluster together with firms numbered 115 & 149. This is a typical example of cooperation between different stakeholders, i.e. public-academic-business cooperation, to deal with a common industrial problem. The objective of this training centre is to provide ready-to-work human resource for member firms of VNITO. This helps firms to save their resources, which would have spent on training their new employees, on other important matters. The initiative to establish this spin-off institution stems from the urgent demand in skilled human resource for the ICT sector in Vietnam (Participant 131).

While QTSC Development Company acts as a bridge to attract firms from VNITO, the private higher education institution is in charge of training activities. Firms from VNITO also contribute by providing their job requirement information, so as the training centre could tailor its syllabus to fit with the labour market demand. VNITO firms also exchange knowledge and information with the training centre through seminars and presentations on new technology for students.

The quality of labour output from this training centre satisfies, yet, its quantity is far from the demand of clustered firms. Let alone, as revealed by the deputy director of this training centre, only 50% of their graduates working for firms inside QTSC.

On the one hand, the cooperation between this training centre and other higher education institutions inside QTSC is limited, i.e. they "*have only a few students from two universities (which is inside QTSC)*" (Participant 131, 7:12).

On the other hand, geographical boundary again restricts the development opportunity of this institution. Typically, the location of QTSC in District 12 is far from the concentrated places of higher education institutions (such as Thu Duc District) in the same city. This causes disadvantages to connect with these institutions – which provide the sources of human capital input for their operation model. Particularly, as explained by the deputy director, the training centre faces a dilemma. If they set up their training centres within universities outside QTSC, software developers and other technician employees from firms inside QTSC are reluctant to travel to give speeches or lectures. If keeping all training activities inside QTSC, while it is convenient for staffs from firms inside QTSC to visit and disseminate practical knowledge, but it would fail to attract a large number of students from outside QTSC.

In short, the establishment of a spin-off training centre has illustrated an outstanding cooperation between public, private and academic sector. However, given the underdeveloped infrastructure

to connect District 12 (where QTSC is situated) with the city centre and higher education institutions, the geographical distance evidently restricts the opportunity of this training centre to expand its activities.

*Sub-contracting*

The other dominant form of cooperation found in the cluster is sub-contract. In literature, there are two approaches to explain the rationales and level of innovativeness in subcontracting, namely transaction cost and knowledge-based approach (Bocquet, 2011). According to the transaction cost theory by Williamson (2000), sub-contracting is to reduce cost. There is little room for innovative knowledge creation; hence, sub-contracting is a mere '*by-product of the division of labour*' (Bocquet, 2011, p. 4). Subcontractors in this situation are likely to work in non-core issues of the subcontracting firms. Meanwhile, firms subcontracting by the knowledge-based approach seek complementary knowledge to theirs in the sharing projects.

Subcontracting from a foreign invested firm to a domestic firm could be a channel of LKS from the foreign sector to a developing country. Yet, subsidiaries from MNCs maintain their knowledge internally, which results in limited LKS to other co-located firms in Vietnam. (Participants 114, 103, 105, 101 and 117).

For exceptions, there is a few evidence of subcontracting from a foreign invested firm to domestic firms inside QTSC, for example, the case of 107. This interviewee explains that due to excessive workload, his firm subtracts a part of their job to other firms inside QTSC in order to deliver their orders to clients in time. But the main reasons for subcontracting are cost reduction and resource saving (Participant 107). In this case, this is subcontract from an outsourcing foreign firm to an outsourcing domestic firm. Hence, despite the flow of LKS, the level of innovative capacity in this case may not be significant.

The knowledge-based approach, where firms subcontract to seek complementary knowledge in their common projects is not particularly prominent amongst co-located firms. There is evidence that firms are aware of the knowledge-based approach but they encounter challenges in finding subcontracting suppliers inside QTSC. This problem would be addressed further in the next theme.

***Reasons for weak cooperation inside QTSC***

There are four emerging codes to explain for the weak cooperation inside QTSC, namely, relatedness, problems regarding cooperation contracts, lack of an effective communication system and underdeveloped cooperation culture.

*Relatedness*

The theme of relatedness discusses business commonality and matching or equivalent capability as the reasons for poor cooperation inside QTSC.

*Business commonality*

The reason of dissimilarities in business domain has been prominently found amongst firms with unique technologies. For example, case 103 is working on software integrated with machines in the mechanical precision industry:

> …I do not think inside QTSC there are other companies similar to our field, so ***the sharing of technical information is rarely to happen*** ... (Participant 103, 11:46) (emphasis added).

Or the software of firm 119 is associated with electronic circuits, while firm 143 develops software in association with imported security and surveillance equipment. Other example is firm 152, a data centre providing services relevant to data storage, hosting and other forms of data solutions.

Both of the above firms have cited the uniqueness of their technological fields to justify for being disconnected from other co-located firms. This argument does not necessarily mean that business diversification within cluster is unhealthy for cooperation. Instead, it should be interpreted in connection with other factors. In particular, the excuse due to the irrelevance of business domain is rarely an independent factor; rather it is inter-related with others, such as business strategy and confidentiality issues. For example, the firm owner of case 119 first argues that the main reason for not cooperating with other clustered firm is due to differences in business domain. Later, he reveals that there are other firms working in the similar product, i.e. software integrated with electronic circuits, but for different clients. When being probed into the reason for not sharing knowledge with these firms given a certain level of technological similarity, he referred to the confidentiality issue.

To remind of the finding from the theme of business strategy, this firm, i.e. numbered 119, obtains an inward strategy; hence they tend not to seek external knowledge exchange except for their one and only client. Here, this case illustrates the interaction of multiple factors causing firms less likely to open up for cooperation opportunities even under the favourable condition of geographical proximity.

As guided by critical realism (chapter 3), the causal mechanism may often consist of more than one single factor; therefore, discussion on further reasons will shed light on the current institutional setting inside the largest software cluster. Also, it will show how a variety of factors

may affect cooperation amongst economic actors within the cluster. The following parts demonstrate other factors.

**Matching or equivalent capability**

The relatedness aspect also covers the problem of matching or equivalent capability between technological frontier and followers in the same locality. This problem is not overwhelming across all transcripts, but mainly reported by several software production firms with evidence based on their own working and study experience (case 118) and their own experience in seeking and implementing cooperation with other economic actors within and outside QTSC (case 117).

In common, both cases numbered 117 and 118 are outstanding due to their technology-intensive products, indicating a certain level of product innovation. However, both imply that they could not find a comparably competent partner in Vietnam in general and inside QTSC in particular in order to cooperate in technological matters. Taking firm 117 as an example, they used to cooperate with a data science institute in Ho Chi Minh City – apparently the best data science institute in Vietnam; but it was a failure. In the own words of its Chief Product Officer:

> … our collaboration with the X Institute didn't work out well because … lack of knowledge of students of that centre, lack of coaching and product management from professors... now, we are hesitant to seek collaboration on data science in Vietnam … (Participant 117/1, 9:50).

Since the mentioned institute represents the best source of human capital and knowledge in the area of data science, the Chief Product Officer concludes that such a competent partner in data science does not exist in Vietnam at least for the time being. So, his firm resorts to their global linkage for complementary knowledge in the field of data science.

At the same time, cooperation with other co-located firms, which are majorly outsourcing vendor firms, is rarely to occur alike. The Senior Product Manager from the same firm, i.e. 117, elaborates on the low possibility of cooperation with other outsourcing firms. The main reason is that traditional outsourcing firms are in short of critical skills needed in the early stage of product creation. To support her statement, she uses her working experience at a large outsourcing firm inside QTSC:

> … I worked at [firm 149] before, so I know the working process at [firm 149], so does [115]. They are traditional outsourcing companies, so when they are implementing the outsourcing projects, the key decision had already been made by the clients … therefore, the stage of an outsourcing project when it comes to those companies is the implementation only… (Participant 117/2, 4:35).

In addition, the working method of a production firm differs with that of an outsourcing firm:

> …in essence, our company builds product, so our procedure is different, our working method is different, so does our working model… (Participant 117/1, 3:10).

Hence, the inequivalent and mismatched capability between software production and outsourcing firms, especially in terms of technological capability and professional working skills, obstruct two sides to reach deal on cooperation.

Similarly, the firm owner of case 118 criticizes the weak technological capability and lack of innovation knowledge of higher education institutions in Vietnam in general. Apparently, there exists a technological and mind-set gap between this firm and other co-located firms:

> …in terms of innovation … the concept of innovation is still new amongst companies inside QTSC… (Participant 118, 16:19).

The availability of matching competent partners within QTSC in specific and in Vietnam in general is associated with knowledge searching strategy of firms. Both firms in the examples recognize the importance of cooperation to innovation; given the lack of useful knowledge locally particularly inside the cluster; hence, they need to find alternative sources of external knowledge. While firm 117 makes use of their international linkage in technological knowledge; firm 118 – a domestic and spin-off firm - chooses to cooperate with firms in other industries such as banking, insurance and finance to make use of their complementary knowledge in pursuit of a sharing ecosystem.

Ones may argue that these production firms could subcontract to outsourcing firms, which could be a form of cooperation. However, other issues emerge, namely problems regarding the cooperation contract, e.g. price and other agreement in time and human resources. This issue will be discussed in the following section.

*Problems regarding cooperation contracts*

This part explains why in some cases, some firms was close to make a cooperation deal but failed to actualize their initiatives. There are three main problems identified through the qualitative data, namely confidentiality, price and agreement on human resource and delivery time.

*Firstly*, with regard to confidentiality, some outsourcing firms could not subcontract to outsiders given the confidentiality agreement made between them and their clients. As a result, those firms completely keep all technological knowledge and information internally; hence there is little LKS beyond the firm boundary. Despite the technological commonalities with some other

outsourcing firms within the cluster, the confidentiality matter strictly blocks any thought of cooperation of some firms (Participant 119).

*Secondly*, the price of cooperation contract with outsourcing firms is not affordable to other clustered firms. There is evidence from both supply and demand sides in this matter.

From the supply side, those pure outsourcing firms disfavour the domestic market partly due to the unattractive price. For example, firm 101 provides products, i.e. ICT solutions, to European clients. They neither establish any cooperation nor have any clients in Vietnam for the reason of market demand shortage. The firm leader explains that the number of their target clients in Vietnam is insufficient since the majority of firm population may not be able to afford their services.

Similarly, in another example, firm 107 demonstrates the wide earning gap between from foreign clients and from domestic clients:

> … we still look for clients (in Vietnam), but rarely, partly due to the price. The price in Vietnamese market is too cheap, for example … for every one hour the Japanese client will pay us 100,000 VND, while Vietnamese client could only pay us 20,000 VND… (Participant 107, 36:27).

From the demand side, for those who have demand to cooperate, some claim unaffordable price quoted by outsourcing firms. Typically, in case 151, where the firm used to approach other clustered firms; but the quotation was beyond their acceptable level.

> …we did approach some companies, but there weren't any particular results … the reason is cost … the price is not appropriate for the cooperation between two sides … (Participant 151, 20:28).

As a result, co-located firms inside QTSC are unlikely to subcontract or share a part of their job to outsiders.

In addition, the price factor in association with other reasons let cooperation opportunities slip away. For example, firm 153 is specialised in 3D laser scanning technology, which is quite a specific technology inside the cluster. If they cooperate with other clustered firms mainly in outsourcing – since production firms would focus on their products rather than developing products for others - the price would be expensive and in short of commercialisation. Strikingly, the latter reason indicates limited commercial awareness of pure outsourcing firms in general. Likewise, the participant from firm 156 – a software production firm - again addresses the unaffordable price if their company subcontracts a part of their job to outsourcing firms. In particular, the software specialisation of small outsourcing firms is irrelevant to that of firm

numbered 156. Meanwhile, the quotation from large outsourcing firms is too expensive for this firm to earn some profits for sales at the domestic market.

*Thirdly*, despite to be a less popular theme than the other two previous ones, the issue of agreement on human resource and timing is noteworthy. While cooperation at firm level encounters unsolvable difficulties, some firms resort to individual experts such as senior staffs in other co-located firms based on their personal network, like the case of firm 153 below:

> … cooperation with other companies is so challenging, so usually, we often recruit individual experienced developers, but there is one limitation; i.e. they are busy with their full-time job, so it would take long time for them to process our request … (Participant 153, 18:37).

Unfortunately, those experts have already been occupied with their full time jobs, so hardly to pay full attention to cooperate with this firm.

To explain this situation, perhaps, it connects to the theme of human capital – which stresses the shortage of labour in terms of both quantity and quality. Additionally, there is a sense running through most of transcripts, especially from firms specialised in outsourcing activities, that client finding is not a major concern. For the reason, those companies have already operated at their full capacity, and even sometimes they desperately require additional employees in order to finish the orders in time. For the same reason, those firms are unable to spare their resources, i.e. time and human capital, to take subcontracting agreements from other clustered firms, let alone collaboration to create something new together. Here, there is a vicious circle at firms - who stay in the outsourcing industry – they keep taking outsourcing orders, and have no time for their upgrading strategy. It suggests that pure outsourcing firms should obtain a long-term development strategy; otherwise, those could be stuck in the traditional outsourcing model or in the low value-added segment.

The next two sections further discuss communication system and cooperation culture within the cluster.

*Lack of an effective communication system*

Communication system here includes both online and offline means of communication amongst co-located actors inside the cluster. While the networking events prove to be ineffective (section 6.3.1); there is no communication platform where co-located firms and organisations can share and exchange knowledge and information on their own initiatives.

Regarding face-to-face communication, most of networking events are organised by QTSC Development Company. Networking events would create opportunities for firms to meet and

exchange information; this is important for firms and other co-located actors, e.g. academic and public sector for example, to gain mutual trust through their discussions in person and face-to-face. Hence, the limitations addressed in the theme of networking within QTSC are closely associated with the ineffective communication system, which partly causes the poor cooperation inside the cluster. This theme adds up extra evidence to the ineffective networking events inside QTSC. For example, one interviewee helps to explain how a typical CEO club meeting happens as below:

> …in such meetings, ***everybody does not talk to each other***; there is one speaker, and people will discuss around the topic, if there is any problem, we will ask everybody in the meeting, rather than we talk privately with each other … (Participant 105, 17:00) (emphasis added).

According to the above extract, this form of meeting is quite formal with little room for personal discussion or the movability for participants to discuss with each other. Actually, this is confirmed by the experience of the researcher while participating in one of the monthly CEO club meetings at QTSC. Several participants even reported that they have never heard of such networking events by QTSC (Participants 150, 117,104).

Besides, a prominent issue recurs throughout the transcripts that the current mechanism of communication is problematic. In particular, as mentioned in the sub-contract section, some firms express their cooperation demand to seek complementary knowledge from others in a common project. However, there is neither a communication platform nor any public discussion forum for actors inside the cluster to exchange information and knowledge amongst themselves voluntarily and on their own initiatives. Rather, every information or knowledge to be shared needs to go through QTSC Development Company, and "*it is inconvenient*" (Participant 108, 34:47), time-consuming and overall ineffective. This mechanism of information circulation evidently causes firms to lose their business opportunities (Participants 108, 123).

Also, to remind of the case of 123, the firm owner has failed to seek cooperation partner when directly contacting some firms inside QTSC. If there had been an effective communication platform, these two firms, 123 and 108 would have found each other or other appropriate firms with complementary knowledge to win the large project together.

As a matter of fact, QTSC Development Company keeps all profiles of companies; but this database is not publicised. If ones have a look on its official website, there is a list of all member companies, but the information on business specialities is too general and not updated. For this reason, some participants stress the urgent need of an open database about technical specialities of firms inside QTSC (Participant 153).

In another case, the interviewee seemingly doubts the responsibility of staffs at QTSC Development Company. When her firm contacted QTSC Development Company to publicise their information on the website of QTSC, the support was not as they expected:

> …the organisation method by QTSC Development Company is ***not really effective*** … they (Customer Service Department of QTSC Development Company) are ***not really interested in working with us***, …***maybe they don't really care*** about …creating linkages between companies inside QTSC …so it is ***really ineffective*** … (Participant 152, 17:59) (emphasis added).

As a consequence of the underdeveloped communication platform, co-located actors within QTSC have few opportunities to get to know each other (Participant 152).

While the rationale for a lack of an effective communication system is more likely related to the role of QTSC Development Company, other reasons may come from firms. The next section moves on to discuss the cooperation culture inside the cluster.

*Underdeveloped cooperation culture*

This sub-theme did not appear in the first template, for the reason that none of interviewees has directly mentioned 'cooperation culture'. Nevertheless, the sense of an underdeveloped cooperation culture in the largest software cluster in Vietnam has run through all transcripts.

*Firstly*, there is a lack of cooperation since the clustered firms tend to work independently. As the vice president of a large domestic firm shares in the interview, the main reason for weak innovation capability of Vietnamese firms is their isolation.

> …we think the reason why innovation in Vietnam is so slow is partly due to the fact that people work individually. If we are weak, and we only work individually, it (innovation process) is stagnant… (Participant 149, 13:33).

In another interview, the principal of a college – which established its campus inside QTSC about 10 years ago, who has participated in most of the club meetings, points out the persistent problem of lacking cooperation within the cluster. Accordingly, co-located firms are "*isolated, working independently … and are afraid of being competed, stolen of ideas and human resources*" (Participant 112, 17:55).

Here, this idea connects with the theme of inward strategy, particularly several firms are afraid to share since they consider KS, i.e. via knowledge sharing and exchange regardless of formally or informally with another technological firm, a loss (Participant 156). As a consequence, those firms doubt the benefits of cooperation, and they are unwilling to cooperate (Participant 133).

*Secondly*, as mentioned earlier, some firms actively search for cooperation partners inside QTSC but have encountered barriers and challenges in terms of relatedness problems, cooperation contracts and communication systems. As opposed to this group of firms, the rest have no cooperation demand at all. Typically, this problem is mostly popular amongst foreign invested purely outsourcing firms. Those firms are heavily reliant on their mother company abroad; and the knowledge, especially technological knowledge is mainly circulated internally only. Their job is to finish the orders from the mother company, and they have little voice on the business and market development strategy. In this group, the level of LKS to co-located firms is therefore extremely limited.

*Thirdly*, another aspect of underdeveloped cooperation culture inside the cluster is expressed through the common belief amongst some firms that there is no help by directly approaching potential partners inside the cluster. Instead, they need to look for intermediaries and they would only do business with friends of their friends.

For example, participant 107 below explains for their passive approach in networking – by waiting for the events organised by QTSC Development Company to meet up with other firms. Typically, in the absence of an intermediary, there is a high possibility that other firms would not welcome a 'stranger' at their office to do business.

> …***our company does not take a proactive approach in this networking matter***; QTSC Development Company will contact us to invite us participate in their events. ***If we contact the companies on our own initiative, they will not see us, that is a common thought*** … If we visit their office straight away … there is little chance that they will greet us ... (Participant 107, 26:43) (emphasis added).

Actually, this social behaviour is understandable in the context of an emerging country like Vietnam (Ahlstrom & Bruton, 2006; Xin & Pearce, 1996). In the literature of strategic management and organisational studies, the majority of developing countries are identified with institutional voids, i.e. lack of specialised intermediaries and contract-enforcing mechanism (Khanna & Palepu, 2000). In Vietnam, some studies confirm the popular shortage of auditable business information especially amongst micro, small and medium enterprises (Le & Nguyen, 2009). For those afore-mentioned reasons, firms in developing countries are more likely to rely on social network to do business with friends of their friends.

The above problem of cooperation culture becomes more severe given the ineffective communication system. Together, such problems pose challenges to establish an indigenous cooperation culture amongst actors inside the cluster. As a vicious circle, it gradually ruins the cooperation interest of other firms with outward strategy. For example, the participant from firm

123 has turned to be hopeless and disappointed when mentioning cooperation inside the cluster after countless times of failure in their efforts seeking cooperation partners:

> …there are many times we have experienced that ***nobody (other firms inside the cluster) wants to cooperate*** …personally, I would like to cooperate, but ***maybe when I approached them for cooperation, they thought that I may have a hidden purpose***… (Participant 123, 21:55) (emphasis added).

For firm 123, the firm owner now presumes that his goodwill in directly approaching other firms for cooperation is probably a 'hidden purpose' in those eyes. It confirms that this practice, i.e. one actor directly approaches others to discuss business, is such an unusual practice amongst the co-located firms. It also implies the low awareness of benefits from cooperation amongst some firms - who are afraid of being stolen of ideas or being cheated by the inviting firm.

Last but not least, additional evidence proves the underdeveloped cooperation culture inside the largest software cluster in Vietnam. In particular, networking events fail to be conducive for cooperation since some firms especially MSEs do not find mutual support from others (Participant 155). Besides, even at the building of QTSC incubation centre, there is not really a community for start-ups to meet and exchange knowledge on new technologies (Participant 118).

Overall, this section has explored four rationales for the weak cooperation inside the largest software cluster in Vietnam; namely relatedness, problems regarding cooperation contract, lack of an effective communication system and an underdeveloped cooperation culture. The next section moves on to articulate other forms of knowledge exchange by clustered firms, typically with higher education institutions and supporting community and services.

### *6.3.3. Other forms of knowledge exchange activities*

Apart from networking and cooperation, connections with higher educational institutions (HEIs) and with supporting business community and professional service providers could be important sources of knowledge for clustered firms to conduct innovation activities.

#### *Higher education institutions (HEIs)*

Relevant discussion about HEIs has been scattered in previous sections. So far, it was found that cooperation between firms and HEIs inside QTSC is restricted within recruitment and a few basic training classes. Actually, this is also a common practice between clustered firms and HEIs within Vietnam alike. Hence, this section offers a more comprehensive discussion from firms' perspective on why they are hesitant to contact HEIs for technological cooperation.

From firms' perspective, few connections with HEIs are attributable for weak capability and cooperation strategy of HEIs in general. There is a sense amongst all the interviewees that HEIs

in Vietnam are in short of both technical capability and business mind-set and skills (Participant 117). Also, firms have pictured HEIs in Vietnam not as a potential cooperation partner, partly based on their evaluation of fresh graduates – as demonstrated in details in the theme of human capital (section 6.2.1).

Technological knowledge produced by HEIs is believed to lag behind that of firms. While the technological change is accelerating every day, the study syllabus at HEIs fails to catch up with modern technology (Participant 118). Besides, knowledge at universities are criticised for being only theoretical, and even lecturers lack commercial awareness of technological products (Participants 118, 156). Hence, in this respect, there is a mismatch in terms of technological capability and mind-set between firms and HEIs, resulting in failures to cooperate, which further limit the spread of LKS.

At the same time, those firms used to approach HEIs for cooperation unanimously agree that HEIs in Vietnam generally lack both motivation for cooperation with businesses and a cooperation model with businesses. For example, some clustered firms approach HEIs to seek help in technological matters, but they had received no reply from junior staffs (Participant 134) or to be diverted to a firm outside universities by the senior staffs (Participant 104).

Apart from the unwilling of HEIs to cooperate with businesses, it appears that HEIs lack a cooperation model and strategy as well. For example, the interviewee below expresses his concern in cooperating with Vietnamese universities despite their successful cooperation with foreign universities.

> …those universities do not have clear information on their capability, hence, the combination between science and business is not possible (15:16) ... Vietnamese universities do not have a clear model in application and commercialization (18:22) ...' (Participant 149).

In the absence of an unambiguous model of cooperation between HEIs and businesses, firms generally confront difficulties in terms of information and administrative procedures. Similarly, the participant from firm 107 mentions the lack of information from HEIs:

> …we lack information on whether educational institutions train their students in our field, or we are unsure whether the HEIs have working experience in a particular process and working with companies… (Participant 107, 29:30).

Accordingly, Vietnamese HEIs in general do not promote themselves to be a promising cooperation partner in technological matter. This is actually in agreement with the literature on the HEIs in Vietnam. HEIs are heavily funded by the State; according to the General Statistics

Office Vietnam, there are total 235 HEIs in 2017, of which 170 are public schools – equivalent to 72.3%. Some argue that due to public funding, these HEIs do not need to concern about the operation costs; and they tend to focus on teaching rather than research and commercialisation of research projects (Tran & Nguyen, 2011).

***Supporting business community and professional services***

This code is particularly prominent amongst spin-off firms. As mentioned earlier, QTSC Development Company apparently aims to build a business and technical community for the clustered firms through their monthly CEO and CTO club meetings, and a number of networking events. However, it is evident that the mutual support between co-located actors inside the cluster is limited. Therefore, a few exceptional firms seek external knowledge from other supporting community outside QTSC on their own initiatives. Besides, while spin-off is a conduit of LKS, a recurrent problem emerges amongst spin-offs, which are mainly MSEs. That is the absence of supporting professional services such as legal, tax, accounting and other business services within the QTSC cluster.

*Firstly*, as a consequence, a few firms participate in other communities outside QTSC. Interesting, those are both spin-offs and MSEs. One of the examples is firm 118 (partly discussed in section 6.2.3). The firm owner of case 118, after leaving a senior management job at a foreign invested firm inside QTSC, has spent more than 10 months in the Entrepreneurship Support Centre of Ho Chi Minh City (BSSC) - an incubation centre for start-ups. The incubation centre outside QTSC has provided complementary entrepreneurship knowledge and skills.

Other example is a spin-off firm numbered 108, which joins a private business community, namely Business Network International (BNI). The operation of this business community is based on geographical location of firms. A group of firms in different business domain but same location is called a 'charter'. Each charter organises regular face-to-face meetings, i.e. weekly, allowing its members to gain trust amongst each other before they give each other business opportunities via 'words of mouth' (Participant 108, 39:01).

*Secondly*, a prevailing theme to emerge amongst spin-off firms is the shortage of professional services. In particular, those firms struggled to deal with a variety of business procedures themselves, such as tax, insurance, legal document in the early stage of their businesses. For example, firm 155 encountered some bureaucratic procedures and received little help from the government officials. Given the limited resources, the firm owner had to take care of all paperwork, e.g. the participant from firm 145 stated that "*I had to do it myself from certificate registration; and … accounting…"* (34:00). Consequently, there is little time left for the firm

owners to focus his mind and effort on innovative matters. Especially, some participants bitterly compare the support for start-ups in Vietnam with that in advanced countries such as Singapore and Israel (Participants 118, 155).

Another noteworthy example is the case of firm 108 earlier. The business community, i.e. BNI, associates with a specialised consultancy firm in business training. Yet, this firm did not have sufficient resources to hire this consultancy firm. On the one hand, the firm owner expresses that entrepreneurship knowledge and skills are of utmost importance for such an MSE to scale up and to conduct innovation activities. He presumes that other MSEs have the same demand to obtain such knowledge and skills. Unfortunately, similar training and coaching in entrepreneurship knowledge and skills for firms could not be found inside QTSC.

On the other hand, geographical distance from the clustered firm to the consultancy firm in the city centre appears to be a barrier. Additionally, the fees charged by the consultancy firm is not affordable; and their expertise in the field of software is restricted. Had a consultancy service existed within the cluster at affordable price and sufficient expertise in the ICT sector, clustered firms could have performed much better in terms of organisational innovation, and probably product innovation.

In summary, this section has explored the nature, patterns and characteristics of local linkage, with a focus on the intra-cluster linkage and connections between some clustered firms with supporting business community outside QTSC. It is evident that the current institutional setting is not conducive to facilitate LKS amongst co-located actor within QTSC. The final theme will address global linkage of co-located firms inside QTSC.

### 6.4. Global linkage

Global linkages are of extreme importance to domestic firms in developing countries like Vietnam, for the reason that, most of important knowledge for the upgrading process, especially technological knowledge, is rooted from abroad (Ndabeni et al., 2016). For an export-led cluster like QTSC, the global linkage appears right from the beginning of the cluster formation, and even becomes more dominant than the local linkage.

This theme explores the type and benefits of global linkage that clustered firms are directly engaged into. By doing so, it investigates how firms in different software business domains work out their global connections for their upgrading process. In turn, it assesses whether such global linkage has successfully transformed into LKS, referring to knowledge flows spreading beyond the boundary of firms who directly connect with global actors.

### *6.4.1. Type of linkages*

Table 6.2 illustrates the colour coding for three types of global linkage based on software business activities, i.e. production, mixed, outsourcing and others.

As can be seen, purely outsourcing firms mainly develop linkage based on ownership and with their foreign clients. Amongst all outsourcing firms, only firm 149 – a large domestic firm - reports to connect with international partners. Domestic outsourcing firms mainly maintain direct contact with their clients; meanwhile, foreign outsourcing firms serve and follow the orders from their parent companies as the only 'client' without direct contact with their downstream clients.

Another striking point to note is that, in most foreign invested firms, the Vietnamese office is specialised in technical and technological issues, while the parent firms or the foreign offices is in charge of business development and customer support. The only exception is firm numbered 153, that they conduct outsourcing activities for their parent firm, but at the same time, have their own business development activities to sell their products in Vietnamese market.

**Table 6.2: Colour coding for Global linkage**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Linkage based on ownership | 101 | 117 | 103 | 105 | 107 | 114 | 115 | 151 | 153 |
| Linkage with clients | 101 | 108 | 133 | 111 | 119 | 123 | 145 | 149 | 155 |
| Linkage with partner | 117 | 134 | 143 | 149 | 151 | 155 | | | |
| Production | | | | | | | | | |
| Mixed (both production and outsourcing) | | | | | | | | | |
| Outsourcing | | | | | | | | | |
| Others (other business activities than software) | | | | | | | | | |

***Linkage based on ownership***

The first type of global linkage is based on ownership, referring to the linkage between clustered firms and their parent companies abroad. So, those are foreign invested firms.

Of which, 103, 105, 107, 114, 115 are purely outsourcing firms. Their connections mainly provide with training and technological materials from their mother companies. Probably, the exception is case 115 – a large firm, which organises training activities for their employees themselves, and sometimes exchanges senior staffs with other offices in the same company group. Yet, in most cases, foreign invested pure outsourcing firms are passive receivers of knowledge and information from their parent companies, i.e. they follow the orders and requests by their parent companies completely, even what kind of specific training they need to take in order to accomplish the orders (Participants 103, 105, 107, 114).

Similarly, other foreign invested firms in production and mixed business activities also receive support in technological issues from their parent companies (Participant 153). Both three production firms, namely 101, 117 and 151 serve foreign clients only. In common, their offices in Vietnam are specialised in technological and technical issues; whereas, the foreign offices are responsible for business development. Notably, for production and mixed firms, the global linkage based on ownership goes beyond one-way direction, where knowledge flows only from parent company abroad to Vietnamese firms, to two-way direction, where knowledge exchange actually happens. For example, the interviewee from firm 151 said:

> …the Vietnamese office is specialised in product development, and the foreign office takes care of business development … we would exchange information and discuss with the German office for business-related matter … (8:40).

Accordingly, due to the process of information exchange between Vietnamese office and foreign office, so the Vietnamese firm could tailor their products to adapt with the requirement of clients.

***Linkage with clients***

Those with direct global linkage with clients are domestic invested and purely outsourcing firms. In general, knowledge exchange with clients is important for these firms to decide the investment direction of their resource (Participant 149).

There is not much information on how domestic firms find their clients, especially given the lack of supporting professional services within QTSC mentioned earlier; but there are two outstanding cases worth of noting here. Particularly, firm 111 and 108 have relied on their representative offices abroad, especially in their target markets, to deal with clients.

> …we have two sale representatives; one from USA, the other from Singapore … they bring clients to us … (Participant 111, 3:53).

> … we have a unit in Korea to advise in this matter (working with clients), we set up an agency in Korea, so that agency could legally sign the contract on behalf of us … they take care of legal document and procedures… (Participant 108, 47:12).

Such method of client finding could be considered as innovative since this is not a common practice amongst domestic invested firms in QTSC. The closer outsourcing vendor is to the end-users or downstream customers, the deeper the knowledge exchange becomes (Kohli & Jaworski, 1990). For the reason, outsourcing vendor could obtain commercial awareness, i.e. understanding on the purpose of the products or solutions. Later, those may evoke these business

ideas and make use of their accumulated knowledge to create their own software products for new markets.

***Linkage with partners***

There are only a few cases involving global linkage with partners. Of which, there are two foreign invested firms conducting production activities and for foreign markets, namely firm 117 and 151. Amongst four domestic firms reporting global linkages with partners, there is only one outsourcing firm, i.e. 149; two firms with the main market in Vietnam, i.e. 134 & 143; the other firm, i.e. 155, conducts both production and outsourcing activities targeting mainly foreign markets. Each firm has made use of their global linkage with partners for differing purposes (Table 6.3).

**Table 6.3: Firms with direct global linkages**

| Firm | Ownership | Dominant market | Business activities | Purposes of using global linkages |
|---|---|---|---|---|
| 117 & 151 | Foreign | Foreign | Production | Improve existing products |
| 149 | Domestic | Foreign | Outsourcing | Catch up with newest technology |
| 134 | Domestic | Domestic | Other | Be entitled for specialised knowledge by the global technological frontiers |
| 143 | Domestic | Domestic | Production | Create a combined product for domestic sales |
| 155 | Domestic | Foreign | Mixed | Extend market & jointly provide products |

The results from Table 6.3 highlight that outsourcing does not necessarily mean less innovative. Rather, business strategy matters. Firm 149 is one of the largest domestic firm and a leading outsourcing vendor in Vietnam. As mentioned earlier, this firm has its own research and development (R&D) centre, to conduct research in new technology in order to provide smarter and innovative solutions for their clients. Furthermore, they conduct some collaborative R&D with foreign universities and research institutes to catch up with technological changes and to secure their loyal clients. The interview with the Vice President demonstrates the determination toward innovation of this firm. Firm 149 might be a role model for other outsourcing vendor firms, especially those micro-to-small outsourcing firms who want to scale up in the outsourcing industry.

Meanwhile, firm 134 conducts other business activities than software; i.e. providing digital marketing solutions to Vietnamese market. As revealed by the firm owner and according to the

information on their official website, this firm is amongst a few certified advertising agencies of Google in Vietnam. Besides, they also distribute the Cloud service by Amazon in Vietnamese market. Due to the forward linkage with Google and Amazon, this firm has benefited from specialised training from these global technological frontiers, which represents a rich source of knowledge flows from global linkage. Recently, this firm has supported Google to execute their training project for small and medium enterprises (SMEs) in Vietnam in digital marketing skills. In this case, knowledge embedded within global linkage has spread beyond the firm boundary to other domestic firms in Vietnam.

Two foreign invested firms numbered 117 and 151 are both software production firms. They both collaborate with foreign partners to improve their existing products. In particular, firm 151 cooperates with an international payment service provider, i.e. Master Card, to complete their product, i.e. travel and payment services. Meanwhile, firm 117 collaborates with foreign partners, clients and consultants to upgrade their existing products. These two firms enjoy the KS from global linkage with their partners. Yet, they only serve foreign markets and develop no formal connections with other clustered firms and institutions; rather their intra-cluster linkage hangs loosely via networking events organised by QTSC Development Company. Therefore, LKS from these two firms to other co-located firms are quite limited.

The case of firm 143 has been cited earlier in section 6.2.3 to illustrate the outward strategy. To remind, this firm collaborates with the foreign manufacturers to create a complete product for sales in Vietnamese market. The remaining domestic firm, i.e.155, chooses to collaborate in order to extend their market and to provide advanced services for their clients. Accordingly, this firm sets a foot in new market by cooperating with local start-ups, technological and consultancy firms. At the same time, they take advantage of the technological platform provided by local start-ups in foreign market through partnership to develop their own products. As opposed to firm 149, this firm might be the role model for micro-to-small outsourcing firms who would like to change path development from outsourcing to software production.

In brief, this section has demonstrated three types of global linkages reported by the interviewees. The purposes of global linkage evidently vary with business activities, i.e. outsourcing, production, mixed or other services than software. Hence, the nature and meanings of LKS from global linkage are likely to be subject to business strategy of clustered firms. The next section moves on to discuss in-depth the benefits of global linkage.

### *6.4.2. Benefits of global linkage*

The recurrent themes with regards to benefits of global linkage include the accumulation of financial capital, knowledge accumulation and professional working skills. A few firms have successfully made use of their accumulation process to upgrade their innovative capability – by developing their own software products for sales.

#### *Financial capital accumulation*

Capital accumulation in terms of job and revenue creation is apparently the explicit benefit from service exportation activities. Especially, some clustered firms involving in the software production emphasise that financial capability is essential for them to develop their own products (Participants 118, 123, 155). For example, the firm owner in case 118 chose to set up two companies at the same time; one specialised in outsourcing and the other is start-up to sell their own products. He stresses that "*without the financing from my outsourcing company, I would definitely fail*" (28:50). Meanwhile, firms 123 and 155 started to be an outsourcing vendor but with the long-term strategy to be a software production firm. For those two firms, outsourcing revenue is an internal financial resource to conduct R&D activities; therefrom to create their own products. The two quotations below explain the complementary of outsourcing division to production division in each firm in terms of financial capital:

> …the way we are doing is taking outsourcing order to generate capital for developing (our own) products … (Participant 123, 37:19).

> …when we do outsourcing, we … improve our financial capability. When we follow production, we must have internal capability, finance, and human resources. Even with human resource but lack of money, you could not do it. So we ought to take outsourcing order to nurture the production plan … (Participant 155, 31:34).

#### *Knowledge accumulation*

Knowledge is embedded within human capital. Global linkage with parent companies, clients and partners is a lucrative source of knowledge in two perspectives, i.e. (i) technical and technological knowledge and (ii) business and market knowledge.

*(i) Technical and technological knowledge*

The software industry is a knowledge-intensive one, which Vietnam has to build up from scratch. Global linkage has allowed clustered firms to be exposed to new technologies, which are unavailable locally. Also, learning is an accumulative and interactive process (Edquist, 1997a;

Freeman, 1995; Lundvall, 1992; Nelson, 1993). By taking outsourcing orders, domestic firms could learn technical and technological knowledge from their clients; and after a period, they could build up their own technological capability (Participant 145). In addition, in many cases of outsourcing firms, there are no formal education in particular technological fields available locally. Therefore, firms have to learn by doing, and learn from their working experience (Participants 119, 123).

In some firms, backward linkages with foreign actors abroad are evidently beneficial in terms of technology transfer. For example, both firms 143 and 153 appreciate the benefits of global linkage, which provide them with access to new technologies embedded in goods and services for their sales in domestic market. Like firm 143, technology transfer from their foreign partners is through technical learning materials, which has not existed in Vietnam yet. Similarly, as a foreign invested firm, firm 153 stresses that without outsourcing activities to their parent company in the beginning, they would have never gained access to new technology in order to develop their own market in Vietnam. In both cases, with an outward strategy and growth mind-set, these firm owners further spread their absorbed technological and technical knowledge to the other actors in Vietnam, though not necessarily within the boundary of cluster; since they have no co-located firms or institutions as their clients. At least, it shows that knowledge flow from global linkage has been spread beyond the boundary of recipient firms.

Apart from technology transfer, pressure on quality requirements from foreign clients or parent firms has motivated the clustered firms to learn and upgrade their technological capability. For some firms, since their foreign clients come up with new or improved products regularly, hence, they need to adjust their software to be compatible with such changes (Participants 119, 153). In doing so, they could strengthen their technological capability, which in turn attracts high-profile clients and build up reputation for this firm:

> …when we do a basic service like 2D scanning, but our clients have much higher request on the quality, so they request us to upgrade our capability in line with their requirement, so that's one way to force us to innovate our technology and enhance our knowledge… (Participant 153, 26:31).

In other cases, horizontal LKS are found typically amongst firms with software production activities. In particular, via observation and imitation, domestic firms started to take outsourcing orders, and then they have learned and created their own products tailored for a new or a niche market. Especially, this process is evidently prominent amongst spin-off firms, whose firm owners have spent years in other outsourcing firms before establishing their own business in the same cluster. Yet, the accumulation of technical and technological knowledge is not the only

contributing factor for some spin-offs to foster their product innovation. Such upgrading process also requires business and market knowledge.

*(ii) Business and market knowledge*

Business and market knowledge is a critical factor, since the majority of outsourcing firms, especially micro-to-small firms in general do not have a specialised business development department; rather, they are highly reliant on a few clients or only on their parent companies. Also, the literature dictates that in the outsourcing industry, the source of useful knowledge for innovation is majorly client-driven (Lema, 2009). Hence, the better firms understand the market demand, the more likely they are to be innovative.

Business and market knowledge refer to the understanding of relevant markets, and of the relevant industrial development, i.e. in the ICT sector. In addition, ICT is quite a special sector, since advancements in this field may have spillover effects to the whole economy due to its vertical disintegration from other business sectors (Stiglitz & Greenwald, 2014). Vice versa, outsourcing firms in the ICT sector also benefit from knowledge in other sectors.

> …outsourcing involves a range of business areas … knowledge from these business areas could be useful, like we once took outsourcing orders in automobile industry, we understand functions of different elements in the car, and we would consider how to make use of that knowledge in Vietnamese market; so overall, it help to expand your thoughts and to gain better access to the market … (Participant 108, 51:30).

As shown in the above quotation, obtaining other industrial knowledge enriches the business profile of outsourcing firms, i.e. '*expand …thoughts and gain better access to the market*'. The accumulation of such business knowledge enhances the competitive advantage of outsourcing firms. It prepares those firms to be ready to grab future opportunities in other markets including the domestic one.

In another example, firm 155 enjoys working with their foreign clients due to the newness and interestingness of their clients' ideas. The presumption is that developing countries like Vietnam generally lag behind other advanced countries in terms of digitalisation; if this firm could work out innovative solutions for clients in advanced countries; later, when the domestic country - Vietnam reaches the similar stage of digitalisation, with similar demand, then this firm will definitely earn an advantage (Participant 155).

At last, it is noteworthy that the theme of business and market knowledge is prominent amongst spin-offs and those firms with outward strategy and growth mind-set. In common, those are proactive learners, and both follow long-term strategy to make and sell products of their own.

***Professional working skills and methods***

Apart from financial capital and knowledge accumulation, global connections have brought advantages to some clustered firms in terms of professional working skills and methods. There are three emerging themes across all transcripts, namely (i) working culture adaptation, (ii) improvements in working methodology and (iii) enhancement of business skills.

*At first*, the theme of working culture adaption prevails amongst firms working with Japanese clients or with Japanese parent company. Japanese is also the second largest foreign investor after America, and the number of Japanese invested firms is the highest in QTSC[xx]. According to the interviewees, Japanese people obtain respectful qualities such as 'meticulous' (Participant 114), 'hard-working', 'disciplined and dedication to excellence and precision' (Participant 103).

In working for and with Japanese, those firms have to learn and adapt Japanese working culture to theirs. Especially, the pressure from high quality requirement motivates these firms to work harder:

> … I have to take care of every single detail, and to make sure the highest quality, the final products must be nearly perfect, because we have to deal with every detail … (Participant 114, 11:56).

In another example, the Vietnamese chief technical officer in a Japanese invested firm (107) points out the cultural difference between Japanese and Vietnamese. He highly appreciates the working attitude of Japanese workers. In particular, Japanese staffs only leave office once they finish their work; while Vietnamese ones generally leave office every day at the same time, e.g. 5pm, regardless of whether their work is finished or not. Or when Japanese employees make mistake, they apologize even before other people notice about their mistakes; while the Vietnamese ones may try to circumvent the problems (Participant 107). Probably, this issue links with the quality of human capital as discussed in section 6.2.1, i.e. lack of professional working skills. In dealing with this problem, this firm embraces and applies some practices of Japanese working culture to their employees.

*Secondly*, pressure from high quality requirement motivates firms to work smarter – more efficiently - by improving working methodology at their firms. Working methodology involves internal organisational methods and approaches, and those in dealing with external economic actors, such as clients, partners and parent companies. In common, most of firms conducting outsourcing activities agree that the improvement in working process with clients and parent companies is attributable for feedback and support from these actors respectively. Besides, some firms realize that they need to strengthen their internal organisational methods as a mean to upgrade their capability:

> … from the beginning we only know about technical knowledge, and we did not follow any certain working process, but after working with them for some time, we realise that we need to create our own working process,…our clients also give us feedback on our working process, and we are forced to upgrade our system, our capability of human resource to meet their requirement/demand … (Participant 108, 48:33).

Moreover, the analysis also finds proof of LKS via spin-off. Typically, firm owners of spin-offs have learned from organisational methods applied in their previous workplace, majorly foreign outsourcing firms. For instance, the extraction from firm 123 echoes this argument:

> …when I worked at [firm 115], it is a big company, they have professional working process, it has CMI4, I learn from it; and through several companies, I learn and now apply at my company; in the application process, we need to adjust to gradually adapt in line with the working procedure with our clients … (Participant 123, 26:38).

Similarly, at another spin-off, i.e. firm 118, the firm owner has created most of the digital applications for internal management and organisation by himself, using the accumulated knowledge from his previous working place – a foreign invested firm in the same cluster.

*Last but not least*, global linkage provides some clustered firms with opportunities to acquire and enhance other business skills. The educational and training institutions in Vietnam in general have not paid close attention to soft skills to prepare their graduates ready to work. Additionally, as mentioned earlier, there is overall a lack of professional services inside the cluster, which could support firms in a variety of essential business skills. Hence, the clustered firms could resort to their global linkages as a way to learn and obtain transferrable skills such as critical thinking, market research, project management and problem-solving skills. Besides, in an outstanding case, the interviewee from a Japanese invested firm talks about the innovative mind-set of Japanese individuals:

> …they (Japanese people) are ***always progressive***; like if they see a Vietnamese person is manually doing a task, they will think of how to make the task automatic. Meaning if we finish this task, the others will be automatically completed. ***Their thought is very innovative, trying to automate most of everything***… (Participant 107, 44:12) (emphasis added).

Yet, in the learning process, it requires a certain level of capability of the knowledge receivers to produce new knowledge; as the same interviewee admits that:

> …sometimes they (Japanese staffs) ask me why do you have to do it manually, it takes lots of time …***but our company is passive***, sometimes we think about it, but ***don't know how to do it, our technical capability is limited and not comparable to Japanese experts*** … (Participant 107, 44:12) (emphasis added).

In short, this theme of global linkage has identified certain patterns in the type of linkage based on software business domains. Evidently, global linkage has provided demanding resources for clustered firms to upgrade their innovative capability, including financial capital, knowledge accumulation and professional working skills. However, global linkages do not always transform into LKS beyond the boundary of firms connecting to foreign actors abroad. Rather, this process is likely to depend on the business strategy at firm level, i.e. knowledge searching behaviour and the initiatives of firm leader.

A few innovative spin-offs manage to take advantage of their outsourcing experience for organisational and product innovation at their firms. On the one hand, due to their intensive technical expertise in previous workplace, these spin-off firm-owners conduct organisational innovative methods at their firms. On the other hand, spin-off firms make use of business ideas from the outsourcing process for foreign clients to customise their own products for sales in markets. Evidence found on those spin-offs has uncovered a shift of capability in the outsourcing community in Vietnam, from capabilities to fulfil outsourcing orders to capabilities to create new product innovation.

### 6.5. Chapter summary

This chapter has presented the results from the template analysis on collected interview data. The template consists of three top-level themes, namely intra-firm factors, local linkage and global linkage. The analysis has demonstrated how the localised institutional setting, consisting of inter-related and interactive factors, has determined the level of LKS amongst co-located firms.

The intra-firm factors theme covers human capital, absorptive capacity and business strategy. These sub-themes show how internal factors of firms shape the amount of LKS that a firm receives and spreads to other co-located actors. Given the labour supply from surrounding institutions fails the expectations of co-located firms, these firms have deployed different means to upgrade their absorptive capacity. Business strategy matters to the magnitude of LKS in terms of knowledge searching strategy and the leader's initiatives. It is evident that pure outsourcing firms tend to obtain an inward knowledge searching strategy and their leaders are likely to obtain fixed mind-set.

Networking within QTSC is ineffective for three main reasons regarding (i) the relevance of networking events' topics, (ii) the frequency of networking events and (iii) the role of participants in networking events.

With regard to cooperation inside QTSC, there are two dominant forms of cooperation, namely recruitment and sub-contract. However, the cooperation inside QTSC is overall very limited due to four main reasons, namely (i) relatedness, (ii) problems regarding cooperation contracts, (iii) lack of an effective communication system and (iv) lack of a cooperation culture.

Global linkage could be divided into three types, namely (i) linkage based on ownership, (ii) linkage with clients and (iii) linkage based on partnership. There are three main benefits from global linkages, namely (i) financial capital accumulation, (ii) knowledge accumulation and (iii) enhancement of professional working skills. Not all of firms are aware of and therefore could efficiently take advantage of the two last forms of benefits to develop their own software products for sales. Amongst those exceptional cases, there are some spin-off firms under the directing of growth mind-set leaders, who perceive changes as an essential motivation for innovation. These spin-offs illustrate an outstanding channel of LKS for innovation.

# Chapter 7: DISCUSSION

## 7.1. Chapter overview

This chapter presents integrated findings from chapter 4, 5 and 6 to address the research objectives and research questions as stated in chapter 1. To iterate, the overall research objective is to gain insights into LKS, as one of the knowledge subsystems within a cluster, –by assessing the complex interaction of determinants at different levels, namely intra-organisation (inside firm), intra-cluster (amongst firms, and between firms and other co-located actors), and external linkages outside clusters, typically global linkages.

Hence, the structure of this chapter starts with section 7.2, to summarise respective key findings in response to each research question. It is then followed by section 7.3 which discusses QTSC as the whole cluster before summarising the chapter in section 7.4.

## 7.2. Research questions (RQ), key findings and discussion

### *7.2.1. Research question 1*

**RQ 1.** How does the institutional setting affect LKS within QTSC? (Chapter 4 & 6)

The localised institutional setting consists of formal and informal institutions, and sets the context for external learning of firms within a cluster. Overall, QTSC, like other clusters in developing countries, is identified with a thin institutional setting. It experiences the absence of crucial institutions (both rules and actors), and the inefficiency of available institutions to support innovation in general, and the diffusion of knowledge for innovation in particular.

***Formal institutions***

In terms of institutional political context, Vietnam conducted its Doi Moi (‘Renovation’) reform policy in 1986 to move from a central planning to a market-oriented economy. Decentralisation in Vietnam is still limited to fiscal and administrative, rather than political decentralisation (Vu, 2016). Industrial clusters are used to mainly attract foreign direct investment (FDI). There is an implicit agreement that foreign enterprises conduct export activities, while state-owned enterprises serve the domestic market. Recently, in 2016, the Politburo of the Vietnamese Communist Party, for the first time acknowledged that the private sector ought to be the driving force of the economy as opposed to the previous period when the state sector was prioritised. Yet, for such a long time, the private sector had been treated less equally than the state and foreign sector. Similarly, the entrepreneurship matters in the socio economic agenda had been given inappropriate attention from the government (Gray, 2012; London, 2017 ).

Perhaps formal institutions, especially legal infrastructure, do not directly shape the LKS phenomena within a cluster; but they do exert a certain influence, via channels of LKS, i.e. labour mobility, spin-off and networking. The legal infrastructure in Vietnam leaves sufficient room for firms to regulate themselves in order to protect their tacit knowledge, i.e. trade secrets. However, a weak legal enforcement system, in combination with poor public awareness on intellectual property, is more likely to enable inter-firms KS via labour mobility.

Knowledge, especially tacit knowledge is embedded in human beings, and "*much of a high technology firm's intellectual property is informal in character*" (Gilson, 1999, p. 594). Therefore, those legal instruments which could either enable or restrict clustered firms to prevent LKS, in the form of trade secrets via labour mobility, are worthy of discussion.

In Vietnam, the most relevant (and highest) legal documents to the KS, via labour mobility and spin-off, are Labour Law 2012, Intellectual Property (IP) Law 2005 and its amendments in 2009, and Competition Law 2004, and 2018. Accordingly, employer and employee are free to negotiate their labour contracts including the agreements on trade secrets. Yet, unlike America, typically Massachusetts laws in the case of Route 128 cluster (Gilson, 1999), the Vietnamese legal system in general does not regulate post-employment conditions in the agreements between employer and employee.

In the matter of knowledge qualified as trade secrets, it is subject to the employers to protect using their own measures. According to Article 121 on owner of industrial property objects of IP Law 2005, unless there is other agreement, if trade secrets are formed intentionally or unintentionally as parts of the required or assigned job to the employee, then it belongs to the employer. This type of tacit knowledge could be protected as a trade secret only if there is written corroboration of the period of time when knowledge is created, recorded and exchanged with the owner. In some situations, it is difficult for the employer to claim certain knowledge as his/her trade secret. For example, the employee has made use of the facilities provided by the employer to create his/her knowledge as a by-product of the main task assigned to him/her, but the employee chooses not to report and share with the owner things that are only in their mind or in their personal diary. The departing employee may take this knowledge with him/her to their new employer or to their own start-up.

Apart from Labour and IP Law, trade secret violation is also regulated as one type of unfair competition activity in Competition Law 2004 and 2018. However, the Vietnamese Competition Law does not specify any situations regarding trade secrets as disclosed by departing employees. According to the annual reports by the specialised state agency dealing with competition issues, the overall statistic on the number of unfair competition cases is abnormally small and on a

decreasing trend, despite the economic integration and development in Vietnam in recent years (Nguyen et al., 2016), i.e. the total number of unfair competition cases in 2016 is 20; the highest number was in 2012 with 41 cases. There have been no disputes in trade secrets recorded by this state agency since its establishment. Regarding the observation from the local top-tier legal firms, disputes in trade secrets are extremely uncommon in Vietnam; there were only two cases heard by the courts regarding the confidentiality and non-competition clauses in labour contracts (Le, 2016).

In short, the regulations regarding trade secrets are scattered in different laws, and there is a lack of coordination between these laws, which is a common feature in the Vietnamese legal system. On the one hand, the regulations on the same matter from different specialised laws could be useful and inclusive, since one violation on this matter is assessed from different aspects; i.e. with regard to trade secrets, there are industrial property and competition perspectives. On the other hand, due to the lack of connection between multiple laws and legal documents, there may be legal inconsistencies when it comes to legal proceedings and punishment for a given violation.

Apart from tacit knowledge, firms could protect their codified knowledge by registering with the National Office of Intellectual Property. The existing literature dictates a dilemma regarding the IP legal system, which could affect innovation in opposite directions (Hassan, Yaqub, & Diepeveen, 2010; Stiglitz & Greenwald, 2014). In particular, a too strong IP legal system may impede innovation since it limits the diffusion of knowledge from previous inventions in registered patents. However, a too weak IP legal system could damage creativity and innovative ability as well, for the reason that innovative actors do not receive exclusive benefits in association with their innovative work. In Vietnam, given it is a member of the Paris Convention on Industrial Property and the Berne Convention on Copyright, the substantive legal framework is quite comprehensive.

The major problem with its current IP legal system is more likely to be its weak and ineffective legal enforcement and general poor public awareness on IPRs. Regarding IP legal enforcement, administrative fines are still the most common settlement on IP infringement in Vietnam. However, this method is criticised due to its "*low level of penalties and lack of compensation*" (IPO, 2014, p.6); hence it fails to act as a deterrence against IP violation. Apart from negotiation, the other type of legal settlement for IT infringement is via court actions, however, they "*are lengthy and relatively costly*" (ITA, 2018, p.3). Besides, there is also a lack of well-trained legal staff and judges in IP matters. Additionally, Vietnam has experienced severe rent-seeking and corruption problems (Vu, 2012). Therefore, Vietnamese firms have low confidence in the court

system (ibid), and in the government system in general. This represents a low level of institutional trust, which is a common problem in transition economies from a central planning to market - oriented stage (Humphrey & Schmitz, 1998).

For a developing country like Vietnam, the weak legal enforcement in IP may have fatal effects on technology transfer from foreign sectors to domestic firms. Similarly, given that KS is embedded within contractual technology transfer, the above feature of a formal institution damages the extent of KS from foreign sectors alike. In literature, empirical evidence shows that a stronger IP legal system in developing countries encourages MNCs to transfer technology through market-based channels including, but not limited to, trade and FDI (Hassan et al., 2010). Of which, licensing technology is likely preferable to trade and FDI, as those MNCs seek to obtain control over their intangible assets. Meanwhile, in a weak IPRS regime, MNCs are inclined to transfer their technologies to their local subsidiaries in order to maintain ownership over their intangible assets. Evidence from the primary data analysis confirms the dominance of this practice inside the research cluster (QTSC). Foreign investors transfer their technology to the local subsidiaries, and these companies usually have no market-based technological transaction with other clustered firms and even other firms outside the cluster. Findings from the formal network survey have confirmed this point. Also, as discussed earlier, there is an implicit agreement in Vietnam that foreign invested firms tend to work in the exporting sector rather than the domestic sector. Most foreign invested firms in the QTSC are outsourcing companies, and they have no Vietnamese clients.

***Informal institutions***

Chapter 6 has uncovered some aspects of informal institutions, namely the lack of cooperation culture and the bureaucratic governance and support from state-run cluster management and incubator. Also, there is an absence of specialised knowledge providers, as well as venture capitalists necessary for innovation within QTSC. From the system failure framework (Woolthuis et al., 2005), these localised conditions do not well support the diffusion of LKS amongst co-located actors within the cluster.

In respect of cooperation culture, co-located firms inside the QTSC mainly work independently, and there is a low level of trust and mutual reciprocity. In a similar vein, clustered firms in QTSC are sceptical about potential benefits from cooperation since they are worried about opportunistic behaviour. As a consequence, the atmosphere in the largest software cluster in Vietnam is mainly competitive, resembling the cluster template by Porter (1998, 2000), rather than a blend of both cooperation and competition as recommended by industrial district literature (Becattini, 1990; Piore & Sabel, 1984). The weak cooperation amongst co-located firms in fact

resembles the situation of other software outsourcing clusters, such as the Bangalore cluster in the early 2000s (Caniëls & Romijn, 2003), and IT clusters in developing countries (Wang et al., 2010).

The bureaucratic governance and support from the state-run cluster management and incubator is ineffective to facilitate LKS amongst co-located actors. Notwithstanding the effort of QTSC Development Company to promote their social gathering events, there is a lack of evidence on how these events blossom into successful inter-firm cooperation. Meanwhile, the incubator is evidently a failure given only a few firms succeed in fundraising, and a large number of spin-off firms end up in traditional outsourcing routes. It does not mean that spin-offs in outsourcing industry are not beneficial for the cluster development; rather, it contradicts the very ambitious plan of the cluster, to create innovative spin-offs who are capable of producing software products in substitutions for imported ones. The fieldwork study also reveals the lack of dynamic synergies amongst spin-offs supported by the incubator. There is no social interaction between these spin-offs even they are located in the same building, and the incubator did not organise any social events where spin-offs could meet and exchange new ideas. The cluster management company and incubator obviously in QTSC are evidently less competent to disseminate LKS useful for innovation and to nurture innovative start-ups compared with (i) hi-tech clusters in developed countries (Pauwels, Clarysse, Wright, & Van Hove, 2016), or (ii) with software clusters in large emerging countries such as China (Jan, Chan, & Teng, 2012).

The role of educational and research institutions to a software outsourcing cluster like QTSC is more likely to provide labour, rather than research facilities and research results as in hi-tech cluster in developed countries (Manning, 2013). However, the available institutions, i.e. academic institutes, universities and colleges within QTSC, actually contribute little to the human capital of firms inside QTSC. These universities and colleges neither major in nor well-known for IT subjects. As a consequence, the labour supply, i.e. fresh graduates, from these within-cluster institutions do not satisfy the expectations of firms, in terms of both quantity and quality. Besides, most of these institutions do not actively participate in the documented formal and informal network. In this case, universities and other academic institutions within QTSC fail to act as a bridge to connect co-located firms, and hence fail to promote the cluster development (Tiffin & Kunc, 2011).

#### *7.2.2. Research question 2*

**RQ 2.** How do the structure and composition of social network within QTSC influence the nature and patterns of LKS? **(Chapter 5 & 6)**

Spatial proximity could facilitate the 'local buzz' (Malmberg et al., 2006), referring to face-to-face conversation - a channel of LKS. Evidently, firms within QTSC, are generally afraid to share knowledge of their own. Chapter 5 has used SNA to gain the first impression about the LKS via social interaction inside QTSC. Meanwhile, chapter 6 has provided further evidence complementary to the findings from SNA.

- ***How dense is the social network within QTSC?***

The informal network inside the cluster is overall quite sparse. There are 18 firms who report that they are completely isolated with other actors in the network, equivalent to nearly 19% of the cluster population, and 31% of the network sample size. To compare with other clusters such as the Montevideo software cluster in (Kesidou, 2007), the network density of QTSC is smaller, meaning that the LKS might be diffused better via a social network in Montevideo, than QTSC.

Amongst established connections between actors in the network, strong ties are dominant followed by weak ties and medium ties. In the examination of network structure, there are a high number of triads (clique analysis); equivalent to 38% of the network sample size belongs to a triad. However, the triad transitivity is quite low (0.111) compared with general social networks, which often range from 0.3 to 0.6 (Snijders, 2012). This further confirms the sparse nature of the network. There are four components of the network which are strongly connected, equivalent to 29% of the network sample size. In each component, foreign firms seem to mostly socialise with each other, leaving most domestic firms out of their leagues. The only exceptions are a small domestic firm (145) who specialises in outsourcing, and an educational centre (112). They could both cultivate their strong linkages with foreign firms to enjoy the LKS from them.

- ***What are the most important ties and nodes in the informal network within QTSC?***

The Lambda set helps to identify the most crucial ties and actors in the network. In particular, a set of three nodes, representing the largest foreign outsourcing firm (115), the largest domestic outsourcing firm (149) and the only IT training centre (131), are the most important triads with strong ties in the network. This means that most information and knowledge are circulated through these three actors. Also, the closer a domestic firm is to one of these three nodes, the more likely it will gain easier access to the critical source of knowledge via LKS for innovation.

The brokerage analysis in ego-network helps to detect the relevant nodes with brokerage roles in the network. Unsurprisingly, the three nodes (115, 131 and 149) also have the highest brokerage scores. In addition, a small outsourcing firm (145) has the highest brokerage score amongst spin-off firms; it seems that this firm lives up to the theoretical reasoning on the KS theory of entrepreneurship (Audretsch & Lehmann, 2005). Accordingly, spin-offs take advantage of their

localised connection for their innovation. Yet, the other part of argument, namely small firms have higher innovative outputs, is arguable. This firm is a purely outsourcing one which engages in some sub-contracting relations with other firms inside the cluster. From an organisational innovation perspective, for QTSC, this could be a new form of industrial organisation, due to firm differentiation or specialisation. However, from a product innovation perspective, firm 145 introduces no new product to market compared with other innovative spin-offs with their own products. Evidence from qualitative analysis also confirms that the observed high brokerage score of firm 145 is associated with its supplier-buyer linkages and previous working experience of the firm owner.

Besides, unlike the case of the Montevideo cluster in (Kesidou, 2007), there is an absolute absence of the academic sector, such as universities and research institutes in the list of the most important nodes as the sources of knowledge for innovation.

- ***Which type of attributes affect the involvement level of a firm in the informal network within QTSC?***

While the component analysis indicates that firm ownership seems to make a difference in the pattern of group socialisation, (i.e. firms tend to socialise with other firms in the same type of ownership), t-test analysis does not confirm that ownership matters when it comes to the network participation in QTSC. In other words, there is not sufficient evidence to conclude on whether firm ownership, i.e. foreign versus domestic, associates with the tendency of a firm to take part in the social network. Neither could we reach any conclusion on whether foreign firms tend to socializes more than domestic firms and vice versa.

On the contrary, firm size and business association membership are two attributes that result in statistically significant results. In particular, medium and large firms, i.e. with more than 50 employees, are evidently more active than micro and small firms, i.e. with less than or equal to 50 employees. Qualitative analysis (chapter 6) offers some more evidence and explanation for this finding (in local linkage theme). While the network survey asks firms about their face-to-face social interaction, the qualitative interview examines in detail the most frequent gathering of firms and institutions inside QTSC, namely the monthly club meetings, under the initiative by QTSC Development Company. Many firms report that they only meet other co-clustered firms in events organised by QTSC. The social interaction derived from firm initiatives, for example an accidental meeting due to spatial proximity or purposive arrangement of meeting for business purposes does occur, but at a much rarer frequency rate than these club meetings.

In these network events, this study observes the absence of micro and small firms, and academic institutions. Medium and large firms act as key presenters and leaders of these events, but the topics of discussion are mostly not of interest for the majority of micro and small firms. In particular, spin-offs, which are innovative start-ups with new technologies and products, almost never participate in these monthly networking events. For the reason, medium-and-large firms are all outsourcing firms, who show distinctive management and technological interest compared with micro-and-small firms. Therefore, these firms fail to lead the technical community inside QTSC. As a result, technical club meetings happened for a few times then stopped, causing firms to gradually lose their commitment and interest in this activity.

Turning back to chapter 5, it was found that business association membership is positively associated with informal network participation within QTSC. According to the CE approach, (Schmitz, 1995, 1998, 1999a), the business association represents the collective action of firms, and it is presumed that a certain degree of information and degree flowing across firms in the association. In this case, VNITO, an outsourcing alliance, is established with the mission to promote Vietnam as an attractive global outsourcing hub. To do this, VNITO organises some marketing activities, such as business tours and conferences. Nevertheless, the technical support of VNITO to its members is quite limited and under-developed; there is also lack of a code of ethics to guide the whole community. This partly contributes to the fact that most firms inside the cluster work independently and there is a serious shortage of dynamic synergies amongst each other. Despite the fact that VNITO is co-founded by a QTSC Development Company, there are more than 40% of firms in the network sample size, which have not obtained a VNITO membership. However, it is evident that VNITO membership does push the network connectivity. The t-test analysis demonstrates that members of VNITO are more active than non-members in the informal network. It may be due to the socialisation propensity of firms or firm strategy to actively seek external resources of knowledge for innovation. Some firms tend to socialise more, either in formal business associations or informal social interaction, than others. Owing to the organised events by VNITO, its members had had a chance to meet each other in person, they then developed initial trust and this in turn enabled further informal conversation outside these events.

### *7.2.3. Research question 3*

**RQ 3.** How significant LKS via different channels are to innovation at firm level within QTSC? (Chapters 5 & 6)

The regression analysis (chapter 5) focuses on organisational innovation due to the recommendation from literature; of which, the dominant form of innovation in developing

economies is organisational and incremental (Mina et al., 2014). Plus, QTSC is an outsourcing cluster; hence, the majority of firms do not develop products for their own use, rather they work on software customisation or provide IT services upon request from foreign clients.

The correlation matrix of all variables shows statistically significant correlation amongst some pairs of variables, especially between organisational innovation and degree centrality. The researcher first tests the assumption of multiple linear regression analysis. Notably, the test for model specification confirms the validity of the current model specification, and there are no important variables omitted. For the research dataset, there are some violations of the OLS estimator assumptions. Specifically, they are (i) outliers and influential points, and (ii) these points further cause non-normality of the residual distribution, (iii) independence of error terms likely caused by the measurement of LKS via social network. To deal with these violations, Chapter 5 has used a number of robust regression analysis methods to achieve unbiased and efficient estimation.

In the results, firm size, LKS via social network are positively associated with organisational innovation with a high level of efficiency (meaning small absolute values of standard errors). Spin-off produces one-time significant results in the regression analysis only, while labour mobility does not generate any significant results. Both of these two later channels of LKS are not statistically correlated with organisational innovation. These findings are different with previous ones in (Kesidou, 2007), where only LKS via spin-off was found to significantly affect organisational innovation; hence, they further contribute to the mixed evidence literature on the influence of LKS via different channels on innovation. Therefore, it requires insights from the qualitative analysis to explain the quantitative results.

Qualitative analysis in chapter 6 offers complementary elaboration on the (un)importance of LKS channels to innovation at firm level, i.e. via social interaction, labour mobility and spin-offs inside QTSC.

There is proof of the positive influence of LKS via social interaction on organisational innovation of firms inside QTSC due to the content of social networking events. According to the semi-structured interviews, co-located firms socialise most frequently in the events organised by the QTSC Development Company. For instance, they organise monthly meetings amongst firm representatives, for example managers and directors of co-located firms, in order to exchange information on effective organisational methods. For example, firm representatives gather to discuss how software firms should react to a new Vietnamese regulation draft on cyber-security, or to share organisational practices for the scaling-up process from a small to a medium and large firm.

Regarding LKS via labour mobility, interviewee firms generally are not concerned about the previous workplace of their new employees, whether inside or outside QTSC. Furthermore, none of the interviewees acknowledged the superior quality of labour from other co-located firms over firms outside the cluster. This indicates the lack of differentiation in terms of labour skills between inside and outside QTSC, and even between firms inside the cluster. For fresh graduates, most firms report that they have to provide a training programme to activate this labour force (preparing new employees to be ready for work). Fresh graduates from surrounding universities and colleges in general do not satisfy the requirements of firms both in terms of quality and quantity. This confirms the findings from regression analysis that LKS via labour mobility within the cluster, does not significantly contribute to innovation at firm level. It also contrasts with the conventional notion of 'cluster' by CE scholars, who describe industrial clusters in developing countries with distinctive features, such as the labour division between inside and outside a cluster, as well as the specialisation amongst co-located firms within the cluster (Das, 1998; Dawson, 1992; Schmitz, 1995, 1998).

Regarding spin-offs, they are mostly young firms, and their firm owners had worked for foreign outsourcing firms before. However, not all spin-offs are innovative. Spin-off only acts as an effective mechanism of KS if it helps to spread the knowledge rather than merely shift it (Audretsch & Keilbach, 2008). This study has found example about a spin-off in a purely outsourcing business working on the same tasks with the same client as the one in its parent outsourcing company. It is evidently not beneficial for this firm innovation unless the firm owner is about to execute significant changes for the sake of innovation at their firm. Furthermore, according to the qualitative analysis, the innovativeness of spin-offs depends on the leader's mind-set, whether they are risk-taking or risk-averse (Miller & Friesen, 1982). A few firm owners left their old working place to initiate new purely outsourcing firms; but the main reason was to gain financial independence. Very differently, some spin-off firms are evidently risk-taking; they left their own job not only to gain financial independence, but also to create something new of their own, for example, a new product/service and a new market. For this group, some may start with the conventional route of outsourcing; but, they insist on and currently are working hard on their long-term strategy to research and develop their own products/services for sales in markets. Hence, as opposed to the risk-averse spin-offs, all of them are fully aware of the needs and benefits of innovation, both in terms of organisational and product innovation. While risk-averse spin-offs are afraid of changes, risk-taking spin-offs favour continuous changes. As a result, there are variances in the level of innovation amongst these spin-offs.

### *7.2.4. Research question 4*

**RQ 4.** How do idiosyncratic characteristics inside firms affect LKS within QTSC? (Chapters 5 & 6)

The correlation analysis in chapter 5 shows that the level of education (an indicator of absorptive capacity) does not significantly correlate with any channels of LKS. However, it is significantly and negatively correlated with firm size. This confirms that on average, smaller firms have a better quality of human capital based on educational degree. Most of the large firms inside QTSC are specialised in software outsourcing; while the business activities of micro, small, and medium firms are various, from software outsourcing and IT service provision, to software product provision. There are some comments in the qualitative analysis that large outsourcing firms, especially foreign ones, have attracted talents away from domestic and smaller firms, as similarly observed in the hi-tech cluster in Beijing, China (Zhou & Xin, 2003). Large firms with stronger financial capabilities establish strong linkages with local universities; this in turn aids their recruitment process, to be able to recruit a large number of fresh graduates for outsourcing purposes. At the same time, most firms complained about the inadequate quality and quantity of fresh graduates. This is in line with the general obstacles against doing business in Vietnam, according to the 2017-2018 Global Competitiveness Index report by the World Economic Forum. Accordingly, 'inadequate educated workforce' is the second biggest barrier. Outsourcing requires only average IT skills, which could easily attract a mass scale of fresh graduates. Hence, the negative correlation between educational level and firm size implies that for other business domains than outsourcing, it may demand a stricter requirement on the quality of labour skills; at least this holds true with the measurement by educational level.

Therefore, the findings in the present study are different to previous empirical studies, such as (Kesidou, 2007), where there was significant positive correlation between educational level and degree centrality (LKS via informal network in Montevideo software cluster).

Meanwhile, chapter 6 has shed light on how intra-firm characteristics could influence the LKS phenomenon within a knowledge-intensive cluster in developing countries (intra-firm factors theme). Significantly, with the support of a quantitative analysis technique, chapter 6 has established that knowledge searching behaviour and leader's initiatives are distinctive amongst three groups of software business domains, including pure outsourcing, software production, and mixed between outsourcing and production. Knowledge searching behaviour and leader's initiatives in turn, could exert their influence on the LKS phenomenon within the research cluster.

Pure outsourcing firms tend to internally seek and circulate information and knowledge for innovation (market and technical knowledge and information). Despite their global pipeline with foreign firms which represent the knowledge flow from outside cluster, these pure outsourcing firms act in isolation and seriously consider LKS as a cost, and therefore contribute little to the LKS phenomenon via social interaction with other actors in the same locality. In other words, except for a few large outsourcing firms, who play a key role in informal gathering events, most of the pure outsourcing firms inside QTSC play an insignificant role in diffusing knowledge and information beyond their firm boundary.

Meanwhile, firms who sell their own products, or operate in multiple chain markets (mixed between outsourcing and software production) prove to be more innovative (Navas-Alemán, 2011). The majority of these firms obtain a growth mind-set, with a risk-taking attitude, high entrepreneurial spirit, and actively cultivate multiple external sources of knowledge for their innovation.

However, there is a slight difference in terms of intra-cluster network participation tendency of two groups, namely, mixed business activities and software production. In particular, firms from mixed business groups still join the social gathering events and software outsourcing business association (VNITO); therefore, they proactively take advantage of the collective learning process of the outsourcing community and contribute to the LKS phenomenon via social interaction within the cluster. Conversely, software production firms are completely isolated in the intra-cluster network (either cooperation or sub-contracting or informal network). The exclusion of these innovative nuclei is a loss for the intra-cluster social network in terms of promoting innovation and cluster development.

The initiative of the firm leader also distinguishes innovative with non-innovative spin-offs which is an important channel of LKS. In literature, firms with a risk-taking attitude and proactive approach in seeking knowledge, tend to be more innovative (Miller & Friesen, 1982). Also, the industrial cluster literature stresses that firms in developing countries need ‘strategic intent’ to deliberately innovate by the means of upgrading (Humphrey & Schmitz, 2002, p.1024). In the absence of firms’ deliberation to innovate, it is challenging for the whole cluster to upgrade; as a result, it may be trapped into a low value-added stage of the relevant GVC.

#### *7.2.5. Research question 5*

**RQ5.** How does the local-global dynamism influence LKS amongst firms inside QTSC? (Chapter 6)

Schmitz (1995) expressed his positive expectation about the initiative to establish techno-parks and business incubators in transition economies in order to promote small firms, by providing them with space and business advice. On the contrary, in practice, the cluster initiative, especially the top-down approach, is insufficient to generate collective efficiency (Dyba, 2016); and this also holds true for the case of QTSC.

So far, it has been found that LKS via social interaction, i.e. network degree centrality, exerts its positive influence on organisational innovation; but the informal network inside QTSC is quite sparse. Following this finding, the qualitative analysis has particularly ascertained the rationale behind weak local linkages in general, and poor local buzz in particular. As mentioned earlier in section RQ 2, to explain the isolation problems of many firms inside QTSC, there are three main reasons, namely the role of presenters in social gathering events, the irrelevance of discussion topics and the low frequency of these events. The absence of software production firms in the social network implies that LKS via social network may convey an effective channel to improve organisational practices, as confirmed by regression analysis, rather than to distribute technical information and knowledge for new product/service innovation.

In addition, sub-contracting is not a prevalent organisational practice inside QTSC; emphasising the low level of differentiation and of labour skills division. There is almost an absence of both vertical and horizontal cooperation, similar to the Bangalore software cluster in India in the early 2000s (Caniëls & Romijn, 2003). Regarding the currently weak cooperation between firms in QTSC, there are four outstanding reasons; namely relatedness, problems regarding cooperation contracts, ineffective communication systems, and an under-developed cooperation culture. Relatedness refers to the mismatch in terms of capabilities between software production firms and outsourcing firms. User-producer interaction requires certain conditions, i.e. both have demand/incentives in sharing knowledge, and both have sufficient in-house capacities for collaboration (Chaminade & Vang, 2008). Meanwhile, in the case of QTSC, despite the willingness for collaboration of some firms, such vertical interaction rarely happens. The relatedness problem has been amplified (i) by the (relatively expensive) cost of sub-contracting quoted by outsourcing firms to production firms; (ii) by the scarcity of high-quality employees in advanced technologies, such as data science, AI or Block chain; and (iii) by the ineffective communication system. For the last barrier, the cluster governance is unnecessarily bureaucratic provided that most of the networking activities and information sharing must pass through the QTSC Development Company (a state company). A few previous studies on the Vietnamese software clusters associated this form of governance with the lack of initiatives from the private

sector (Kasabov, 2015). This thesis adds another reason for such passivity of software firms in the cluster, namely the underdeveloped cooperation culture (as elaborated in RQ1).

Apart from social interaction, chapter 6 also demonstrates factors influencing the occurrence of LKS via labour mobility and spin-offs. The support for spin-offs is in general bureaucratic and ineffective; the number of firms succeeding in fund raising is marginal. There is no venture capitalist inside QTSC. Perhaps, the most noteworthy source of labour is from the training centre, one of the three most important nodes in the informal network (chapter 5). However, the volume of employees graduating from this centre is insufficient to create a mass critical leverage for the cluster competitiveness. The training centre basically provides fresh students with both on-demand soft skills and technical skills, rather than advancing tools or new technologies. The main reason for such complementary training is due to the low and inadequate quality of university and college education. By cooperating with the training centre, clustered firms could save their resources for tasks other than training their new employees.

Similar to firms in India in the early 2000s, outsourcing firms in the largest software cluster in Vietnam iteratively express their preference for the global market rather than the domestic market, for the reason of "*small size and low profitability … low disposable incomes, low investment and high piracy*" of the domestic market (Heeks & Nicholson, 2004, p. 273). This resembles an 'enclave economy' within the software sector (ibid), when it over-relies on global demand rather than domestic demand. As a result, pure outsourcing firms in general do not mobilise their resources toward local linkages to develop the domestic market. According to (Ndabeni et al., 2016), most of the knowledge useful for innovation in developing countries came from the global linkages of firms. My concern with global linkages is whether those firms with global linkages act as technology gatekeeper or broker between inside and outside the cluster or not.

Software is a knowledge-intensive industry and developing countries like Vietnam had to establish the industry from scratch. In this case, global linkages definitely play a significant role for building up an indigenous force of domestic firms, and their production capabilities. Global linkages provide clustered firms, especially outsourcing ones, with financial capital, technical and market knowledge, professional working skills and methods. Yet, there are only a few firms who have managed to develop bi-dimensional knowledge exchange embedded in their global linkages; the rest are mainly uni-dimensional and therefore have low levels of innovativeness. This commonality of uni-dimensional knowledge exchange between developed and developing countries has been previously found in literature (Nadvi & Halder, 2005).

By dividing firms with global linkages by business domain, i.e. pure outsourcing, software production and mixed between outsourcing and production, it is found that these firms pursue distinguished strategies and purposes regarding their global linkages.

In closer detail, most foreign pure outsourcing firms use their global linkages for training purposes; hence, they intend to absorb only new knowledge required and necessary for their outsourcing tasks. Meanwhile, innovation in the software sector is largely user-driven since the origin of this sector is rooted in the vertical disintegration from other industries (Giuliani et al., 2005; Pavitt, 1984). The closer a software firm is to its clients in the value chain network, the quicker it reacts to market changes, and the more likely it is to be innovative. However, it was unclear how the majority of domestic pure outsourcing firms sought their clients in the first place, given the absence (i) of a market development team inside these firms except for a few incumbent firms, and (ii) of specialised knowledge providers in market research within QTSC. Probably, as evidenced in a few spin-off outsourcing firms, those domestic firms have found their clients based on pre-existing relations in the old workplace and their personal network.

Apart from linkages based on ownership and supplier-buyer, a small number of firms inside QTSC have a partnership with global actors. Strikingly, only one large firm in pure outsourcing who develops their global linkages with foreign universities and colleges to increase their innovative capacity, appear on this list. The remaining firms involve some software production activities; and therefore establish global linkages for their new product/service innovation.

Once identifying those firms with direct global linkages, I have traced their positions in the informal network or social interaction network to see how far knowledge flows from global linkages which could spill over to localised actors. Global linkages are only beneficial to the accumulation of knowledge within a cluster on condition that the cluster has already obtained a "high-quality local buzz" (Morrison, Rabellotti, & Zirulia, 2013, p. 93), i.e. there is an efficient interaction mechanism within the cluster to further disseminate knowledge from global linkages. Accordingly, only the largest domestic pure outsourcing firm, who actively seeks external knowledge from their global linkages, acts as the most crucial node in the network. Production firms are mostly segregated from the social network inside QTSC. Hence, despite the knowledge flows associated with global linkages in these firms, these global linkages fail to transfer into LKS beyond the boundary of these firms. Meanwhile, due to the over-reliance on parent companies abroad and serious negligence of market knowledge, foreign pure outsourcing firms are specialised in technical issues. To reiterate, technical knowledge is highly codified and only useful for specific tasks, and therefore it is of little use to diffuse to a wider technical community supporting different business domains, such as finance, e-commerce, fashion, and construction,

inside QTSC (Bathelt et al., 2004). Therefore, "*the more codified the knowledge involved, the less space sensitive should these processes tend to be*" (ibid, p.32). Hence, LKS derived from foreign pure outsourcing firms, if any, tend to be limited in management and organisational practices, which prove to be more useful for outsourcing firms than software production firms.

Another striking point to note about global linkage regards spin-offs firms. Only a handful of outsourcing spin-off firms creatively make use of their global linkages to develop their own products. This proves that learning for (product) innovation via the outsourcing route is viable, but it is subject to the (long-term) business strategy of firms, especially their strategic intent to invest into their technological capabilities (Bell & Pavitt, 1993; Lall, 1992).

Besides, a significant velocity of international worker exchange as seen in Dalian cluster in China was not observed in QTSC (Jan et al., 2012). Most of the labour mobility embedded in global linkages is for training purposes; for example, Vietnamese workers travelling to learn from their partner or client firms abroad.

### 7.3. A discussion on the whole cluster of QTSC

A discussion on the whole cluster of QTSC is important in order to compare and contrast the findings at firm level of QTSC with other types of clusters specifically in developing countries. This is to avoid making any broad generalisations to a variety of other clusters than (i) export-led knowledge-intensive clusters, and (ii) in developing countries other than Vietnam.

Overall, the development of QTSC as an outsourcing hub is more likely to be similar to the Indian type, which focuses on services, rather than the Israeli, Irish (Heeks & Nicholson, 2004) and Uruguayan ones (Kesidou, 2007), which focus on products; though both of these countries follow export-led cluster models. Similar to India in the early 2000s, the Vietnamese software outsourcing industry faces several impediments in terms of labour shortage and the poor investment of firms in developing their own products. These impediments threaten the sustained growth of this industry. Also, the outsourcing industry in Vietnam is neither big enough to create a critically competitive mass service provision like India, nor innovative enough to export software products in niche markets such as in the case of Israel, Ireland and Uruguay.

Vietnam further encounters additional obstacles. Except for the lower wages of software developers and engineers, Vietnam is less competitive than India (Sonderegger & Täube, 2010), due to its relatively weaker technical base of local universities and research institutes, and there is an untapped resource of Vietnamese diaspora abroad (Sturgeon & Zylberberg, 2017). Also, Vietnam is at a disadvantage to other countries such as China and Uruguay, where software exporting firms take advantage of sharing languages with neighbouring countries (Heeks & Nicholson, 2004; Kesidou, 2007). Recently, given the new wave of investment from Japan into

the software industry in Vietnam (Hirakawa & Nguyen, 2017), a number of Japanese language teaching centres have emerged, even inside QTSC to supply an on-demand Japanese-speaking labour force. However, some firms still report in the interviews that the recruitment of employees with sufficient language proficiency for working is still challenging.

QTSC possesses common characteristics of clusters in developing economies, such as a weak IPR legal protection system, weak R&D capacity, poor research profile by local universities and research institutes, and a lack of specialised knowledge and service provider (Wang et al., 2010). These institutional conditions could be summed up in one phrase 'thin institutional setting' as opposed to thick institutional setting in advanced clusters such as Silicon Valley (Saxenian, 1996). The description of QTSC also fits with the general picture of developing economies, especially transition economies, i.e. problem of distrust and opportunistic behaviour (Humphrey & Schmitz, 1998; Schmitz, 1999b). As an example of the shortage of institutional trust, a few domestic software production firms choose to keep their software code as their own business secret, rather than register with the National Office of Intellectual Property, since they are worried that their code may be stolen and sold by government officers to their competitors.

QTSC also exemplifies knowledge services clusters (KSCs) in developing countries (Manning, 2013), which obtain both similarities and differences with low-cost manufacturing clusters in developing countries, and hi-tech clusters in developed ones. KSC provides "*lower-cost technical and analytical skills and expertise serving global demand for increasingly commoditised knowledge services*" (ibid, p.381). Given the disadvantages in terms of localised institutional settings, KSCs manage to attract a large amount of FDI. And, KSCs target global market right from the beginning on account of the marginal domestic market demand for knowledge services, such as software and IT services. The entry barrier to join the KSCs is less restrictive than manufacturing, which is in general capital-intensive. In KSCs, there is a much lower level of localised integration compared with hi-tech clusters. As a result, KSCs like QTSC, experience a dormant localised network of production and services provision. It has been confirmed in this study, i.e. the sparse supplier-buyer network contributes little to facilitate LKS amongst co-located firms.

Furthermore, social network structure in service-export clusters like QTSC is dissimilar to rural industrial clusters (Kimura, 2011; Vu et al., 2009). For the latter type of cluster, mainly in traditional manufacturing and craft, there is a dense, well-established production network based on kinship and family ties, and the cluster has been sustained for a long time due to shared social norms and conventions. On the contrary, for such an emerging KSC like QTSC, no well-

established shared norms and conventions have emerged. As a consequence, a low level of inter-firm trust causes a huge barrier for LKS to occur within the cluster.

In addition, in the case of QTSC, there is a lack of specific common purpose for which co-located firms must work together, as empirically observed in other export-led industrial clusters specialising in traditional manufacturing (Perez-Aleman, 2011; Voeten et al., 2015), or in domestic-led hi-tech cluster in other developing countries (Zhou & Xin, 2003). In the former example, under the external pressure for technical changes, co-clustered firms act together to share equipment and facilities and to adopt new technologies. Meanwhile, in the latter example, with the target market being domestic, foreign and domestic firms collaborate based on their complementary knowledge in terms of technology and market to adapt foreign software to the local conditions. The absence of a shared purpose fails to trigger formal cooperation as well as informal interaction amongst actors within QTSC. As a result, the level of LKS via network is particularly limited.

Regarding other channels of LKS, i.e. spin-offs, innovative start-ups with their own products and new markets do not gain effective support; the support from the state incubator is bureaucratic. Meanwhile, labour mobility from within the cluster is not significant to LKS useful for innovation. Labour mobility from abroad is limited since the connection with Vietnamese diaspora is not prevalent through the findings as opposed to the case of India (Arora, Arunachalam, Asundi, & Fernandes, 2001; Heeks & Nicholson, 2004). QTSC currently has a low division of labour skills amongst firms inside the same cluster, and between inside and outside the cluster. Such blurred division has not given much leverage to develop inter-firm relations adequately (Das, 1998).

### 7.4. Chapter summary

This chapter has integrated findings from previous chapters to address the research questions posed in chapter 1, and compared these findings with previous literature. In doing so, it demonstrates the complementary evidence offered from both quantitative and qualitative strands. This helps to yield a comprehensive picture about the LKS phenomenon via different channels, i.e. social network, labour mobility and spin-off. In particular, the meta-inferences from mixed-method methodology have revealed the causal mechanisms behind the (non)significance of these channels on innovation at firm level, under the light of institutional context of an export-led knowledge-intensive cluster, i.e. QTSC, in developing countries, i.e. Vietnam. The chapter has ended with a discussion on QTSC as the whole cluster by comparing and contrasting it with other clusters in terms of cluster development and characteristics which influence the occurrence and significance of LKS amongst co-located actors.

## Chapter 8: CONCLUSION & RECOMMENDATIONS

### 8.1. Chapter overview

This final chapter concludes the whole thesis and presents theoretical, empirical and practical contributions. It further acknowledges some limitations due to inevitable constraints in terms of time and resources. Finally, it suggests some ideas for future research.

### 8.2. Conclusion

The institutional setting of the QTSC cluster is not supportive for the diffusion of LKS beneficial for innovation of clustered firms. The cluster is currently in short of specialised knowledge providers while the existing institutions are not working efficiently. The relevant policies have focused mainly on financially supporting software firms within cluster but failed to facilitate the diffusion of tacit knowledge from foreign investors. The government agency - QTSC Development Company mainly provides hard infrastructure and utility services to clustered firms. The social network events organised by this agency evidently promote beneficial LKS for organisational innovation, rather than product innovation.

Besides, the cluster currently lacks a cooperation culture. The business environment is characterised by competition atmosphere which does not encourage knowledge sharing, hence LKS, amongst clustered firms. Educational and research institutions contribute little to building a technical community inside the cluster. This leaves co-located firms to act on their own initiatives to obtain technical knowledge from other sources, mostly via their global linkages.

The network within the cluster is sparse, with large outsourcing firms play the crucial role. However, the type of knowledge circulated and controlled by these firms are beneficial for organisational innovation mainly. Spin-offs in new technology do not join in the network because either they share no common interest with outsourcing firms in the cluster, or they do not see any benefits for their innovation process by participating in the local network. Bigger firms, mostly outsourcing firms which are members of the local business association, namely VNITO, tend to socialise more than smaller firms in the local network.

LKS via spin-off and social interaction exert positive influence on organisational innovation of clustered firms. Spin-off founders absorb knowledge about organisational practices from their previous workplace, then apply them at their new ventures. Meanwhile, social network events evidently facilitate the sharing of useful organisational and management practices adopted earlier by incumbent firms.

Firm size positively associates with organisational innovation as large firms tend to have strong resources to invest in new organisational approaches, e.g. buying new ICT application. Also, compared with smaller firms, large firms are likely to have more complex organisational

structure which requires the aid of ICT applications to deal with such complexity. Educational level does not statistically have significant effects on any channels of LKS as well as innovation. On average, smaller firms, especially spin-offs in new technology, obtain higher quality of employees than larger firms, especially outsourcing firms. Knowledge searching behaviour and leaders' initiatives which influence the flow of LKS inside the cluster are distinctive amongst different groups of firms based on their software business domains.

Global linkages prevail local linkages to provide technical and market knowledge for clustered firms. Nevertheless, as the local linkages inside the QTSC cluster are weak, knowledge from global linkages fail to diffuse further to local communities in the form of LKS.

## 8.3. Contributions

Overall, by illuminating the nature, pattern and channels of LKS as well as its implications for innovation at firm level, this study has contributed to the literature of (i) economic development in developing countries via learning route, and (ii) economic geography of innovation literature. On the one hand, it has uncovered how co-located firms learn from different sources of external knowledge, especially LKS along with knowledge flows embedded within global linkages, for their innovation or upgrading process, which in turn, provides a means for economic development. On the other hand, this study highlights that spatial proximity is not sufficient to trigger LKS, especially in the context of thin localised institutional setting like a knowledge service cluster in developing countries. LKS could play significant role to innovation at firm level, but not all channels of LKS exert equal effect. It then leaves room for managerial and policy discussion in order to cultivate LKS for the sake of innovation at firm level within the alike clusters.

The following sub-sections will discuss the theoretical, empirical and practical contributions of this research.

### *8.3.1. Theoretical contributions*

While past studies only mention general macro-economic and sectoral conditions as external factors influencing the LKS phenomenon (Caniëls and Romijn, 2003), this research illuminates hierarchical levels of influences on the LKS phenomenon within a cluster from macro, industry to cluster and individual firm levels (as shown in Figure 8.1).

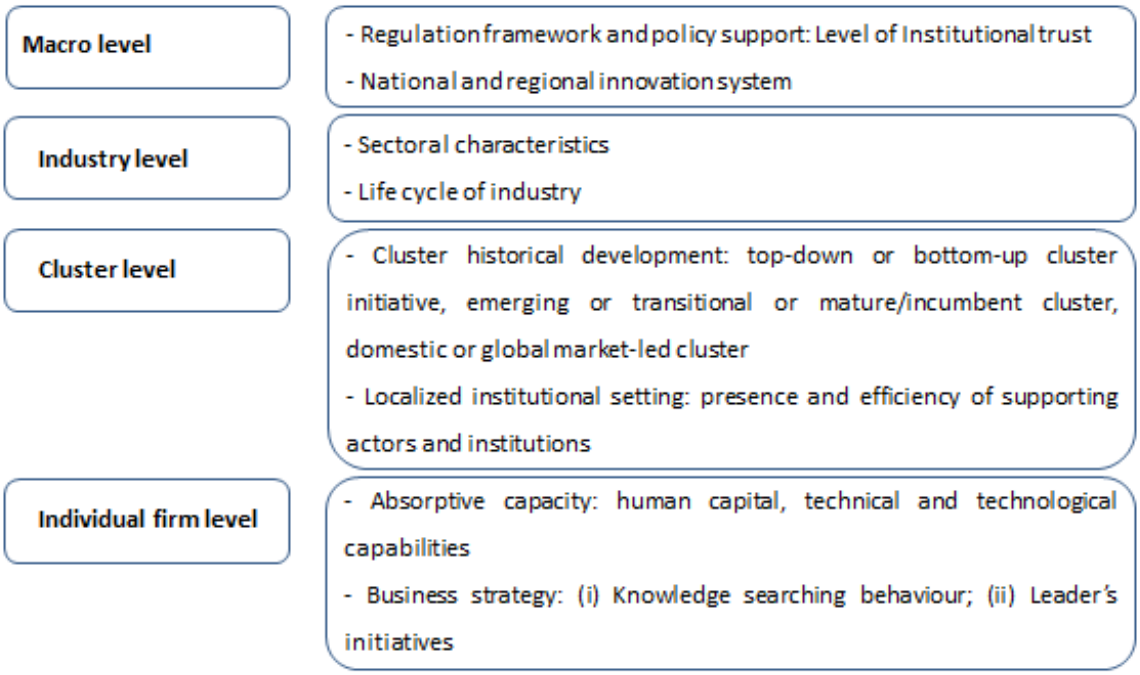



**Figure 8.1: Hierarchical levels of influences on LKS phenomenon within a cluster**

The macro level refers to the formal regulation framework; especially those regulations governing the exchange and protection of tacit knowledge, e.g. trade secret, labour, intellectual property rights and competition laws. The whole quality of legal framework generates a certain level of institutional trust, which could either encourage or discourage firms to interact with each other formally and informally regardless of pre-existing relations between them. Also, the establishment of national, regional, and local innovation systems is crucial to establish networks of innovative actors and capabilities conducive to KS across different geographical scales.

The industry level, particularly sectoral characteristics, could influence the nature of LKS and its relationship with innovation. The dominant form of knowledge varies by sector, i.e. whether tacit or codified matters, given that LKS within a cluster refers mainly to the diffusion of tacit knowledge. Sector also matters with regard to the prevalent source of knowledge for innovation; for example, software majorly relies on clients as the source of knowledge; while traditional manufacturing relies on capital goods such as machines and new production technologies (Giuliani et al., 2005; Malerba, 2006; Pavitt, 1984). Furthermore, the nature of LKS depends on the life cycle of industry (Malerba, 2006). Emerging industries such as biotechnology may experience the higher tendency to rely on LKS than mature industries. The other factor is whether the cluster is specialised in an 'old economy' traditional industry with strong pre-existing local linkages for production or a 'new-economy' knowledge-intensive industry with the dominance of global linkages in substitution for poor pre-existing local linkages. The pre-

existence of local linkages would facilitate the LKS amongst co-located firms even with the presence of global linkages in the later phase of cluster development.

At the cluster level, the presence and importance of LKS are subject to the historical development of the cluster i.e. whether it is a top-down or bottom-up cluster initiative (Dyba, 2016), whether it is an emerging or transitional or mature/incumbent cluster (cluster evolution) (Chaminade & Vang, 2008; Feldman, 1999), and whether the dominant market of clustered firms is domestic or global ones. Localised institutional setting, i.e. the presence and efficiency of supporting actors and institutions within the cluster significantly influences the occurrence of LKS.

At the micro level, i.e. individual firm level, absorptive capacity matters to turn external knowledge flows into commercial ends (Cohen & Levinthal, 1990). To be innovative, it requires firms to strategically invest in their technical and technological capabilities beyond their human capital, such as using technology for new organisational practices. The knowledge searching behaviour, whether inclined toward inward or outward strategy, affects the level of LKS that a firm generates and exchanges with co-located actors. Another important factor, namely the initiative of firm leader, i.e. their mind-set, attitude toward risks and entrepreneurial spirits, especially of spin-offs, determines the magnitude of LKS flows within a cluster, and the upgrading of the entire cluster.

### *8.3.2. Empirical contributions*

***Contribution to the gap No.1:***

> *Lack of efforts into synthesizing factors moderating the effects of LKS to innovation according to its channels, i.e. labour mobility, spin-off, and network, given the cluster initiatives in developing economies often presume the automatic presence of LKS.*

Empirical findings from this study advance our understanding about which factors, and how these factors interact to moderate the relationship between LKS channels and innovation within cluster in developing countries, particularly emerging countries that are ambitious to establish export-led service clusters from scratch. In addition to the theoretical contributions as shown in Figure 8.1, Figure 8.2 illustrates factors moderating the influence of LKS via its three main channels to innovation.

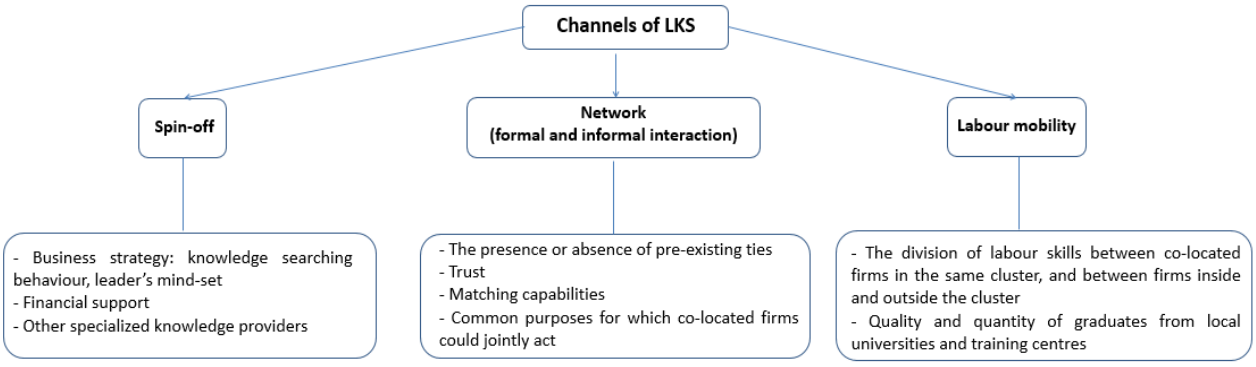



**Figure 8.2: Factors moderating the influence of LKS via different mechanisms to innovation**

There are many channels of KS, but not all of them are restricted within a geographical boundary, and therefore relevant to LKS phenomenon. The present study has focused on three relevant channels of LKS, namely spin-off, network, and labour mobility.

To nurture spin-offs, it requires financial support and specialised knowledge providers ideally located within cluster. Meanwhile, at firm level, business strategy, especially knowledge searching behaviour and the mind-set of firm leader could distinguish innovative from non-innovative spin-offs.

To facilitate network as a conduit of LKS, it takes time to build up new ties amongst co-located actors. With the aid of spatial proximity, trust enables the formation of new ties. For formal cooperation, it also takes time for firms to accumulate their technological and production capabilities; then afterwards, there would be more opportunities for cooperation given the matching capabilities. Also, as experienced in other clusters, as a necessary condition for initiating a network either formally or informally, there needs to be common purposes for which co-located firms must act together to address (Perez-Aleman, 2011; Voeten et al., 2015).

Finally, the mobility of hi-skilled labour is more significant than low-or-medium skilled labour. Hence, the quality and quantity of labour supply from local universities and training centres is important not only for the overall human capital of clustered firms, but also for the diffusion of useful knowledge for innovation. In addition, localised labour mobility is only significant if there is a well-established division of labour skills between firms inside and outside cluster (Das, 1998; Dawson, 1992; Schmitz, 1995, 1998). If there are trivial differences in terms of labour quality from within cluster and outside cluster, then the meaning of clustering for labour mobility as a conduit of LKS becomes less significant.

***Contribution to the gap No.2:***

> *Lack of empirical studies investigating the importance of LKS to innovation at firm level within a 'new-economy' cluster in developing countries given the distinctions between low-cost manufacturing cluster and knowledge-intensive cluster (Manning, 2013), and the mixed evidence found in previous studies (Huber, 2012; Kesidou, 2007; Tsang, 2005).*

This study sheds new light on the importance of LKS to innovation in a new context, i.e. knowledge intensive cluster in developing countries. Chapter 7 demonstrated the key differences of QTSC as a KSC compared to other types of clusters in both developed and developing countries. For instance, in old-economy clusters, usually in low-cost manufacturing and traditional craft, there are locally developed production linkages to some extent, sometimes largely overlapping with family ties and kinship relations. Meanwhile, for 'new-economy' cluster, i.e. KSC, there is mostly an absence of localised production linkages, i.e. neither strong family ties nor kinship connections exist within the cluster. To acknowledge these differences is to avoid making broad generalisation to a wide range of clusters than services export-led knowledge-intensive cluster in developing countries.

Besides, this research has underlined some interesting findings which are against some previous empirical studies in software industry such as (Kesidou, 2007; Tsang, 2005). Particularly, the present research has found statistically significant effect of only one channel of LKS via social interaction on organisational innovation. A variety of factors, such as the isolation of software production firms in the informal network, the undistinctive division of labour skills, the under-developed technical and technological community, lead to the conclusion that LKS via labour mobility and network do not contribute much to product innovation of co-located firms. Whereas, not all spin-offs are innovative, rather the innovativeness depends on the heterogeneous firm characteristics, especially their business strategy, i.e. their knowledge searching behaviour and their leaders' initiatives. Additionally, it is surprising to find an absence of correlation between the average educational level – an important indicator of absorptive capacity - and any channels of LKS, neither with organisational innovation indicator. This partly reflects the low quality of labour supply from local universities and colleges.

This study also extends our current understanding about why LKS might not be crucial for clustered firms. For instance, past studies highlighted the differences in terms of social norms between the focus cluster and other well-known cluster in the world. In (Huber, 2012), despite the fact that Cambridge IT cluster enjoyed an advantage due to its proximity to a well-establish university (Cambridge); its business culture is significantly contradicted to Silicon Valley in

America (Saxenian, 1996). Therefore, labour mobility is not a typical phenomenon contributing to innovation as opposed to Cambridge IT cluster. Meanwhile, QTSC is clearly a far less advantaged cluster with weak research intensity of local universities and the absence of specialised knowledge providers. LKS via labour mobility plays a minor role to the innovation process of co-located firms on account of the low labour division. Moreover, the currently weak formal and informal linkages within cluster are attributed to the lack of common purpose for co-located firms to act together.

***Contribution to the gap No.3:***

> *Lack of empirical studies investigating the dynamism of local-global linkage given the export-led nature of many clusters in developing world, particularly through the lens of LKS, i.e. how the global connections may further diffuse knowledge to local communities.*

The importance of this PhD research lies in its investigation on the local-global dynamism involving clusters in developing economies. Previous studies on this topic have failed to notice the heterogeneous characteristics of firms and, thus, treated the whole cluster as one homogenous industrial organisation (Nadvi & Halder, 2005; Wang et al., 2010). In this study, benefits from global linkages were found to spread unequally amongst outsourcing firms, subject to type of ownership and intra-organisational factors such as a firm's business strategy. Only a few firms creatively use both local and global linkages for their innovation process.

The present study presents two novel points to the existing empirical literature of local-global dynamism. *One* is to elaborate the benefits of global linkages according to business activities of firms. *Two* is to trace how knowledge flows from global connections could transfer to LKS via local connections. To connect the business activities of software firms with the learning process during technological accumulation, knowledge-using elements prevail in pure software outsourcing; meanwhile knowledge-changing elements are prevalent in those firms involving into software production. As shown in the findings, foreign pure outsourcing firms make use of their global linkages for training only; and their knowledge exchange with global actors is uni-dimensional. Meanwhile, firms involving in software production participate in bi-dimensional knowledge exchange embedded within their global linkages. For the former type of firms, most of the knowledge in exchange is technical knowledge, which is highly codified; and therefore, hard to diffuse locally. The software production firms are, in general, isolated in both formal and informal network inside the cluster; meaning a little amount of knowledge flows from global linkages has been further carried into LKS.

### *8.3.3. Practical contributions*

#### *8.3.3.1. Management recommendations*

The empirical findings from this study entails insightful managerial implications for both pure software outsourcing firms, software production firms and firms which conduct both software outsourcing and software production activities. Each of these firms could make use of LKS within cluster to promote their innovation.

For pure outsourcing firms, participating into the network evidently offers some benefits to outsourcing firms at least in terms of organisational innovation. The current problem with most pure outsourcing firms, especially indigenous ones is with their small size. To earn bigger outsourcing projects, in the short term, those pure outsourcing firms need to cooperate based on their complementary skills. In the long term, those firms must scale up to become medium-and-large firms. To scale up, they need to apply new organisational methods to increase productivity and improve efficiency of their working and management process. Equally importantly, those firms should establish a specialised team dedicated to market development to avoid the over-reliance on a few single clients. After scaling up, there could be multiple development trajectories, either continuing the outsourcing route by acquiring new outsourcing services or expanding their markets or starting their new product development project.

For mixed software outsourcing and production firms, it requires a strategic intent to develop their own products. Evidently, some firms grow gradually from the conventional software outsourcing route to software production. This way of development might be less risky than starting a software production firm from the beginning, given the lack of venture capitalists in cluster. Outsourcing is markedly a means of self-financing for product development. It also prepares outsourcing firms with technical and technological capabilities as well as market knowledge necessary for new product development. The only concern is that these firms need to creatively allocate adequate amount of their resources to both outsourcing and new product development. Joint action with other co-located firms in new development projects might be a viable route; however, it currently lacks evidence of this form of joint action in the research cluster for the problem of distrust and mismatch capabilities. Maybe, once the whole cluster evolves to a certain point in future, i.e. with higher level of inter-firm trust and with improved technological capabilities, this form of collaboration would occur organically.

For software production firms, it is evident that currently being a member of the cluster does not offer any benefits except for cost reduction and cluster reputation nationally and globally. In other words, these firms could not find essential sources of knowledge for both organisational

and product innovation within the cluster; for that reason, most of them are isolated in the social network. For production firms targeting foreign markets only, in the long term, when the domestic market becomes more mature; such as better IPR legal protection, and higher demand on software and IT products, they may consider to team up with co-located domestic firms to adapt their products to local market. However, to facilitate that scenario in future, they need to build up their local linkages, via social networking events for example, from now on. Similarly, for product firms who already targeting domestic market, they could selectively build up their local linkages with key actors who have strong global linkages in software production. This is to plan for the expansion of their market to other countries in future.

#### *8.3.3.2. Policy recommendations*

Findings from this study could be a useful aid for policymakers in developing countries, especially those deploy the cluster initiatives to promote innovation.

To invest more on both the quality and quantity of labour force for the IT sector should be the priority of the government in developing countries. Human capital is the critical input of such a knowledge-intensive industry like software. Yet, investing in education is not sufficient; rather the role of government needs to go beyond providing public goods, and becomes more strategic with the focus shifting away from static factors, such as financial incentives to attract FDI in clusters toward dynamic elements such as knowledge and KS (Stiglitz & Greenwald, 2014). This shift is crucial for emerging countries like Vietnam which is now heading toward a new economic growth model, moving away from export-led growth to productivity-led and innovation-led growth.

The over-reliance on FDI in the current agenda of industrial policy in developing countries like Vietnam is debatable. Admittedly, every country needs to undergo an accumulation process of capital and technological capabilities. Especially for backward countries, FDI is often taken for granted as a crucial source of knowledge for development. However, the overreliance on FDI and global demand is not a sustainable route of development, or at least an automatic route. The Indian model of software industry development attracts similar criticisms (Arora et al., 2001). The evidence from this PhD study has proved that foreign pure outsourcing firms play minor role in diffusing LKS beneficial for innovation, and to the technical community within cluster. Like Bell and Albu (1999) stress, there is a distinction between production and technological capabilities. The strategic cluster policy should aim to build up the technological capabilities of indigenous firms. Bearing this in mind, cluster policies should wisely target the right innovative actors. For example, they should particularly pay more attention on the indigenous SMEs, start-

ups, and spin-off firms, especially those with product innovation for domestic market (Vietnamese market).

So, how the governments in developing countries like Vietnam could intervene to promote LKS within knowledge-intensive cluster for innovation purpose?

The principle is that governments, especially local ones need to intervene in a way to promote joint action and encourage firms to invest more in R&D to improve their competitiveness. Governments could be the first client to initiate joint action projects amongst firms, or between firms with universities and research institutes.

The localised institutional setting of a cluster matters for LKS and innovation. For this reason, apart from building the efficient regulation framework, the governments in developing countries also need to be attentive to informal institutions such as cooperation culture or entrepreneurial spirits– which requires a persistent strategy. For instance, since LKS is a type of public goods; so QTSC Development Company ought to undertake the key role in establishing a communication platform including database on technical specialities of firms inside the cluster. LKS within the cluster should be placed within the strategic cluster development plan. By building an effective communication system, it helps to accelerate knowledge circulation, and to increase the cooperation opportunities amongst co-located actors within the cluster. Once this is done, clustered firms develop a sense of belonging to the technical community; therefore, the cluster would obtain a more advanced comparative advantage, which is based in knowledge elements.

In addition, to deal with the distrust problem between government and firms, the state management company of cluster like QTSC Development Company as well as the local and national governments could learn from practices in other developing countries. For instance, there is an initiative from Indonesia, with the establishment of local economic development forums as interim institutions emerging between state and society (Phelps & Wijaya, 2016).

Furthermore, for strategic cluster development, knowledge service clusters like QTSC could evolve into a hi-tech cluster. The evidence from Bangalore cluster in India dictates that the transition from an emerging to a mature regional innovation system (RIS) requires the co-evolution between the upgrading strategy of the firms and the evolution of the RIS (Chaminade & Vang, 2008). Hence, policy makers also need to focus more on building a system of regional innovation that the cluster is embedded within, to support and nurture the network of learning actors for innovation across different geographical scales; most importantly in the case of Vietnam are the university-industry linkages, and connections with Vietnamese diaspora.

### 8.4. Limitations

Despite the contributions, this study presents some limitations.

Due to time and resource constraints, the primary data only captures what happens with the cluster at one point in time. As the cluster evolves, the nature and interaction of factors affecting LKS and therefore the innovation of clustered firms will change. Other researchers should be aware that there may be no ultimate or constant causal mechanisms for a given phenomenon like critical realism suggests. With the aid of additional data reflecting the time span of those factors demonstrated in Figure 8.1 and 8.2, future studies would be able to further explore the complexity of causal mechanism underlying the relationship between LKS and innovation of clustered firms.

Besides, the present study confronts some limitations with the measurement of labour mobility and absorptive capacity. Ideally, the localised labour mobility of a firm should be measured by the inflow rate of new employees who previously worked for other firms and organisations in the same cluster divided by the total employee of that firm (Kesidou, 2007). As a matter of fact, participant firms did not keep any record on whether their employees have worked for other firm/organisation in the same cluster before. This research has relied on the data triangulation, combining a quantitative measurement of the general new employee inflow rate following (Boufaden, 2017) with interview data on the recruitment of new employees from the same cluster, to evaluate the influence of localised labour mobility as a channel of LKS on innovation.

Similarly, in the beginning, the researcher aimed to capture absorptive capacity via two variables, namely educational level and R&D intensity. Yet, most of participant firms neither accounted their expenses on R&D separately nor knew exactly how much firms dedicated their budget for R&D activities. As a consequence, this variable was largely missing, making educational level become the single variable representing absorptive capacity. Since absorptive capacity is a multidimensional concept, future quantitative studies should refer to other measurements (Jiménez-Barrionuevo et al., 2011). Meanwhile, the present study lends support to other mixed-methods researchers, by demonstrating how the qualitative strand could provide complementary information about absorptive capacity, reflecting the heterogeneous characteristics of firms.

In addition, the concerns of this study are limited within organisational and product innovation, hence, similar studies should be careful in interpreting the findings. For instance, pure outsourcing firms are not necessarily less innovative than software production firms. They might achieve other forms of innovation; for example, obtaining new clients in new markets, or using new marketing strategies to dominate a new market (marketing innovation). This opens a new direction for future studies which particularly investigate innovative activities of software outsourcing firms in developing countries.

Besides, the empirical findings from a case study of QTSC would be applicable for other clusters in developing countries with similar localised institutional setting to that of QTSC, Vietnam. Though future studies are beneficial from the analytical frameworks suggested in Figure 8.1 and 8.2, ones should be aware that different clusters are endowed with different levels of factors moderating the relationship between LKS and innovation.

### 8.5. Future research suggestions

Bearing the above limitations in mind, this section suggests some ideas for future research.

Other researchers could conduct comparative case study involving more than one cluster to examine factors affecting LKS phenomenon and its relationship with innovation at firm level. These studies could make use of the theoretical framework in Figure 8.1, and the list of moderating factors in Figure 8.2.

Or, to investigate the dynamics of LKS phenomenon, ones could study the evolution of cluster along with the upgrading of firms. Particularly, this research has observed the heterogeneous characteristics amongst firms in different software business domains. Additional research effort is required to demonstrate how pure outsourcing firms upgrade, and how the role of LKS against external knowledge flows is in this upgrading process. The development trajectory of pure outsourcing firms could be varied. Hence, future research also needs to identify whether the role of LKS differs by these trajectories.

In addition, relevant to local-global dynamism, while the mixed-method methodology in use helps to trace whether global linkages transform into LKS flows, it does not elaborate how firms combine local and global linkages to a varied extent for their innovation purpose. In this regard, ones could employ qualitative comparative analysis to ascertain the configuration of local and global linkages for firm innovation.

Finally, ones could testify the importance of LKS via its channels on other types of innovation of pure outsourcing firms within a cluster, such as new market or new outsourcing services.

## Appendix A: Ethics documents

INFORMATION SHEET

You are being invited to take part in my PhD study. Before you decide to take part it is important that you understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it me if you wish. Please do not hesitate to ask if there is anything that is not clear or if you would like more information.

**What is the study about?**

The purpose of this study is to gain an insight into the knowledge subsystems within a knowledge-intensive cluster in developing countries. Typically, it aims to understand the mechanisms of knowledge spillovers and the effects of knowledge spillovers to firms' economic and innovative performance.

**Why I have been approached?**

You/Your companies are invited to participate if your company/organisation is located within QTSC

**Do I have to take part?**

It is your decision whether or not you take part. If you decide to take part you will be asked to sign a consent form, and you will be free to withdraw at any time before the data analysis step happens (estimated within 3-4 weeks since the date of data collection) and without giving a reason.

**What will I need to do?**

If you agree to take part in the research you/your company will be asked to fill into the innovation and network surveys. In addition, you will be invited to take part in a interview lasted for 45-60 minuites. The interview will be recorded for transcription and translation.

**Will my identity be disclosed?**

All information disclosed within the surveys and interview will be kept confidential. The data will be accessible by the researcher and the supervisors only. The digital information will be stored securely in password-protected location. The names of participants will be anonymised. However, there is a very small chance that participants as companies could recognize themselves and others in the social network analysis. In this case, there is no harm to participants as companies at all since there is no sensitive information about companies being asked and distributed in the research.

**What will happen to the information?**

The collected data will be organised, cleaned and analysed. It is anticipated that the research may at some points be published in a journal or report. It may be necessary to use your words in the presentation of the findings.

**Who can I contact for further information?** If you require any further information about the research, please contact me on: *E-mail: Thi.Ngo@hud.ac.uk.*

**CONSENT FORM**

**Title of Research Project:** Knowledge spillovers within a knowledge-intensive cluster in developing countries and its relation with innovation and economic growth at firm level: An empirical study of QTSC Vietnam

**It is important that you read, understand and sign the consent form. Your contribution to this research is entirely voluntary and you are not obliged in any way to participate, if you require any further details please contact your researcher.**

| | |
|---|---|
| I have been fully informed of the nature and aim of this study as outlined in the Information Sheet, and have had the opportunity to ask questions. | ☐ |
| I consent to taking part in this the study. | ☐ |
| I understand that my participation is voluntary and that I am free to withdraw at any time before the data analysis step happens without giving any reason. | ☐ |
| I give permission for my words to be quoted (by use of pseudonym). | ☐ |
| I understand that no person other than the researcher and her supervisor will have access to the information provided. | ☐ |
| I understand that my identity will be protected by the use of pseudonym in the report. | ☐ |

If you are satisfied that you understand the information and are happy to take part in this project please put a tick in the box aligned to each sentence and print and sign below.

| Signature of Participant: | Signature of Researcher: |
|---|---|
| | (signed) |
| Print: | Print: THI NGOC BICH NGO |
| Date: | Date: 20th June 2018 |

(one copy to be retained by Participant / one copy to be retained by Researcher)

**Appendix B: Final template (long version)**

**1. Intra-firm factors**

***1.1. Human capital***

*1.1.1. Quality*

1.1.1.1. Technical knowledge

1.1.1.2. Business mind-set

1.1.1.3. Transferable skills

1.1.1.4. Language skills

*1.1.2. Quantity*

1.1.2.1. Shortage of labour for the overall IT industry

1.1.2.2. Supply from inside QTSC play a minor role

1.1.1.2.1. Training subjects at educational institutional inside QTSC

1.1.1.2.2. Labour mobility from other firms inside QTSC

1.1.2.3. MSEs has a disadvantage in recruitment

***1.2. Business Strategy***

*1.2.1. Knowledge searching behaviour*

1.2.1.1. Inward strategy

1.2.1.2. Outward strategy

*1.2.2. Leader's initiatives*

1.2.2.1. Fixed mind-set associated with risk-averse attitude

1.2.2.2. Growth mind-set associated with risk-taker attitude

***1.3. Absorptive capacity***

*1.3.1. To locate and identify external knowledge*

1.3.1.1. Based on personal network

1.3.1.2. Based on expertise of senior staffs

1.3.1.3. Based on a separate R&D team

*1.3.2. Internal absorption process*

*1.3.3. Means to upgrade absorptive capacity*

1.3.3.1. Training activities

1.3.3.1.1. Online courses

1.3.3.1.2. Invite teachers, experts come to firms to train

1.3.3.1.3. Send staffs to abroad

1.3.3.2. Improve working methodology

1.3.3.3. Develop a learning culture

**2. Local linkage**

***2.1. Networking within QTSC***

*2.1.1 Relevance of networking events' topics*

*2.1.2. Frequency of networking events*

*2.1.3. Roles of relevant economic actors*

2.1.3.1. Co-ordinator and organiser

2.1.3.2. Leading institutions or firms

***2.2. Cooperation within QTSC***

*2.2.1. Forms of cooperation*

2.2.1.1. Recruitment

2.2.1.1.1. Graduates

2.2.1.1.2. Interns

2.2.1.2. Sub-contract

*2.2.2. Reasons for weak cooperation within QTSC*

2.2.2.1 Relatedness

2.2.2.1.1. Business commonality

2.2.2.1.2. Matching/equivalent capability

2.2.2.2. Problems regarding cooperation contracts

2.2.2.2.1. Price

2.2.2.2.2. Agreement on human resource and timing

2.2.2.2.3. Confidentiality

2.2.2.3. Lack of an effective communication system

2.2.2.4. Lack of a cooperation culture

**2. 3. Other forms of knowledge exchange**

*2.3.1. Higher educational institutions (HEIs)*

2.3.1.1. Collaboration strategy of HEIs: Lack of a collaboration model & Unwilling to cooperate with businesses

2.3.1.2. Capability of HEIs: Technical capability & Business mind-set and skills

*2.3.2. Supporting services and community*

**3. Global linkage**

***3.1. Type of linkage***

*3.1.1. Linkage based on ownership*

*3.1.2. Linkage with clients*

*3.1.3. Linkage based on partnership*

***3.2. Benefits of global linkage***

*3.2.1. Financial capital accumulation*

*3.2.2. Knowledge accumulation*

3.2.2.1. Technical and technological knowledge

3.2.2.2. Business and market knowledge

*3.2.3. Professional working skills*

3.2.3.1. Working culture adaption: long-hour working, better working attitude toward job responsibilities

3.2.3.2. Improved working methodology

3.2.3.3. Business skills: Critical-thinking, market research skills, project management skills, conflict handling, etc.

**4. Additional themes**

***4.1. Sources of market and technological information and knowledge***

*4.1.1. Client*

*4.1.2. Competitor*

*4.1.3. Internal personnel*

*4.1.4. International standard*

*4.1.5. Personal network*

*4.1.6. Technological frontier*

*4.1.7. The mother company*

*4.1.8. Training workshop, conference, seminar*

*4.1.9. Internet*

***4.2. Reasons to choose QTSC as the office location***

*4.2.1. Cost attractiveness: tax reduction, cheap office rent*

*4.2.2. QTSC brand name helps to attract clients*

*4.2.3. Personal network of the firm owner*

*4.2.4. Business network*

*4.2.5. Working environment: open 24/7, stable Internet connection and electricity, a clean and tranquil environment*

*4.2.6. Support of QTSC Development Company in business registration especially for foreign invested firms*

## Appendix C: List of interviewees

| No. | Date of interview | Code | Title | Business |
|---|---|---|---|---|
| 1 | 25th July 2018 | 108 | Director/ CEO | Mixed |
| 2 | 4th Sep 2018 | 120 | Director/ CEO | Mixed |
| 3 | 26th July 2018 | 153 | Director/ CEO | Mixed |
| 4 | 17th July 2018 | 155 | Director/ CEO | Mixed |
| 5 | 19th July 2018 | 133 | Director/ CEO | Mixed |
| 6 | 14th & 26th August 2018 | 134* | Director/ CEO | Other |
| 7 | 19th July 2018 | 104 | Director/ CEO | Other |
| 8 | 3rd July 2018 | 152 | PQA Manager cum. Administration Manager | Other |
| 9 | 20th July 2018 | 149 | Vice President | Outsourcing |
| 10 | 18th July 2018 | 115 | Vice President | Outsourcing |
| 11 | 26th July 2018 | 103 | Deputy Director (in charge of operation in VN) | Outsourcing |
| 12 | 24th July 2018 | 105 | Head of branch | Outsourcing |
| 13 | 30th July 2018 | 107 | Chief Technical Department | Outsourcing |
| 14 | 17th July 2018 | 111 | Director/CEO | Outsourcing |
| 15 | 25th July 2018 | 114 | Manager/Chief of Technical Department | Outsourcing |
| 16 | 14th August 2018 | 119 | Director/ CEO | Outsourcing |
| 17 | 25th July 2018 | 123 | Director/ CEO | Outsourcing |
| 18 | 17th July 2018 | 145 | Director/ CEO | Outsourcing |
| 19 | 18th July 2018 | 150 | Director/ CEO | Outsourcing |
| 20 | 17th July 2018 | 101 | Head of branch | Production |
| 21 | 17th July 2018 | 118 | Director/ CEO | Production |
| 22 | 25th July 2018 | 126 | Director/ CEO | Production |
| 23 | 26th July 2018 | 143 | Head of branch | Production |
| 24 | 31st July 2018 | 151 | Director/ CEO | Production |
| 25 | 10th August 2018 | 156 | Chief Technical Department | Production |
| 26 | 3rd June 2018 | 117/0* | CEO | Production |
| 27 | 17th June 2018 | 117/1 | Chief Product Officer | Production |
| 28 | 24th June 2018 | 117/2 | Senior Product Manager | Production |
| 29 | 20th July 2018 | 112 | Rector | College |
| 30 | 20th June 2018 | 121 | former Deputy Rector | University |
| 31 | 26th July 2018 | 131 | Deputy Director | IT Training centre |

*: interview via email.

**Appendix D: Interview guidance**

1. Understanding business activities of firm

Tell me about your business domain and business activities. How do you describe it in terms of outsourcing, production, mixed or other?

2. Reasons to locate at QTSC

From the beginning, why did your enterprise decide to locate within QTSC? Would your enterprise consider continuing your location here?

3. Sources of technical, technological and market knowledge for innovation:

Where are the sources of knowledge/information technology to improve your enterprise's productivity and efficiency? Can you find these sources within QTSC? Do you encounter any barriers in gaining access to and in exploiting these sources? Or Where do you seek market and technical information/knowledge?

4. Cooperation activities

Tell me about your cooperation activities with external organisations and firms. Where are your cooperation partner? In which sector/industry? How does collaboration mean to your enterprise's innovation and business strategy?

In your opinion, how could the cooperation between enterprises, universities, colleges and other organisations within QTSC be improved?

5. Does your enterprise register any intellectual property assets such as trademarks, patent, etc.? If not, why?

6. Benefit of outsourcing

If your firm conduct outsourcing activities, how could outsourcing benefit innovation at your firm?

**Appendix E: Survey questions**

**INNOVATION SURVEY**

***Research title:*** Knowledge spillovers within a knowledge-intensive cluster in developing countries and its relationship to innovation and economic growth at firm level: An empirical study of QTSC, Vietnam.

This survey collects information regarding your enterprises' innovation and economic activities. Your enterprise is invited to fill into the survey if it is located within Quang Trung Software City (QTSC) Vietnam. The term "your enterprise" used in this survey is to ask about your enterprise at QTSC, not the enterprise group that your enterprise is member.

The survey consists of 13 questions. All collected information will be analysed for the purpose of study and relevant publications, reports only. Should you have any questions, feel free to contact the researcher, Thi N.B. (Alice) Ngo at thi.ngo@hud.ac.uk.

The survey starts from the next line.

**Name of your enterprise:**

**Website (if any):**

**Year of establishment:**

**Contact of the person filling this survey:** Email: Mobile:

* All collected information remains confidential for the purpose of research only.

**1.a** Is your enterprise a spin-off company from another enterprise or university within QTSC?

☐ Yes

☐ No

**1.b.** Is your enterprise a foreign-invested company?

☐ Yes

☐ No

**2**. Please provide names of your enterprise' ***suppliers*** of specialised equipment, machines, tools, software, and other inputs of your production, who are also located within QTSC here

…….

If none, what is the geographical location of your enterprise's ***suppliers***?

☐ Inside Ho Chi Minh city ☐ Abroad

☐ Outside Ho Chi Minh city, still inside Vietnam

**3**. Please provide names of your enterprise' ***clients***, who are also located within QTSC here ……

If none, what is the geographical location of your enterprise's ***clients*** outside QTSC?

☐ Inside Ho Chi Minh city ☐ Abroad

☐ Outside Ho Chi Minh city, still inside Vietnam

**4.** Please provide names of your enterprise' ***cooperation partners*** in knowledge sharing, training, R&D, etc., who are also located within QTSC here (if none, skip)

……..

If none, what is the geographical location of your enterprise's ***cooperation partners*** outside QTSC?

☐ Inside Ho Chi Minh city ☐ Abroad

☐ Outside Ho Chi Minh city, still inside Vietnam

**5.** In the last three years, has your enterprise introduced new or significantly improved product (services/goods)?

☐ Yes. If yes, there are ……. (a number here) new or significantly improved product in the last three years.

☐ No

**6.** In the last three years, has your enterprise employed any ICT applications (information communication technology) in working with clients, suppliers, and/or to improve productivity at your enterprise? *ICT application such as CRM, ERP, etc.

☐ Yes. There are ……. (a number here) ICT applications in the last three years.

☐ No

**7.** In the last three years, has your enterprise registered any Intellectual Property Rights (IPRs) assets (such as patents, trademarks, and copyright) with the National Office of Intellectual Property (NOIP) and foreign IP registry office abroad?

☐ Yes. There are ……. (a number here) registered IP assets in the last three years.

☐ No

**8.** Please provide numbers (or percentage) of employees according to their degree:

Total number of employee: **…… employees**

| Level | Vocational & College | Bachelor | Master | Doctoral |
|---|---|---|---|---|
| Number of employees | | | | |

**9.** In the last one year (June 2017-June 2018), what are the numbers of new employees and leaving employees?

Number of new employees: **…**….

Number of leaving employees: ……..

**10.** In the last three years, has your enterprise invested in researching and/or studying new technology and/or hot trend technology in your field?

☐ Yes. Please provide the average proportion of investment into such new technology out of total costs here: **…….%**

☐ No

* *Investing in new technology:* including the acquisition of machinery, equipment, buildings, software, and license; engineering and development work, feasibility studies, design, training, R&D and marketing when they are specifically undertaken to develop and/or implement a product or process innovation. This also includes all types of R&D consisting of research and development activities **to create new knowledge or solve scientific and/or technical problems.**

**11.** By comparison with the total revenue of the first six months in 2017 (January to June), what is the growth rate of your enterprise's total revenue of the first six months in 2018?

**…….%**

**12**. By comparison with the total revenue from export of the first six months in 2017 (January to June), what is the growth rate of your enterprise's total revenue from export of the first six months in 2018?

**…….%**

## NETWORK SURVEY

Think about all of your friends, who have been working for a company/organisation within QTSC.

In the last 5 years (2013-2018), whom amongst your friends have you shared with or talked to when:

(i) you had a technical/technological difficulty at your firm; and/or

(ii) you had an important decision need to make regarding your company's performance and strategy.

Please name companies where your friends work in equivalent to the frequency of your face-to-face contact:

| **Frequency of contact** | **Name of firm** |
|---|---|
| VERY OFTEN, i.e. at least every week | |
| OFTEN, i.e. almost every month (and less than every week) | |
| SOMETIMES, i.e. a few times per year (and less than every month) | |
| RARELY, i.e. one time per year (and less than a few times per year) | |

* if you do not have any such friends to contact, please leave it blank.

**Appendix F: Some key legal and policy document regarding the IT industry and software clusters in Vietnam**

Resolution 49/CP on IT development in the 1990s

Decision 211/TTg on approval of the national program on IT

Resolution 7/2000/NQ-CP on the establishment and development of software industry for the period 2000-2005

Directive 58/CT-TW on accelerating the use and development of IT for modernisation and industrialisation

Decision 128/2000/QD-TTg on some measures and policies to encourage investment and development of software industry

Decision 81/2001/QD-TTg on approval the action program to implement Directive 58/CT-TW for the period 2001-2005

Decision 95/2002/QD-TTg on approval the plan of IT application and development in Vietnam to 2005

Law on Information Technology 2006

Law on Technology Transfer 2006 and 2017

Law on Intellectual Property Rights 2009

Law on Technology Transfer 2017

Decision 246/2005/QD-TTg on approval of development strategy of ICT industry in Vietnam to 2010 with vision to 2020

Decision 51/2007QD-TTg on approval of plan on software industry development in Vietnam to 2010

Decision 331/QD-TTg on approval of the plan on IT human resource development up to 2010

Resolution 13/NQ-TW on building a synchronous infrastructure system in order to turn Vietnam into a modern industrialised country by 2020

Resolution 26/NQ-CP on promulgating the action program of the Government on the implementation of the Resolution No. 36-NQ/TW dated July 1, 2014 of the Political Bureau of the Party Central Committee of Viet Nam to accelerate the application and development of information technology to meet the requirements of sustainable development and international integration

Resolution 41/NQ-CP on tax incentives to promote the development and application of IT in Vietnam

Decision 1755/QD-TTg on approval of the master plan to early make Vietnam a strong country in ICT

Decision 392/QD-TTg on approval of the targets for IT industry development program to 2020 with vision to 2025

Decision 153/QD-TTg on approval of the targets for IT industry development program to 2020 with vision to 2025

Decision 698/QD-TTg on approval of the overall plan on IT human resource development up to 2015 with vision to 2020

Decree 35/2017/ND-CP

## Appendix G: Some statistic data on the IT industry in Vietnam

Source: ICT White Book Vietnam 2014, 2017, 2019 (MIC, 2014, 2017, 2019)

### Total revenue of the IT industry

Unit: million USD

| IT industry/Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|
| Hardware, electronic industry | 4,627 | 5,631 | 11,326 | 23,015 | 36,762 | 53,023 | 58,838 | 81,582 | 91,516 |
| Software industry | 850 | 1,064 | 1,172 | 1,208 | 1,361 | 2,602 | 3,038 | 3,779 | 4,447 |
| Digital content industry | 690 | 934 | 1,165 | 1,235 | 1,407 | 638 | 739 | 799 | 825 |
| IT services (not including trade and distribution) | | | | | | 4,453 | 5,078 | 5,432 | 6,185 |

### Total revenue from export of the IT industry

Unit: million USD

| IT industry/Year | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|
| Hardware, electronic industry | 49,860 | 57,737 | 74,936 | 78,566 |
| Software industry | 2,192 | 2,491 | 3,301 | 3,743 |
| Digital content industry | 503 | 561 | 734 | 771 |

### Number of registered enterprises

Unit: enterprise

| IT industry/Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|
| Hardware, electronic industry | 992 | 1,273 | 2,763 | 2,431 | 2,485 | 2,980 | 3,404 | 4,001 | 4,730 |
| Software industry | 1,756 | 2,958 | 7,044 | 7,246 | 6,832 | 6,143 | 7,433 | 8,883 | 11,496 |
| Digital content industry | 2,844 | 2,312 | 3,289 | 3,883 | 4,498 | 2,339 | 2,700 | 3,202 | 3,561 |
| IT services (not including trade and distribution) | | | | | | 10,196 | 10,965 | 12,338 | 19,074 |

### Total number of employees

Unit: person

| IT industry/Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|
| Hardware, electronic industry | 121,300 | 127,548 | 167,660 | 208,680 | 284,508 | 533,003 | 568,288 | 678,917 | 717,955 |
| Software industry | 64,000 | 71,814 | 78,894 | 80,820 | 88,820 | 81,373 | 97,387 | 112,004 | 127,366 |
| Digital content industry | 41,000 | 50,928 | 60,200 | 63,242 | 67,680 | 44,320 | 46,647 | 55,908 | 51,952 |
| IT services (not including trade and distribution) | | | | | | 62,888 | 68,605 | 75,692 | 76,419 |

### Some statistic data on IT concentrated zones in Vietnam

(*since 2016: including 3 recognized zones by Prime Minister and Hoa Lac Hi-Tech Park)

| IT industry/Year | Unit | 2015 | 2016* | 2017 | 2018 |
|---|---|---|---|---|---|
| Number of IT zones | IT Park | 3 | 4 | 4 | 4 |
| Total size of land | $m^2$ | 524,875 | 845,015 | 845,015 | 845,015 |
| Total size of office space | $m^2$ | 466,215 | 579,215 | 601,215 | 620,000 |
| Total number of enterprises IT parks | Enterprise | ≈ 300 | > 700 | >800 | 750 |
| Total number of IT employees in IT parks | Person | > 20,000 | > 36,000 | >41,000 | 42,000 |

## Average salary of IT employees

Unit: USD/person/year

| IT industry: | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|
| Hardware, electronic industry | 2,859 | 3,866 | 4,452 | 5,392 |
| Software industry | 6,215 | 6,849 | 7,570 | 8,578 |
| Digital content industry | 6,120 | 6,189 | 6,737 | 7,696 |
| IT services (not including trade and distribution) | 5,376 | 5,609 | 5,909 | 6,932 |

## R&D projects in ICT

| Period | Number of national projects on ICT |
|---|---|
| 1995-2005 | 344 |
| 2006-2010 | 166 |
| 2011-2016 | 165 |

## R&D projects in ICT

| Year | Number of ministerial projects on ICT |
|---|---|
| 2012 | 195 |
| 2013 | 67 |
| 2014 | 61 |
| 2015 | 84 |
| 2016 | 85 |

## Human resource training for ICT

| | *2016* | *2018* |
|---|---|---|
| ***Tertiary training*** | | |
| Total number of universities and colleges | 666 | 236* |
| Total quota of students enrolment in universities and colleges | 700,000 | N/G |
| Number of universities and colleges with training subjects in IT, electronics, telecommunications and information security | 250 | 149 |
| Quota of student enrolment for universities and colleges in IT, electronics, telecommunications and information security | 68,883 | 51,114 |
| ***Vocational training*** | | |
| Total number of vocational training schools and colleges | 469 | 909 |
| Total quota of students enrolment in vocational training schools and colleges | 250,000 | 540,000 |
| Total number of vocational training schools and colleges offering IT, electronics, telecommunications and information security training | 164 | 412 |
| Total quota of students enrolment in vocational training schools and colleges offering IT, electronics, telecommunications and information security training | 18,311 | 545,000 |

* does not include universities and colleges under the Ministry of Defence and Ministry of Public Security.

## Appendix H: Inclusion and Exclusion criteria for empirical literature review

***Inclusion criteria:***

- Studies that explicitly discuss about LKS and/or its equivalent terms, such as external economies, industrial atmosphere, etc;

- Studies that are published in peer-reviewed journals (for example, those listed in the ABS ranking).

***Exclusion criteria:***

- Studies that do not discuss LKS and/or its equivalent term at all;

- Studies that are purely conceptual paper, or simulation modelling paper without the use of either primary or secondary data to illustrate the conceptual framework and/or (mathematic) model;

- Studies that presume the existence of LKS without examining its emergence and mechanisms;

- Studies that fall into the KS location and KS demography approaches (as explained in Literature Review chapter);

- Studies that focus on the role of a few intermediaries to facilitate LKS regardless of the mechanisms of LKS;

- Studies that are conducted at other levels than firm level of analysis, such as individual level, cross-regional level.

- Studies that are not published in peer-reviewed journals.

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[i] Creative destruction refers to "*the process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one"* (Schumpeter, [1942], 2003, p. 83)

[ii] Purposive sampling refers to the 'selection of individuals/groups based on specific questions/purposes of the research in lieu of random sampling and on the basis of information available about these individuals/groups' (Tashakkori & Teddlie, 1998, p. 76).

[iii] Convenience sampling refers to the sampling 'is done on the basis of availability and ease of data collection rather than in terms of sustainability based on research objectives/questions' (Tashakkori & Teddlie, 1998, p. 76).

[iv] At https://dichvuthongtin.dkkd.gov.vn.
[v] Template analysis derived from psychology literature, and it was founded by Professor Nigel King.
[vi] The most updated Oslo Manual is its 4th edition released by OECD jointly with Eurostat in October 2018, which is published after the fieldwork study in Vietnam.
[vii] For example, some relevant laws approved these industries including Decision No. 55/2007/QD-TTg in 2007 and Decision No. 879/QD_TTg in 2014.
[viii] Decision 154/2013/ND-CP specifically defines IT concentrated zone; however, in the English version of publications issued by the Ministry of Information and Communication, it is referred as "IT park".
[ix] Such as Geographic Information System (GIS), Smart building, Wastewater monitoring system, Smart parking systems, Smart power grid systems (Smart Grid), etc (Source: https://www.qtsc.com.vn/en/introduction)
[x] The number of possible ties of a network consisting of n nodes is n(n-1)/2.
[xi] 'In binary data, density is …computed as the average of all entries in the adjacency matrix (typically omitting the main diagonal, which represents self-ties). In valued data, we….compute the average of all ties, which is to say we compute average tie strength' (Borgatti et al., 2018, p. 175).
[xii] This fact is noted in a discussion between the researcher and a representative of the QTSC Development Company in the fieldwork study.
[xiii] Dyad refers to the tie between two connected nodes.
[xiv] "A clique is a subset of actors in which every actor is adjacent to every other actor in the subset and it is impossible to add any more actors to the clique without violating this condition" (Borgatti et al., 2018, p. 213).
[xv] Degree centrality is calculated as the number of ties that a node has.
[xvi] Legend: (given flow 1-->2-->3, where 2 is the broker).
Coordinator: A-->A-->A (all nodes belong to same group)
Gatekeeper: B-->A-->A (source belongs to different group)
Representative: A-->A-->B (recipient belongs to different group)
Consultant: B-->A-->B (broker belongs to different group)
Liaison: B-->A-->C (all nodes belong to different groups)
[xvii] VNITO Alliance: Vietnam Information Technology Outsourcing Alliance.
[xviii] at http://vietnamitodirectory.com/directory/.
[xix] The term "growth mind-set" is coined by Professor Carol Dweck (2017).
[xx] Source: internal report provided by QTSC Development Company.