
Investigating the Technology Catching-up Trajectory of Chinese Hi-Tech SMEs: an Integrated Framework from Industry-, Resource-, and Institution-based view

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Abstract

Purpose

This paper intends to review the literatures on the technology catching-up trajectory of latecomers in order to understand the innovation strategies of Chinese Hi-Tech SMEs (Gu & Tse, 2010; Xie & White, 2006; Chen & Qu, 2003; Lee & Lim, 2001; Kim, 1997). It also tries to construct an integrated framework to investigate their innovation strategies and the impact on organizational performance from the Industry-, Resource-, and Institution-based view (Peng, Wang, & Jiang, 2008).

Design/methodology/approach

The authors have reviewed papers published in the leading journals in the R&D field and proposed an integrated conceptual framework of innovation strategies of Chinese Hi-Tech firms based on Peng, Wang and Jiang (2008)'s institution-based view framework to examine the innovation strategy from Industry-, firm-specific Resource-based, and Institution-based View

Originality/Value

This paper pays attention to the institution factors in shaping Chinese SMEs to develop innovative capabilities. Chinese firms have comparative advantages, such as better comprehending Chinese local market, better understanding of local business environment comparing to MNEs. Our paper argues that by developing effective innovation strategies and improving innovative capabilities, Chinese SMEs will be able to survive from the severe competitions from state-owned enterprises and foreign firms in China.

Keywords: Resource-based View, Institution-based View, Chinese Hi-Tech SMEs, Innovation

Introduction

The topic of technology catching-up has been received attentions in recent decades. Many studies have specifically focused on the trajectory of successful technology catching-up in the industrialisation of developing countries (Lall, 1992; Bell & Pavitt, 1993; Hobday, 1995, 1998; Kim, 1997; Lee & Lim, 2001; Mathews, 2002). It is believed that latecomer firms from newly industrialised economies (NIEs) (e.g. Korea) initially rely on importing mature technology from developed countries, and then build and accumulate their own technological capabilities (Hobday, 1995, 1998; Kim, 1997). Nevertheless, some researchers argue that Chinese companies will be likely to create its pathway to produce high value-added product and service innovations to continue its fast economic growth rather than to continue to adopt its low cost strategy (Porter, 1998; Gu & Tse, 2010) and/or rely on imitation strategy (Xie & White, 2006; Chen & Qu, 2003). China's huge domestic market has provided ample room for Chinese indigenous firms to entry and expansion in many industries without the need to immediately entail penetrating into global market (Xie, 2004; Xie & Wu, 2003; Brandt & Thun, 2010). It should be noted that less attention has been paid to the heterogeneities of Chinese small- and medium-sized enterprises (SMEs) in the catching up process. Facing competition from large sized firms of Chinese domestic market and Multi-national enterprises (MNEs) from developed markets, it is momentous to improve innovative capabilities of Chinese high-tech SMEs. Additionally, it may be necessary to pay attention to the impact of the role of institutions to Chinese SMEs' innovative behaviour.

Despite the efforts by researchers in explaining latecomer firms catching-up literature, most have assumed institutions as 'background' (Peng et al., 2008; Gao et al., 2010). Indeed, as institutions in emerging economies in the context of China differ drastically from those in developed countries (Seligman, 1999; Shenkar, 2005) and significantly formulate firm's innovation strategies, omitting institutional environments in investigating the drivers of innovative behaviours and performance has seriously limited our understanding of Chinese high-tech SMEs' catching-up strategy (Gao et al., 2010). Thus, drawing on Peng et al. (2008)'s "Strategy Tripod" framework, this paper provides a thorough review on the technology catching-up trajectory of Chinese Hi-Tech SMEs from Industry-, Resource-, and Institution-based perspective.

In this paper, we begin with a review of existing literature in Chinese firms' technology catching-up, and identify our research gap. After that, we review the general development of Chinese SMEs. Following this, we will separately review the literature from industry-, resource-, and institution-based perspective to suggest an integrated theoretical model for illustrating the impact of innovation strategy to firm performance in Chinese high-tech SMEs.

Early work relating Catching-up to Chinese firms

Several studies have been carried out to analyze the processes of catching-up in Chinese firms (see table 1). Most of the studies focus on examining the effects of internal factors on firm's technology catching-up process rather than the effects of external factors. In particular, institutional environment factors have mostly been neglected in the extant latecomer's catching-up literature although firm's strategic choice directly has been influenced by institutional factors in emerging economies (Peng, 2003; Peng et al., 2008; Gao et al., 2010).

Furthermore, as majority of these empirical studies placed their attention to the large-sized state-owned enterprises (SOEs) or quasi-SOEs (e.g. town and village enterprises), it is likely that most can secure government financial and/or legitimate support easily. However, there is a lack of research on examining the technology catching-up trajectory of Chinese SMEs from ‘tripod strategy’ perspective (Peng et al., 2008, 2009).

Table 1 A summary of studies of the trajectory of Chinese firm’s catching-up.

Studies	Sample	Key findings
Chen & Qu (2003)	Qualitative analysis; Single case study of ZDZK Automation Ltd Co.	<ol style="list-style-type: none"> 1. Korea’s model of technology catching-up may not meet the needs of China nowadays. 2. Chinese firms that already possess a certain technological capability can and should circumvent the lower stages of the traditional model.
Xie (2004)	Qualitative analysis; Case studies of Chinese colour TV (CTV) industry.	<ol style="list-style-type: none"> 1. Despite China’s CTV industry relied mainly upon the purchase of imported-technology, it can combine marketing skills for focusing its attention on the huge domestic market for a long time. 2. latecomer firms in developing countries should view the industrial development from a global perspective, rather than seeking complete localization of components
Mu & Lee (2005)	Qualitative analysis; case studies Chinese telecommunication industry	<ol style="list-style-type: none"> 1. It finds that the extent to which catch-up hinges on the prior technological capabilities and the nature of arranged access to knowledge and terms of transfer. 2. China can take advantage of its large market to enable technology transfer through joint venture with foreign MNEs from developed countries. 3. The indigenous Chinese firms were able to secure their competitive advantage by satisfying different demands in the segmented markets.
Fan (2006)	Case study and simple regression analysis; survey data from China’s telecom-equipment industry (note: Four large-sized firms)	<ol style="list-style-type: none"> 1. It finds that innovation capability and self-developed technologies have been the key to leading domestic firms’ catching up with the multinationals. 2. It emphasizes that domestic firms should prioritize in-house R&D to build innovation capability from the very beginning, supplemented with external alliances.
(Lee, Cho, & Jin) 2009	Qualitative analysis; case studies of	<ol style="list-style-type: none"> 1. Chinese indigenous automakers have been making a quick catch-up upon entry because the

	mobile phones and automobiles sectors in China	<p>auto sectors tend to feature a higher degree of embodied technical change and increasing modularity in many components.</p> <p>2. Chinese domestic mobile phones makers can achieve early catch-up owing to the high modularity of production and availability of knowledge pool around the nation.</p>
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Development of Chinese Small and Medium-sized Enterprises (SMEs)

Over the past three decades, Chinese SMEs have developed quickly due to the development of China’s reform and opening-up. According to Chen’s research (2006), there are roughly three development periods that Chinese SMEs have experienced. They are as follows:

1. 1978-1992: the quickly expansion of SMEs in number and scale is resulted from the government’s stimulation of and support for the development of township, collective and self-employed companies.
2. 1992-2002: the government adopted different measures to reconfigure state-owned SMEs for gradually reducing the state’s ownership in SMEs and the rapid development of non-public sectors due to establishment of the socialist market economy.
3. 2002-on going: China promulgated the small and medium-sized enterprises promotion law in 2002 and amended the constitution to grant the non-public economy a legal status in the socialist market economy in 2004.

Particularly Chinese SMEs have become the driving force for the dissemination and application of existing new technology and innovation. However, their expenditures on research and innovation are very limited (Chen, 2006; Wang & Yao, 2002). It may be because SMEs generally lack the resources (e.g. human, legitimate or financial resources) for innovation although they are flexible in responding to market signals (Wang & Yao, 2002). They also face severe competition and challenges from state-owned and foreign firms. For instance, state-owned commercial banks still regard state-owned firms and publicly-owned companies as the main candidates for loans for innovation and development (Wang, 2004). It should also be noted that more than 60 percent of the Fortune 500 companies have established operations in China by 2001, most with the intention of serving the domestic market by taking advantage of their advanced technology (Xie & White, 2006) Thus, it is imperative for Chinese SMEs to build ‘suitable’ innovation strategy to survive in this intense competition.

Theoretical Framework and background: ‘Strategy Tripod’ Framework

Industry-based view:

The industry-based view, pioneered by Porter (1980), emphasises how to attain a dominant position by interacting between firm and its environment. It maintains that both the strategy of firms and performances hinges on the structure of industry. According to Porter (1980),

firms can identify and defend themselves against all external environmental threats in the industry. In other words, the external environment in which a firm operates puts pressures on firm to adapt to survive and prosper (Collis, 1991). Firms can manage their dependence by formulating and implementing competitive advantages in an attempt to alter their position in the industry vis-à-vis competitors and suppliers (Gao et al., 2010). Consequently, industry factors are important to determine and limit a firm's strategic behaviour (Teece et al., 1997). Nevertheless, industry-based view has been criticised by scholars such as Wernefelt (1989), Rumelt (1991) and Caloghirou et al. (2004). The reason for this is that it has been needed to account for a firm's performance from firm-specific factors rather than the industrial effects. In this paper, by focusing on China's domestic market, we identify and propose three aspects are important, namely competition intensity, industry turbulence and industrial development orientation.

- Competition intensity

Competition-related factors such as industry concentration and barriers to entry have been recognised as important determinants of innovation in the literature (Dijk et al., 1997; Kraft, 1989; Salavou et al., 2004). Additionally, much empirical evidence from the existing literature suggests that firms' innovative behaviour is affected by external competitive pressure (Salavou et al., 2004; Kamien & Schwarts, 1982; Fritz, 1989; Abernathy & Utterback, 1978). For instance, Kamien and Schwarts (1982) argue that intense competition may hinder firms' innovative activities, as fierce competition likely remove incentives to innovate. The intense competition combined with internally financial pressure will force firms to focus more on marketing performance in a short term rather than on innovation for the long-term benefits. In contrast to this type of reasoning, it can also be argued that competition provides condition and motivation for innovation (Dasgupta and Stiglitz, 1980).

It should be noted that prior literature about the development of Chinese SMEs in the 1980s is mainly focusing on labour intensive industries, such as textile, garment, leather, furniture, plastic products and durable consumer goods (Lin, Cai, & Li, 1994; Lin & Yao, 1998). It can be partly explained that China pursued the heavy industry-orientated development strategy prior to the 1980s so that this gave SMEs a perfect opportunity to fill the un-addressed market gap (Wang & Yao, 2002). As abundant and cheap labour resources in China, SMEs can build their competitive advantages by adopting low cost strategy. However, since the 1990s China has been much more open to foreign direct investment (FDI), many foreign MNEs from developed countries penetrated into Chinese market by exploiting their advanced technology. These foreign MNEs occupied Chinese high-end market quickly, where consumers are more sensitive to quality rather than price (Brandt & Thun, 2010). According to the research of Ghemawat and Hout (2008), foreign MNEs gained market leadership in China in every industry in which the ratio of R&D intensity to sales is greater than 8%. This embraces of packaged software, mobile phones, semiconductors and semiconductor equipment, advanced consumer electronics, mobile phones, photographic equipment, carbonated beverages and personal care (Brandt & Thun, 2010). Arguably, foreign MNEs still have dominated sectors which are technology and capital-intensive as well as needing sophisticated knowledge about marketing, branding and distribution. Thus, it is notable to observe to what extent Chinese SMEs do survive in and growth in this high-tech sector, where they are facing both foreign MNEs and SOEs' pressure in the competition.

- Industry turbulence (demand uncertainty & technological turbulence)

Domestic industry turbulence can have a direct effect on Chinese SMEs' innovation strategy formulation. According to Voss and Voss (2000)'s research, different market forces can be put into three main categories: demand, competitive and supply characteristics. Of these, there are three most fundamental ones relating to firms' innovation strategy, namely *demand uncertainty*, *technological turbulence* because they represent the influence of customers and technology on the market (Li & Calantone, 1998). Demand uncertainty refers to the diversity and unpredictability of customer preferences and expectations (Gatignon & Xuereb, 1997; Jaworski & Kohli, 1993; Zhou, 2006). If customer demand is relatively stable, firms likely tend to achieve superior performance by making sizable investment in production capacity with aim of scale of economies (Kerin et al., 1992). However, if customer need is highly fluid and fast changing, it arguably can be seen as a kind of motivation for firms to pay more attention on innovation due to efforts to differentiate products. It also should be noted that identifying customer's changing demand will be much more difficult at the same time (Golder & Tellis, 1993). Thus, it is likely that firms will not spend their time and resources on innovation to avoid possible failures in market. Rather, firms may adopt imitation strategy and watch the other competitors, and then initiate their activities only after the signs of market potential are clear (Zhou, 2006). Technological turbulence refers to the rate and speed of technological change within an industry (Jaworski & Kohli, 1993). An important aspect that benefits innovating firms is 'first mover' advantage. As summarised by Gu and Tse (2010), research has shown first-mover advantages in the form of competition pre-emption through the monopoly of superior resources (Wernerfelt, 1984; Barney, 1991), such as R&D and patent races based on existing technologies (Lieberman & Montgomery, 1988). However, early entrants are likely unwilling to cannibalise their existing product lines, because they have invested substantially in their existing technological assets (Lieberman & Montgomery, 1998).

More and more foreign MNEs are now operating in China today. It is believed that these MNEs are enjoying 'first mover' advantage due to their advanced technology. In the meantime, the needs of Chinese customers are becoming more complicated and product and service diversifications are required due to economic liberalisations and the development of Chinese market. However, it seems to be difficult for foreign MNEs to flexibly satisfy Chinese consumers demand due to their standard production procedure, especially when the local market is only a small portion of their portfolio (Brandt & Thun, 2010). From this perspective, Chinese domestic firms have better understanding of their domestic market and possess advantages comparing to foreign competitors. Conversely, Chinese SMEs grew outside the plan, unlike SOEs, they are more sensitive to market discipline and will be better attuned to consumer preference (Wang & Yao, 2002; Brandt & Thun, 2010).

Firm Resource-based View (RBV):

The RBV suggests that a firm can gain competitive advantage to compete and win within the same industry by means of possessing and deploying its valuable, rare, inimitable, and non-substitutable resources (Barney, 1991). According to the RBV, firms' superior performance hinges on the efficiency of resources and competences rather than relies on product-market positioning (Teece et al., 1997). It should point out that Penrose's argument (1959) is the basis of the RBV heterogeneity of resources. Penrose (1959:24) stated that: 'the firm is more than an administrative unit; it is a collection of productive resources the disposal of which,

between different users, and over time, is determined by administrative decisions'. Wernerfelt (1984) then defines the firm's resource as tangible and intangible assets and examines the relationship between resources and firm performance in terms of profitability. Barney (1991), based on the prior work related to RBV, argued that firms achieve competitive advantage by 'implementing strategies that exploit their internal strength through responding to the environmental opportunities while neutralizing the external threats and avoiding internal weaknesses'. As far as resources and capabilities concerned, firms are heterogeneous because they are endowed with distinctive abilities to accumulate, develop and deploy those tangible and intangible assets to shape and implement value creating strategies (Amit and Schoemaker, 1993; Barney, 1991; Peteraf, 1993; Caloghirou et al., 2004).

Despite the RBV is an important framework for accounting for firm superior performance, it has been criticised as conceptually vague and tautological (Porter, 1991; William, 1991; Mosakowski & McKelvey, 1997; Eisenhardt & Martin, 2000; Priem & Butler, 2001; Bromiley & Fleming, 2002). As argued by Porter (1994), 'at its worst, the resource-based view is circular. Successful firms are successful because they have unique resources. They should nurture these resources to be successful. But what is a unique resource? What makes it valuable?' thus, simply possessing idiosyncratic resources does not make a firm attain competitive advantage. Capabilities are likely to enable firm to coordinate activities by deploying its assets advantageously (Day, 1994; Zou et al., 2003).

Based on RBV, internal resources drive firm's innovative activities, which in turn affect firm's performance. In this paper, we will examine Chinese SMEs' absorptive capacities, talent capacities, ownership structure, and linkage capability.

- Absorptive capabilities

Cohen and Levinthal (1990) defined absorptive capacity as prior-related knowledge, including knowledge of the most recent scientific or technological developments, that confers an ability to recognize the value of new information, assimilate and internalize it, and then apply it to commercial ends. Absorptive capacity is a function of prior-related knowledge is the idea that acquiring knowledge is most effective when the target knowledge is related to what is already known (Cohen and Levinthal, 1990). That is, acquisition of new knowledge from external sources tends to be more successful when a firm possesses existing knowledge related to the new knowledge being acquired. And, internal transfer of the acquired knowledge tends to be more efficient when the recipient unit of the firm possesses prior knowledge related to the knowledge being transferred. Several researchers (Hamel, 1991; Inkpen, 2000; Lyles and Salk, 1996) have focused on the ability of firms to learn and they have suggested that the effectiveness of learning between organisational units is closely related to Cohen and Levinthal's (1990) notion of absorptive capacity (also see Chen & Hatzakis, 2008). In general, Chinese firms are facing the problem of lacking advanced technology which put them into a less competitive position in the competitive global market. As part of their internationalization strategy, technological catch-up will reduce their gap between their competitors from developed markets and help them to develop their independent R&D system. They have to find innovative ways to make space for themselves in markets that were already crowded with giant competitors, for instance, finding new ways to "complement" the strategies of the incumbents, such as through licensing new technologies, to forming joint ventures and strategic alliances (Mathews, 2002). It is plausible that it was through the implementation of these "complementary" strategies that latecomers

were able to win a place in the emergent global economy, not on the basis of their existing strengths, but on the basis of their capacity to leverage resources from the strengths of others, through making international connections (Melin, 1992). These internationalization strategies, designed to enhance firms' resource base rather than to exploit existing assets, represent a fundamental departure in thinking by firms about what "globalizing" means and how it can be accomplished.

According to Mathews (2002), the idea of a "latecomer" turning disadvantages into sources of advantage, was formulated most clearly by Gerschenkron (1962). Gerschenkron identified the role for state agencies to play (e.g. amassing capital and making it available for investment in large-scale plant, or reducing risks by public sector development) in helping latecomer nations to overcome their disadvantages and "catch up" with earlier leaders. The rise of East Asian countries, starting with Japan and then moving to encompass Korea, Taiwan, and Singapore, provides a more recent instance of Gerschenkron's theory. It is now recognized that these catching-up countries have behaved in classic "latecomer" fashion in utilizing state agencies to engineer their entry into export markets and then into high technology sectors.

The sequence of technological development strategies in these countries follows a three-stage model – acquisition, assimilation, and improvement (Kim, 1997, P. 88). Catching-up countries such as China normally acquire advanced technologies from industrially developed countries at the early stage of their industrialization. Lacking of R&D capability, domestic firms only develop production through the acquisition of assembly processes, production know-how, technical personnel, and components and parts. The implementation of transferred foreign technology to manufacture products becomes the only objective of these firms. Once the implementation is accomplished, production and product design technologies are quickly diffused within the country. With low labour cost and little pressure in the protected market, the operation is relatively inefficient (Kim, 1997, P. 88). Therefore, the technical emphasis is placed on manufacturing (engineering) and limited new product development rather than research. Most firms from emerging markets have faced or are facing the situation at the moment. Firms in developed countries develop along a technological trajectory made up of three stages – fluid, transition, and specific (Utterback, 1994). Firms from the first tier of catching-up countries (regions) or (e.g. Korea, Taiwan, and Singapore) that have successfully acquired, assimilated, and sometime improved imported technology may be able to repeat the process with higher-level technologies in the transition stage in developed countries, which is focused on process innovation. At this stage, these firms become more competitive equipped with relatively improved R&D capabilities and low cost resource. Lee and Lim's (2001) built a model of technological and market catching-up to explain the evolution of selected industries in Korea, which introduced the idea of technological regime to the context of technological catch-up by the late-comer firms to derive a model of technological and market catch-up. Applying the Neo-Schumpeterian concept of the technological regime (Breschi et al., 2000) to the context of catch-up economies, they argue that technological regimes of the industries are important elements in catch-up by late-comer firms.

- Talent Capacities

Based on the resource-based theory, human capital and organisational structure can be seen as firm's resources (Barney, 1991; Wernerfelt, 1984; Pierce & Delbecq, 1977). Given

China's distinctive domestic market and cultural environment, it is necessary that building an innovative organisation to engage in innovative activities adding new value to the Chinese consumers (Gu & Tse, 2010). Gu and Tse (2010) extend the conceptualisation of 'exploration and exploitation' (March, 1991; Levitt & March, 1988) and argue that China is entrenched in the paradigm of execution and its two-tier talent structure lacks an extensive pool of middle-level talent. It should be mentioned that other researches also notice this lack of mid-layer labour market phenomenon. For example, a recent McKinsey global labour market report written by Farrell and Grant in 2005 argues that only 10% of Chinese engineers are competent enough to compete in the global outsourcing arena. In particular, George Gilboy's article in *Foreign Affairs* (August, 2004) argues that Chinese firms lack necessary capabilities to effectively support the commercialisation of an innovative idea. This to some extent reflects the lack of mid-level managers that has a broad vision to implement an innovative strategy (Gu & Tse, 2010).

It needs to point out that 'returnees' (those who have studied or had working experiences outside China before going back to the country to work and live), on one hand, play an important role in transferring core technological competence from abroad (Kim, 1997; Saxenian, 2002; Sternberg & Muller, 2005). On the other hand, China has developed a large pool of entry-level 'raw talent' at the same time (Gu & Tse, 2010). Thus the fact is the top-level (i.e., senior executives) supervises and guides the innovation of new integration by orchestrating the combination of novel and existing component innovations, while the bottom-tier employees are entirely engaged in implementation (Gu & Tse, 2010). Thus by means of apprenticeship type of training, Chinese firms are likely to build a competent middle tier which plays a key role in comprehensively connecting top and bottom level to enhance their innovative capabilities which are conducive to capitalising the innovative idea.

- Ownership Structure

Prior research on ownership structure have primarily focused on advanced economies and mainly examine how ownership structure influences a firm's strategy and performance (Hill & Snell, 1989; Tuschke & Sanders, 2003; Zahra et al., 2000). Nevertheless, ever since central governments commenced to launch their reforms of corporate governance and strategically motivate privatization, ownership structure in emerging economies has received increasingly more attention from scholars (Peng, 2004; Liu et al., 2010). Peng (2003) argues that ownership structure plays a particularly vital role in impacting on organisational routines and determining the firm's strategic orientations. For instance, Peng et al.(2004) note that various ownership can result in different managerial outlook as well as mindset. It can be explained that firms from emerging market are generally characterised by large shareholdings in the hands of family and state (or government) in the context of China (Cuervo-Cazurra, 2006; Young et al., 2008). SMEs in emerging economies such as China, especially in the absence of effective formal institutional and financial support, often lack the ability to reduce contextual uncertainties and risks (Young et al., 2008; Liu et al., 2010). It is arguably that SMEs tend to pursue steady profits for survival rather than adventuring with risks according to previous research (Zahra, 1996). It can be seen as to some degree jeopardizing the firm's innovation capability because the firm is possibly to conduct business more conservatively. However, Pent et al.(2004) find that SOEs and privately-owned enterprises (POEs) tend to adopt defender and prospector strategies, respectively. For example, Wang and Yao note that Chinese small companies spent a larger portion of technological expenditures on R&D than large firms (2002). They also find that most of the spending by large firms was used to

increase their production capabilities, whereas small firms were more concentrating on how to absorb new technology and transform the technology into marketable products.

- **Linkage Capability**

Linkage (or network) is directly affecting Chinese SMEs to obtain new technology and enhance their innovative capability. According to Mathew's research (2006), the critical starting point for the latecomer firms is that it is focused not on its own advantages, but on the advantages which can be acquired externally (i.e. on resources which can be accessed outside of itself). Wang and Yao (2005) argues that as Chinese SMEs do not have sufficient capacities to conduct their own innovation (in-house innovation), they are more possibility to purchase or acquire technologies from outside sources than large firms are. For instance, the Development Research Center (DRC), the State Statistical Bureau (SSB) and the Ministry of Sciences and Technologies (MST) study support this argument.

The most important channel for SMEs to acquire technology is to cooperate with an outside source. This can take several forms: acting as a supplier for a large firm, cooperating with a research institute or a university, forming a joint venture with a foreign firm, and cooperating with other SMEs (Wang & Yao, 2002). Gu and Lundvall (2006) argue that Chinese reforms have led to a system that is oriented more to international markets than to local and domestic ones. Foreign firms dominate the export sectors so it is inevitable that they would develop, and governments would encourage, linkages with and among the international firms (including their joint venture partners). But this emphasis proved costly for local firms in that similar linkage within the domestic sector were not developed. 'In general potential local or domestic links along and between value chains have been slow to develop and hard to expand' (Gu & Lundvall, 2006).

Institution-based view

Defined as 'the rules of the game' (North, 1990), institutions significantly put legitimacy pressures for firms and directly affect firms' strategic choices and performance consequences (Hoskisson, Eden, Lau, & Wright, 2000; Peng, 2003; Peng et al., 2008, 2009; Wright et al., 2005; Gao et al., 2010). This view is built on the ground of institutional theory (North, 1990; Scott, 1995; DiMaggio & Powell, 1983). Scott (1995) defines three pillars of the institutional theory: regulative, cognitive and normative. The key is that through these institutional coercive, mimetic and normative pressures 'organisational characteristics are modified in the direction of increasing compatibility with environmental characteristics' (DiMaggio & Powell, 1983, p.149).

Both the industry- and resource-based view are criticized for largely ignoring the formal and informal institutional underpinning that offers the context of competition among industries and firms studied with these lenses (Kogut, 2003; Peng et al., 2008). It is understandable to treat institution as background, because industry- and resource-based views arise primarily out of research on competition in the advanced economies such as the United States, in which it may seem reasonable to assume a relatively stable, market-based institutional framework (Peng et al., 2008). However, researchers increasingly find that institutions in emerging economies are significantly different from those in developed countries, which significantly

shape the strategy and performance of firms (Hoskisson, Eden, Lau, & Wright, 2000; Wright, Filatotchev, Hoskisson, & Peng, 2005; Doh et al., 2004; Lu et al., 2008, Chacar & Vissa, 2005; Hafsi & Farashahi, 2005). Thus, according to Peng (2003, 2006) and Peng et al. (2008, 2009), institutions should be treated as independent variables rather than the background and an institution-based view of strategy places attention to the dynamic interaction between institutions and firms, and considers strategic choices as the outcome of such an interaction in emerging economies. In other words, institution ‘directly determines what arrows a firm has in its quiver as it struggles to formulate and implement strategy and to create competitive advantage’ (Ingram & Silverman, 2002).

It is also interesting to find out that some previous research, emphasizing the role of the government policies, tries to bridge institutional theories with latecomer firms’ catching up (Hobday, 1995; Kim, 1997). For example, Kim (1997) argued that the government’s intellectual property regime in Korea was supportive of the local firms by giving them opportunities to imitate foreign MNEs during the early stages of catching up. Ning (2007) uses Taiwan as an example in his research, argued that Taiwan’s government designed the policies to promote SMEs rather than stressing big business like Korea and limited private investment capital and the different governing ideologies. However there are few studies to examine Chinese firms catching up from institution-based perspective.

Thus it is imperative to include the institutional environment when investigating firms’ innovation strategy and performance in an emerging economy in the context of China. In this paper, we have reviewed the extant literature from both formal and informal perspective.

1. Formal institution factors

(1) Government policy to encourage innovation

It should be noted that the latest plan specifically stresses the need to enhance capabilities for ‘indigenous’ or ‘domestic-grown innovation’, with an aim to establish the necessary infrastructure for a leadership position in a number of S&T-based sectors (Hutschenreiter & Zhang, 2007).

One of the main goals of the 11th Five-Year Program (2006-2010) adopted in 2006 is ‘scientific development and a determined emphasis to encourage ‘an innovation-orientated nation’ (Dobson & Safarian, 2008):

‘In the 11th Five-Year Program period, we will implement the strategy of rejuvenating our nation through science and education and take science and technology advancement and innovation as a major driving force of economic and social development. We will give more strategic importance to developing education and fostering high-quality talented people who are endowed with capability and integrity, deepen system reforms, increase input, accelerate the development of science, technology and education, and make great efforts to build an innovation-oriented nation and strong nation with abundant human resources (Government of the People’s Republic of China, 2006a).’

It is also necessary to highlight that China recently has announced ‘Medium to Long Term Science and Technology Development Plan, 2006-2010’ to institutionally enhance China’s national innovation infrastructure. The goal is that China becomes an ‘innovation-oriented’

nation by the year 2020 and will become a leading innovative economy in the world in the future (Hutschenreiter & Zhang, 2007). It broadly has two aims: (1) *to raise R&D intensity to the current OECD average by 2020 (increasing spending as a share of GDP from 1.3% to 2.5%;* and (2) targets for particular sectors *‘to reduce sharply reliance on imported technology, obtain advanced core technologies in the equipment manufacturing and the information industry, increase agriculture productivity and ensure national food safety, make a breakthrough in energy development, energy saving technology and clean energy technology and build several world-class science and research institutions and university and form a system for innovation that is characteristic of China’*. (State Council, Government of the People’s Republic of China, 2006b; also see Dobson & Safarian, 2008).

Furthermore, Chinese government continuously increased direct support to S&T activities. For example, central government set up its strategy as attracting the financial investment from local government and enterprises, evidenced by the funding structure of ‘Spark Program’, the ‘863 Program’ and ‘973 Program’ (Huang et al., 2004). Additionally, Chinese government has set up many science parks and technology and business incubators. According to Torch Program’s statistics data, the output value from the 53 high-tech science parks in 2001 already dominated in the gross output value of high-tech sector across the country (2004). It is also important that China Hi-Tech Fair (CHTF) now receives strong support from the central government to play a role of connecting Chinese and international high-tech industry sectors (Huang et al., 2004). One of the features of CHTF is that many overseas Chinese students have been actively participating in the even in every year, thus it can be as a mechanism to enhance Chinese human resource capacity too.

(2) Intellectual Property Rights (IPR)

Since 1990s the issue of protection of IPR in China has been not only a national economic and juridical dilemma, but also a significant economic and political concern for a number of industry interest groups and governments in developed countries (Huang et al., 2004). Following its accession to the WTO, China is obliged to bring the protection of IPR according to the WTO arrangement on Trade Related Intellectual Property Rights (TRIPs). Clarke (2001) pointed out that stronger institutions and better protection of property rights encourage greater R&D expenditures in developing countries. Hout (2006) also notes how china’s weak protection of intellectual property rights reduces the incentives to innovate. It is believed that as more Chinese domestic enterprises realize the value of IPR in the fierce competition against multinational giants with IPR advantage and the government’s stronger promotion, patenting in China will improve in the near future. Apparently Chinese government has made efforts to build sound legal framework for IPR protection. For instance, in the S&T and innovation field, Science and Technology Development Law (1993) regulating high-tech industry development, Agriculture Technology Transfer Law (1993), Strengthen Technology Transfer Law (1996), Dissemination of Science and Technology Knowledge Law (2002) and Small and Medium Enterprises Promotion Law (2002) show the efforts of China’s government on legislative actions. Thus, as Hutschenreiter and Zhang (2007) claimed, IPR protection not only affects the willingness of foreign partners to transfer technology to China, but also stimulate Chinese domestic enterprises to become more innovative.

2. Informal institution factors

(1). Culture Norms

Organisational culture is essential for firms to engage in innovation and creation (Johnson, 1996; Judge et al., 1997; Pienaar, 1994; Shaughnessy, 1988; Leonard, 1995; Tesluk et al., 1997; Tushman & O'Reilly, 1997; Long, 1997; Holsapple and Joshi, 2001; Martins & Treblanche, 2003;). A few studies clearly investigate the impact of Chinese organisational culture to firm's innovation. Lu, Tsang and Peng (2008) use organisational cultures as one of internal factors to investigate the influence of the institutional environment on the firm's innovation strategy. Also, according to Gu and Tse's recent research on China's information and communication technology (ICT) industries (2010), they find that the professional cultures are labelled by a preference for short-term, tangible results over long-term, unpredictable but potentially radical hits, for low-cost and efficiency over differentiation, for taking on assigned tasks over 'thinking outside of the box', for conforming to the norm over challenging the status quo, and for exploiting existing knowledge over generating new knowledge. Thus institutionalising the best knowledge sharing and creating practices into local business can create a 'learning-by-doing' and 'learning-by-apprenticeship training' environment within the organisation (Epple, Argote, & Murphy, 1996; Gu & Tse, 2010). Arguably, it is likely that Chinese organisational cultures hinder firms in their efforts to innovate, because the disadvantages of Chinese 'following-order culture' and 'short-term orientation' are not easily overcome. Nevertheless, it should be noted that some Chinese firms adopt knowledge-friendly culture can have a positive influence on firm's innovation outcomes. For example, Chen and Hatzakis (2008) find that creating a trusting and cooperative culture is essential for disseminating and creating new knowledge in Chinese SMEs. Therefore, it is interesting to investigate to what extent the unique Chinese institutionally-embedded cultures affect high-tech SMEs to shape their innovation strategies in their trajectory of technology catching up.

(2).The role of Chinese government

Governments have played an important role in the high successful development of the East Asian economies such as Japan (Hobday, 1995; Kim, 1997). Lau (1997) studied the role of government. He has examined the functions of government, including 'the design and maintenance of the economic environment, the regulation of the economy, the enforcement of laws and contracts, and the provision of public goods such as infrastructure and education'. Following Lau (1997)'s work, this paper focuses on the involvement of government in supporting firms' R&D and innovation activities, whether directly through government laboratories, or indirectly by financially supporting R&D projects at universities and in private industry, can also be viewed as an attempt to create comparative advantage. However, a number of researchers argue that governments' inappropriate policies negatively influence the incentives for Chinese firms. For instance, Kroeber (2006) argues Chinese government policies failed to recognise the importance of incremental innovation. Hout (2006) also claims that the incentive structure for technology-based innovation is shaped by firms in the private sector responding to market signal rather than government policy or funding. Gu and Lundvall (2006) argue that reforms seem to result in an inclination that is oriented more to overseas markets than to domestic market. These preferences for international markets may

encourage learning in export-orientated firms but can weaken innovate on their own (Dobson & Safarian, 2008).

Li (1998) argued that institutional factors will determine the performance of Chinese SMEs. Although gradually reducing its intervention in SMEs, to certain extent, Chinese government still interferes firms' business activities by setting the institutional determinants (Roy et al., 2001; Tan, 2001) and making policies that continue to encourage distorted firm behaviours such as concentrating on government-guided production only (Roy, A., Walters & Luk, 2001).

Chinese local governments have played a very important role in terms of encouraging and supporting the 'exploration and exploitation' processes of these firms. Dobson and Safarian (2008) studies the enterprises in Zhejiang province and found that Zhejiang government has been supportive, market-friendly, investing transportation infrastructure and R&D and industrial parks, and providing common services, some project funding, and loan guarantees. Qian and Stiglitz (1996) state that the Chinese political system can be characterized as one of 'M-form' hierarchy, that is, a multi-level, multi-regional organisation with multilayer structure along vertical lines and multiregional structure along horizontal lines (Qian and Xu, 1993) and government at each level has considerable authority in formulating economic policies. They studied Guangdong provincial government as an example and concluded that the diminishing role of central government is the reason for Guangdong's success because the local government tends to intervene by using indirect rather than direct methods, which is an important part of the changing function of the government. Thus it can be argued that Chinese local government should be more flexible in terms of developing and adjusting the local development strategies and policies to support innovative activities of SMEs.

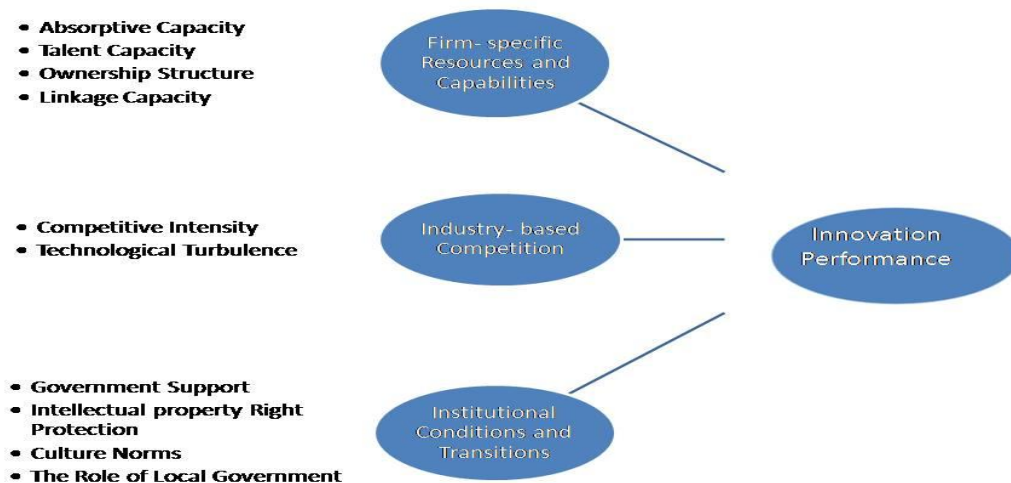
Performance

According to Gu and Tse' research (2010), in this paper we adopt their measures to gauge an organisation's innovation performance, namely the level of novelty of its innovation, degree of successful innovative ideas commoditisation and the growth of its research and development (R&D) team. The first two measures directly match the innovation dimensions given by Roberts (1988): 'newness' and 'commercialisation'. According to the OSLO manual (OECD, 1992), the number of innovations alone is not a good indicator of innovation performance because they might be various across different industries. So it will be better to take into account of both number of inventions and the level of commercialisation of invention in the firm. For example, it may be worth observing the percentage calculated by dividing the number of inventions by the total number of products (Guan et al., 2009). We choose the third one aiming for capturing the trajectory of the development of organisation itself rather than adopt outcome-based measures such as market share because the majority of Chinese SMEs in high-tech sector are not publicly listed and very young (Gu & Tse, 2010). Thus, we endeavour to use the trajectory of R&D team/department as a proxy to investigate the building process in Chinese high-tech SMEs innovative capabilities.

Conclusion

In this paper, we have proposed an integrated framework building upon Peng et al. (2008)'s 'tripod strategy' which examines technology catching-up trajectory of Chinese Hi-Tech SMEs from Industry-, Resource-, and Institutional-based view (See Figure 1 below).

Figure 1: An Integrated Framework of Chinese SMEs' Innovation Strategies (Adapted from Peng et al., 2008)



As industry- and resource-based views arise primarily out of research on competition in the advanced economies to assume a relatively stable, market-based institutional framework, the extant literatures are treating the institution as background or environment in which firms operates (Peng et al., 2008). More recently researchers increasingly found that the institutions of emerging economies significantly differ from those in developed countries. There are increasing appreciation that formal and informal institutions, commonly known as the 'rules of the game', significantly shaped the strategy and performance of firms in emerging economies. Our paper has paid special attention to the institutional factors (formal & informal) in affecting Chinese SMEs to develop innovative capabilities. In this study, we also emphasize the role of Chinese local governments and find that they have developed flexible and supportive policies towards hi-tech SMEs to help and encourage them develop innovate capabilities. The institution-based view can be seen as a strong explanatory tool, above and beyond the industry- and resource-based theory, thus providing an integrated theoretical viewpoint for investigating Chinese firms' innovation strategy. It is also believed that Chinese domestic firms have comparative advantages, such as cheap labour resources, better knowledge about Chinese local market comparing to foreign MNEs from developed countries. Facing intense competition both from large-sized SOEs and foreign MNEs, Chinese SMEs should pay more attentions to indigenous innovation by taking advantage of Chinese huge domestic market. Our study concludes that by developing effective innovation strategies and improving innovative capabilities, Chinese SMEs will be able to survive from the severe competitions from state-owned enterprises and foreign firms.

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