Developing Innovative Competences in an Emerging Business System: New Private Enterprises in Hangzhou's Software Industry

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Abstract:

What kind of innovative competences are credibly developed by private entrepreneurs in China's transition economy? On the basis of original empirical fieldwork in 45 software enterprises in Hangzhou, Zhejiang Province, we propose a working theory of innovative competence development in an emerging private sector. Combining resource-based and institutional perspectives we argue that Chinese private enterprises in Hangzhou were able to develop unique innovative competences to overcome resource constraints and manage technical - and market risks while respecting the location and sector-specific constraints. The findings suggest that private software enterprises in Hangzhou developed five innovative competences: organizational integration, financial commitment, external knowledge transformation, reputation development and strategic flexibility. The analysis further allows to propose three implications: 1) These five competences form a 'configuration' or coherent set of competences in this particular institutional setting; 2) Technological – and institutional regimes shape the potential range of innovative competences firms credibly develop depending on the available resources of the firm; 3) Innovative competences can be functional equivalents of institutions in the absence of well-developed, mature formal institutions.

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INTRODUCTION

In this paper we present a working theory for understanding the development of innovative competences in the emerging private sector in China's transition economy. Since the mid-1990s a significant private sector has emerged in China (Asian Development Bank, 2006; Krug & Hendrischke, 2007; Tsui, Bian & Cheng, 2006). Less the result of state initiated mass privatization, as in the case of Eastern Europe and Russia, the Chinese private business sector emerged via ownership changes in SOEs, the rise of TVEs, and other hybrid forms of ownership and none the least via entrepreneurship when individuals founded new firms (Tsui, et al., 2006). The private business sector in China includes those domestic privately-owned firms that are not dependent – in an accountancy or profit recording way – on other state-owned - or foreign firms, or other government agencies (cf. Krug & Hendrischke, 2007). The development of China's private sector depends on finding new ways for doing business, new ideas for re-combining productive factors, developing and producing new products or more efficient production technologies in order to not only compete with resource-richer SOEs, and foreign firms, but also for coping with (in)direct political constraints and limitations in factor markets (Batjargal, 2007; Krug, 2004; Tylecote & Visintin, 2008). This paper addresses the following question: *What kind of innovative competences are credibly developed by private entrepreneurs in China's transition economy?* We address two gaps in the research literature:

First, we explain firm-level mechanisms of innovation in China's emerging private business sector. The significance of innovation for the private business sector notwithstanding, relatively little attention went to why and how private entrepreneurs were able to develop innovative competences. Research on innovation in China usually stays at the national level (e.g. Liu & Buck, 2007; OECD, 2007), explaining developments in innovation systems (Liu & White, 2001) and analyzing latecomer strategies and technological catching-up (Li & Kozhikode, 2008). Other studies focus on specific features of innovation development, such as Batjargal's study of social capital in innovative software ventures in Beijing (Batjargal, 2007) or knowledge management in large, successful high-tech firms (Lau, Lu, Makino, Chen & Yeh, 2004). Firm level explanations of innovation mechanisms are limited to a handful of researchers, most prominently Qiwen Lu and William Lazonick's work on the computer hardware industry (e.g. Lu, 2000; Lu & Lazonick, 2001) and Shulin Gu's work on New Technology Enterprises (Gu, 1996). As far as we know, none of the conceptual or empirical studies explore and/or explain innovation mechanisms at the firm level in China's emerging private sector. We specifically extend Lu's (2000) study of

indigenous innovation, which remains the most comprehensive study of innovation at the firm level in China. Whereas Lu focused on non-governmental computer firms with a collective/public nature that allowed extensive managerial autonomy and access to state S&T resources ('hidden subsidies'), we will explore innovation processes of private firms that emerged since the 1990s without a state's socialist legacy.

Second, we explain the development of innovative competences in China's emerging private business sector by acknowledging institutional constraints caused by institutional uncertainty and diversity. The combination of competence (resource)-based and institutional perspectives promises valuable insights because it emphasises the organizational nature of competitive advantages and the role of management in mobilizing and transforming human and material resources (Teece, Pisano & Shuen, 1997), while acknowledging institutional forces which influence the way firms manage their resources and determine the value of their resources (Priem & Butler, 2001; Whitley, 2002; Lazonick, 2004). Especially in transition economies we cannot isolate the resource based perspective of firms from changes in the environment to which firms need to quickly and flexibly respond (Meyer & Peng, 2005; Wan, 2005). Recent comparative institutional studies have shown that the development of innovative competences is shaped by institutional arrangements, especially those that govern capital and labour markets (Hall & Soskice, 2001; Whitley, 2007). We will extend the focus of these comparative institutional studies into transition economies. That institutional arrangements in emerging economies are substantially different from those in developed economies (Khanna & Palepu, 2000; Whitley, 1999) is well known. Less researched is the case of China or any other transition economy where institutions remain incomplete and enforcement is often weak (Qian, 2000; Nee, 1992). We observe frequent *institutional change* which the literature claims to constrain the development and commercialization of new technologies. Furthermore, instead of taking the nation state as the unit of analysis we extend the focus to include "sub-national" government agencies to acknowledge the fact that China's economy is characterised by a *diversity* of local business systems (see for instance, Krug, 2007 and Krug & Hendrischke, 2008, Goodman, 1997). In short, we will incorporate institutional change and local diversity into the analysis when analyzing the development of innovative competences.

We present a detailed comparative case study of 45 software enterprises in Zhejiang Province. The findings suggest that Chinese private enterprises were able to develop unique innovative competences to overcome resource constraints and manage technical - and market risks while respecting the location and sector-specific constraints.

WORKING THEORY

We propose that the development of innovative competences depends on the 1) resource base directly or indirectly available; 2) nature of the innovative activity pursued and 3) institutional arrangements in the business environment. In what follows we will develop a working theory for developing innovative competences taking into account technological - and institutional conditions of a transition economy. The connecting factor in this theory is 'critical resources'. Critical resources in this paper refer to tangible and intangible firm-specific assets that are available for the firm to own, control and use at the exclusive discretion of the firm (Amit & Schoemaker, 1993; Teece, et al, 1997). Critical resources are in the competence and capability literature[1] seen as key factors to explain organizational form, behavior and performance that form the basis of (dynamic) competences to innovate. Innovative competence development depends on the critical resources available to the firm while technological conditions affect the requirements of critical resources for innovation and institutional conditions affect the availability of critical resources. **Figure 1** summarizes our working theory in a framework, its constructs and relationships between the constructs. We start with clarifying the core concept: innovative competence.

INSERT FIGURE 1 ABOUT HERE

The Dependent Variable: Innovative Competences

A competence, in its broadest interpretation, enables a firm to grow and take advantage of its opportunities. Whereas early resource- and competence based studies focused on relatively static and stable sources for competences, these ideas are recently being extended to explore the dynamics of how firms gain and loose competitive advantages. Current work suggests that idiosyncrasies in resources, routines, identities and conceptions form the basis of specific competences of a firm[2], whether they are originating inside or outside the firm or are static or dynamic in nature (Buenstorf & Murmann, 2005). Teece et al's (1997) dynamic capabilities concept is useful here because it addresses dynamics and change and stresses the organizational nature of competitive advantages: 'the firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environment' (p. 516). We adopt most of this definition and apply it to our specific context by focusing on innovation and resources. Innovative competences reflect *the firm's ability to integrate, build*

and reconfigure internal and external resources to develop and successfully commercialize new products and services, i.e. innovation.

What types of innovation do we consider? Following Whitley (2000) we distinguish *incremental innovation* involving refining, improving, and exploiting an existing technological trajectory from *radical innovation*, which implies a disruption of an existing technological trajectory. The uncertainty associated with these strategies varies in degree and type in different circumstances. Moreover, another feature is the extent to which an innovation is *systemic*, *modular* or *stand-alone* (Nooteboom, 2004). A systemic innovation is one with tight constraints on interfaces (e.g. telecom industry, oil refinery) leading to high switching costs and limited exploration of new activities. In contrast, a modular innovation knows standards on interfaces yet allows flexibility and thus has lower switching costs. A stand-alone innovation is characterised by autonomy of elements and limited constraints on interfaces (e.g. consultancy, standard application based software) resulting in low switching costs and extensive exploration possibilities. In sum, we differentiate innovation types according to their characteristics (incremental, radical) and systemic features (stand-alone, modular, systemic). Two independent variables – constructs – are expected to influence the development of innovative competences: 1) the technological regime; 2) the institutional regime.

Technological Regimes

The sectoral approach to innovation shows that sectors with distinct technologies can be differentiated according to their specific technical and market risks, or *technological regimes*, comprised of opportunity and appropriability conditions in addition to characteristics of the knowledge base and degree of cumulativeness (e.g. Malerba, 2004; Dosi, 1988). The characteristics of the knowledge base can be understood in terms of specificity, tacitness, complementarities and independence of knowledge. These characteristics of technological regimes and its knowledge base provide restrictions on firms' learning, competences and organization and coordination of innovative activities in a sectoral system. Different sectors then have different patterns of innovative activities. However, innovation leads to economic change only to the extent that agents are successful in taking advantage of the opportunities. In other words, they need competences, which will thus differ strongly across technological regimes that characterize distinct innovative activities.

The link between technological regimes and competences has been studied in case studies and statistical exercises. Several statistical studies reveal patterns of innovative activities linked to specific technological regimes (e.g. Malerba & Orsenigo, 2000). Case study examples of this result are for instance Henderson and Cockburn (1994) and Iansiti and Clark (1994) in pharmaceuticals, computers and automobiles in which competences differ across sectors. The most recent study linking characteristics of technological regimes to innovative competence development is Casper & Whitley (2004). Even though evidence remains archetypical (Malerba, 2004), research suggests that contrasting patterns of innovation can be explained by varieties across sectors where technological risks differ. *Therefore, we expect that the characteristics of a technological regime influence the required critical resources for innovative competence development.*

Beyond sectoral constraints, firms face institutional constraints that shape and guide competences. Although the sectoral approach to innovation does not downplay the role of institutions (see Malerba, 2004), it is generally weak in explaining exactly which competences are developed under precisely what institutional conditions. How institutional arrangements affect the range of credibly developed innovative competences is a question to which we turn now.

Institutional Regimes

Institutions may either constrain or facilitate innovativeness. For instance, studies on the market economies of the US and Europe has shown how distinct patterns of technological development can be explained by the different institutional arrangements of various kinds of economies (Hall & Soskice, 2001; Whitley, 1999). In general *institutional regimes* affect the dominant logic underlying decision making in organizations. Institutional regimes influence the provision of facilitative resources that are made available on a more or less non-market basis (Coriat & Weinstein, 2002). The extent to which these are provided by national, local or sectoral institutions determines the embeddedness of organizations in the institutional context (Whitley, 2007). Furthermore, institutional regimes specify, monitor and control the powers and responsibilities of private companies, especially their authority and discretion. Institutional rules and constraints vary considerably across societies as for instance, state regulation, educational systems and extent of unionization vary considerably across societies and over time and influence competitive behaviour of firms – especially the development of innovative competences (Whitley, 2007). *Therefore, we expect that institutional regimes*

influence the development of innovative competences by 1) distributing and allocating access to critical resources and 2) constraining the opportunistic use of these critical resources.

We cannot directly extend these ideas developed for relatively stable, developed market economies into China's transitional economy. Institutional regimes in China's economy have two distinct features that influence the way how competences develop: institutional uncertainty (unpredictable and incomplete institutions) and variety of local institutional systems. First of all, China has weak economic institutions. The institutions are not weak because they have a socialist hue, which is traditionally unsupportive of private capitalists, but because institutions inherited from both the socialist era and market-oriented institutions co-exist (Krug & Polos, 2004). Institutions are incomplete and unpredictable in the sense that they do not provide a stable institutional frame (Qian, 2000), which would reduce the uncertainty emanating from innovation (Krug & Polos, 2004). Second, the heterogeneity of China's local business environment is a consequence of China's decentralized government system. On the one hand, this leads to vertical intergovernmental inconsistencies where local governments do not or only partly implement central policy. On the other hand, it leads to horizontal competition between local governments (Krug & Hendrischke, 2008). So, in contrast to most comparative institutional studies, which take the nation state as the boundaries of a unitary business system, China's economy is characterised by a *diversity* of business systems s at the sub-national level asking for a local perspective. *Therefore, we expect that a changing institutional regime will affect the distribution and governance of access to critical resources by 1) increasing uncertainty and 2) local diversity*.

Our empirical study proceeds in three steps. First, we identify the innovative competences that Chinese software entrepreneurs have developed in the last 5-10 years. Second, we will explain why these particular competences were credibly developed, by considering the local institutional environment and the nature of different innovative activities. Third, the analysis ends with a discussion of the coherence and interdependence of the innovative competences and the dual role of institutional – and technological regimes. The next section describes how these challenges were taken up in our field research.

METHOD

The Software Industry In Hangzhou

We choose the software industry as the field of research. The software industry is relatively fragmented with a few major players and many small entrepreneurial ventures. The study of software has an exceptional position in that it allows studying both disruptive as well as continuous, accumulative processes of innovation with varied kinds of technical and market risks. Considering the expectations from our working theory regarding sectoral variety and innovative competence development, we choose to study the enterprise software, middleware and standard software sectors (cf Casper & Whitley, 2004), because they have distinct technical and market characteristics and distinct innovative activities. **Table 1** summarizes the main characteristics.

INSERT TABLE 1 ABOUT HERE

After choosing an industry we need to choose an appropriate location. Beyond choosing a location for the research, the selection of a location reflects the selection of a local institutional frame. The 'population' from which we select one location, is a variety of localities across China. The selection of one location takes into consideration the intensive data collection efforts necessary for getting familiar with the local context in terms of language, local culture and developing local networks with research partners and business enterprises. We used three criteria to select Hangzhou as our location: 1) the presence of a significant software industry; 2) the private enterprise as a dominant form of economic coordination and organization; 3) the success of the locality in terms of economic prosperity and business prospects. The latter is important because then the locality is more likely to function as a benchmark for other localities and thus enhances the generalizability of this study.

Hangzhou is the capital of Zhejiang Province, a south-east coastal province. At the forefront of economic development, it offers one of the best business climates in China and is one of the centres for China's booming private sector (World Bank, 2006). A significant share (95%) of enterprises of other types of ownership, i.e. non-governmental enterprises and 90% contribution to gross industrial output of the city, illustrate this point (Hangzhou Statistics Online, 2007). The software industry in Hangzhou emerged successfully: 23,7 billion RMB in 2005 sales revenues of software products, 300 million dollars worth of software product exports (Hangzhou Statistics Online, 2007). The official statistics of China Software Industry Association (CSIA) registered about 180 firms in Hangzhou in 2005. Over

90% of the software business in Zhejiang province is located within the Hangzhou locality, making it the software centre of the province[3].

Sample

The above describes the local population of software enterprises from which we selected a sample for the purpose of this study. The selection criteria for firms were as follows: (1) small or medium size (1-300 employees), (2) privately owned, (3) independent software developers, i.e. firms focused on software development rather than other businesses and (4) in one of the three software sectors. The size of the sample was not determined beforehand. The main criterion was the saturation criterion. This is neither a consensus-based cut-off point, as is usual in social science research, nor a convenience criterion but a theoretical criterion. It means that past the saturation point, an additional case does not add much explanatory power.

Our sample consists of 45 software enterprises in three distinct software sectors with an average age of 5,8 years (1995-2006), on average 75 employees (6-260) and, if making sales revenues, between 200.000 (Internet software) and 80 million RMB (large scale ERP project for government). Enterprise software is extensively customized software using platforms or modules. On average these firms are 6,6 years old (1995-2006) and employ 73 employees (range: 6-200; sd: 62). Standard application based software is written for large homogenous markets. These firms are on average 5,6 years old (1996-2006) and employ 46 people (range: 28-100; sd: 27). Middleware is a new sector focusing on interface technologies that link basic architecture of digital communication networks to standard application software, thereby coordinating various technologies. These firms are on average the youngest with 5,4 years (1995-2006) but employ the most people, 95 (range: 8-260; sd: 85).

The only way to show how representative this sample is for the population of software firms in Hangzhou is by comparing the size characteristics. A lack of systematic data for the population of software firms in Hangzhou is one of the data restrictions researchers in China have to deal with. According to the CSIA, Hangzhou's software industry is structured as follows: standard software (33%), enterprise software (32%), newly emerging middleware (18%), and hardware/software combinations (18%). Especially the middleware sector is growing fast last 2 years and many new firms are not included in CSIA yet. Most firms are SMEs (87% less than 200 employees) and these have on average 67 employees and average total asset value of 9.300.000 RMB. **Table 2** compares the size characteristics of our sample with the population of software SMEs Hangzhou. The results suggest that the sample is

representative for Hangzhou, at least in terms of size, as the averages and standard deviations do not show a different pattern.

INSERT TABLE 2 ABOUT HERE

We note here two sample selection biases. The first is that our study is limited to successful firms, i.e. firms that still operate and have products on a market. The consequence is that we cannot compare our findings with firms that have not been successful in innovation. Therefore we cannot check if firms that are not successful innovators indeed lack the competences we identify. Hence we cannot know if the competences we identify are all necessary and sufficient for successful innovation. However, we can at least assume that these competences are sufficient for innovation if we find systematic patterns across the sectors. The second bias is that access to these enterprises was sought via Zhejiang University, the University Science Park and directly via the authors' personal networks. We take note of the fact that this might not be considered representative by the usual social-scientific standards of Western research practice because all mediators were likely to have applied their own filters to the sample. This is a context specific research limitation, faced by every researcher in China doing in-depth field interviews (cf. Krug, 2004). However, we believe that we have mitigated the majority of the selection biases by not using every 'suggested' firm, doing background research on the selected firm, developing a trust-based relationship with local mediators and only surveying firms that fit our theoretical criteria.

Data Sources

The empirical study is based on firm-level in-depth interviews and triangulated with background information. Prior and after the firm interviews we collected data on the firms from a variety of sources. First, the firm's website, usually in Chinese, provides relatively detailed information on history of the firm, products, news announcements and partnerships with other firms, universities or government agencies. Second, local investment firms provide detailed information on firms and news for selected industries. Next, a news search in local and national news websites supplements the cases. Fourth, we contacted the Zhejiang Software Industry Association and obtained a list of software firms in Hangzhou with product, personnel size, asset value and website information.

However, the main data comes from in-depth interviews with the firms. In a society characterised by a large role of informal institutions, as opposed to formal rules and

regulations, an informal interview with considerable time to 'dig-up' the story is preferred. The interviews also allowed the respondents to express their understanding in their own terms which allows unambiguous communication and establishes communicative validity. The semi-structured interviews were done with either founders or senior managers. All interviewees have a background in engineering with at least a Bachelor's degree.

The interview covers the three topics of this study: innovative competences, sectoral constraints and institutional constraints. Questions on *innovative competences* are based on the analytical framework and the definitions of innovation and innovative competences. Question development started with a survey of antecedents of successful innovation in the literature[4]. Antecedents refer to those resources and activities that give firms potential competitive advantages for developing and commercializing new product and services. In total there were 212 unique antecedents of successful innovation identified in the literature. Many of these antecedents were overlapping or related to the same topic. Therefore, these 212 potential antecedents were reduced to 16 categories (see **Appendix I**). The criteria for this reduction are: 1) theoretically meaningful categories that match the conceptual definition of innovative competence; 2) deletion of overlapping or strongly related antecedents (e.g. business ties, business group, cooperation with university were combined into 'external partner'); 3) deletion of antecedents that were only mentioned once. However, most important was the confrontation with our working theory. These 16 categories are strongly rooted in the conceptual and empirical literature and form the basis for question development (questions 2-21 in the interview protocol).

Questions on *sectoral constraints* were based on ideas and studies from the sectoral innovation system literature. Sources for questions about these topics were, among others, the studies by Malerba (2004), Casper & Whitley (2004), Edquist (1997) on systems of innovation. This literature measures the characteristics of technological regimes in terms of: opportunity conditions, appropriability conditions, the knowledge base, degree of cumulativeness. These four features of technological regimes form the basis for designing questions about sectoral constraints. In the end, the design of questions was determined by the fit with the research problem and the analytical framework (questions 22-36).

Questions on *institutional constraints* are based on a literature survey of the consequences of institutional transformation. We will shortly summarize them: (1) Unpredictability of institutional change; (2) Limited legitimacy of private firms; (3) Competing levels of government; (4) Decentralization of government leading to ambivalent

rules; (5) Hybrid institutions; (6) Weak IPR protection; (7) Lack of transparency (e.g Krug, 2004; Meyer & Peng, 2005; Tan, 2005; Qian, 2000). The questions are based on these seven features. The second set of questions is related to what firms lack in terms of resources; i.e. factor limitations. The literature on the liability of newness proved useful in singling out four specific resource limitations that form the basis for questions on (Krug & Polos, 2004; Aldrich & Fiol, 1994): (1) lack of business routines; (2) lack of a blueprint; (3) lack of knowledge about the business environment; (4) lack of legitimacy (questions 37-54).

In order to create a coherent set of questions, the choice of appropriate topics and the design of questions was eventually determined by the fit with the research problem and the working theory. **Appendix II** shows a short version of the topics and the questions in the interview. We developed the Chinese version of the interview protocol in cooperation with a team of Chinese graduate students from Zhejiang University. After the first translation, the protocol was tested in a pilot interview with a two IT managers. We revised the protocol to better fit the language and understanding of an IT professional. The resulting Chinese interview protocol is consistent, coherent and a valid instrument strongly linked to the working theory for exploring innovative competence development in China.

Data Collection And Analysis

Inductive theorizing makes use of a set of specific observations to move to the discovery of a pattern that represents some degree of order among all the given observations. Data collection and analysis in inductive empirical studies is not a linear process but involves a constant dialogue between theory and data. Our data collection and analysis involved three phases.

The *first phase* involved semi-structured interviews with Chinese software entrepreneurs in the period from February to June 2006 by the authors and a research team of Chinese graduate students. The graduate students were all trained by the first author and sat-in at least one interview. The interviews were done in Chinese. The first author was always present and the interviews were done in tandem. The questions were asked by the students whereas both interviewers took notes. The interviews were not allowed to be recorded. Therefore, interviewers took detailed notes, discussed the notes directly after the interview and then later send and compared each other's notes. The interviews on average took 1 hour and 15 minutes.

The *second phase* involved an organized interpretation of our initial data (30 firms) and additional fieldwork (15 firms). We followed inductive qualitative data analysis techniques to identify those firm-level abilities that integrate, build and reconfigure internal

and external resources to develop and successfully commercialize new products and services. The analysis involved a confrontation of our working theory and the extant literature on innovative competences and their antecedents (**Appendix l**) with the empirical data (cf. Uzzi, 1997; Krug & Hendrischke, 2008; Maeki, 1993). This phase involved the creation of a cross-sector display that indicates the antecedents that were unambiguously named by our respondents, similar to Uzzi (1997). After drafting our initial ideas we went back to the field to do return visits to 11 firms and 15 additional interviews with other entrepreneurs from September to November 2007. The return visits allowed us to present and communicate some of our initial ideas to create communicative and face validity. Additional interviews were necessary to reach a saturation point. The saturation point is defined as that number of cases beyond which adding an additional case causes no significant change in the identified pattern. After the second round of interviews and return visits we identified in total 26 different, unique antecedents that were named more than one time by 45 respondents (in total 160 antecedents were mentioned).

We also did a more formal analysis of the data by looking at the distribution and frequency of antecedents mentioned by each respondent. The results indicate that per standard software – and middleware firm, on average, 5 antecedents were singled out whereas per enterprise software firm 6 antecedents. The analysis also allows checking for the distribution of features mentioned per firm and the results indicate that there is no evidence for single respondents to have mentioned disproportionately many antecedents.

Furthermore, to facilitate the analysis and create an unambiguous understanding of these antecedents we assigned weights to each of the antecedents by calculating the relative importance of each antecedent by dividing the number of times that a specific antecedent was mentioned by the total number of antecedents mentioned. For example, of the total 160 antecedents mentioned by respondents, 6 times 'government subsidies' was mentioned (by 6 different respondents). So, government subsidy has a relative importance of 4% (6/160) in the total data set. We calculated the relative importance of the antecedents for both the total data set and for each sector separately. The subsequent analysis rests on the 26 unique antecedents and their relative importance as shown in **Table 3**. The antecedents mentioned only once are put in one category 'all others'. The totals of the columns add up to 100%.

The *third phase* involved the identification of patterns in the data; i.e. in the list of identified antecedents to single out innovative competences. Following Uzzi (1997) we did a finer analysis of these antecedents and identified five innovative competences; i.e. five constructs (**Table 3**). The fit between these constructs involved the grouping of observations

– antecedents – based on a set of attributes, i.e. 'fit as gestalt' (Venkatraman, 1989). An exploratory perspective – inductive theorizing – is necessarily less precise in specifying the functional form of fit, as argued by Venkatraman (1989). Similar to the inductive studies of Uzzi (1997) and Hendrischke & Krug (2008) and advocated by Maeki (1993) and Whitley (2007), the confrontation of the constructs with the theory and constant dialogue between data and theory is more useful than using formal statistical methods that reduce data to single isolated observations. Before discussing each of these five competences, we will describe the distinct innovative activities of firms across our three sectors.

INSERT TABLE 3 ABOUT HERE

RESULTS

Innovative Activities

The three software sectors show varied patterns of innovative activities (**Table 4**). In the enterprise software sector, innovation takes the form of incremental improvement of products and processes, upgrading service to customers and introducing more products in the same production line. In contrast, standard software firms strive to be the technological leader and to that end innovate radically in product technology and opening up of new markets. The innovative activities of middleware software firms can be summarized as non-customized work for a mass market. Innovation takes the form of new business models, new product line or opening up a new market. These firms strive to be the technological leader and to that end undertake radically innovative activities.

Besides supporting the idea that the three sectors have distinct innovative activities, there is another interesting result: it appears that more than half of the innovations in these sectors are not in new products or services, which are traditionally seen as 'real' innovation (Fagerberg, 2007). On the contrary, firms appear to be innovative in the way they organize their business both in terms of processes and business models, not unlike Western countries where successful catching-up historically also involved innovation of the organizational kind.

INSERT TABLE 4 ABOUT HERE

Innovative Competences

The antecedents of innovative activities provide the basis for understanding what kinds of competences are developed. Finer analysis showed that we can single out five innovative

competences: access to finance, strategic flexibility, access to external knowledge, innovative prominence and organizational integration (**Table 3**). We will now discuss each of these five innovative competences in more detail.

Financial commitment refers to the ability of a firm to commit internal and/or external sources of financial capital for a long-term investment as to assure the collective learning necessary for innovation. The results show 1) the importance of long-term commitment of internal and/or external sources; 2) government and private capital sources instead of capital market; 3) that it is a firm specific competence: liability of 'smallness' (need for capital) and capital is not (yet) available on a capital market basis; 4) we have to distinguish two aspects of financial commitment: source and use.

The patterns in the data indicate the crucial role of diverse financial sources in different types of innovative ventures. In total 14% of all antecedents are related to access to financial capital; but especially important for standard software sector: 21% of all antecedents mentioned in that sector, compared to 12% in both other sectors. Unsurprisingly the standard software sector, characterised by radical, stand-alone innovations are in most need of capital. Enterprise software firms need less investments and can often draw on resources from the customer, whereas middleware firms have limited capital needs altogether.

Attracting capital becomes a firm specific competence because firms are small, require capital and capital is not (yet) available on a capital market basis, as our interviews suggest. Therefore, it is an important competence for these firms to be able to access capital. It is useful to distinguish two aspects of financial commitment: source and use: 1) most government subsidies flow to enterprise software firms, which pursue less radical innovations, carrying less risks; 2) the more risky type of investments – VC and founder capital – are found in middleware firms, firms prone to invest in more risky ventures. The availability of the former hinges on the local government policies, whereas the latter depends on the availability of own resources and/or personal networks that can mobilise financial resources. Summarizing, access to financial capital is a key competences where access to government and personal capital sources is sought instead of capital market based finance.

Strategic flexibility refers to the ability that allows firms to change strategic directions quickly to adapt to changing economic and institutional changes. The results show:1) that firms change strategic directions quickly; 2) that experimentation is important to find the

right model; a *long-term* strategy; 3) that firms quickly establish a customer base and develop and learn complicated new technologies; either via peers or imitation of foreign examples.

In total 15% of all antecedents are related to strategic flexibility, but especially important for middleware firms (24%) as compared to standard (9%) and enterprise software (5%). The patterns in our data show how business models reflect different strategic orientations for different technical fields or market considerations. Especially middleware firms appear to be flexible in their strategic choices, aiming to capture a part of the market as quickly as possible and learning skills from every source possible, which reflects long-term goals. Enterprise firms, on the other hand, focus mostly on learning from local customers and are flexible to the extent that they want to meet (changing) customer requirements. Standard software firms pursue more general flexible strategies that allow them to 'jump' into opportunity windows and the firms in our sample behave rather opportunistically, which both reflects short-term goals.

The role of strategic flexibility, or more generally, the role of strategic orientation has been studied widely in the marketing and innovation literature. Our findings support that different strategic orientations have different consequences for innovative potential (Zhou & Li, 2007). Enterprise software firms in our sample have a customer orientation, which means that they have sufficient understanding of their target buyers in order to create superior value for them, i.e. the customer is set first (Gatignon & Xuereb, 1997; Gao, Zhou & Yim, 2007). Standard software firms have a technology orientation, which means that they are more R&D focused and proactive in finding new technical solutions that are assumed to be valued by the customer (Zhou, Yim & Tse, 2005). Middleware firms have the most entrepreneurial orientation: they pursue new market opportunities, are tolerant of risk and radically innovative (Zhou & Li, 2007).

This result is not surprising for two reasons: one, middleware firms are the youngest, least experienced and most volatile among the three sectors. The interviews suggest that there are high rates of founding and failure, even though we cannot check this with official statistics. Furthermore, previous research on Chinese ventures suggested that private firms behave opportunistically and short-term focused (e.g. Tan, 2005). However, our interviews suggest that these firms are merely experimenting to find the right model and in that sense have a long-term focus on strategy. This strategy has to be flexible to quickly establish a customer base and develop and learn complicated new technologies, either via local industry peers or imitation of foreign examples. Generally, short term flexible – opportunistic -

strategies are found in standard – and enterprise software sectors, whereas the middleware firms have a more long term goal but still flexible in mind.

External knowledge transformation refers to the ability that allows the firm to develop, acquire, transform and share knowledge across firm boundaries. The results show that: 1) firms develop, acquire, transform and share knowledge across firm boundaries; 2) it resembles 'Western' style networking: about technical and business knowledge; 3) however, also a response to limitations in factors markets - liability of newness - i.e. China specific; 4) there is considerable variation in: the type of knowledge (content), governance mode (mobilization / coordination), level of formality.

In total 36% of all antecedents are related to access to external knowledge, making it the most crucial factor. These results are altogether not surprising and follow other research on Chinese ventures (e.g. Krug, 2004). However, what is surprising is that the government as an actor is 'left out'. It appears that networking for knowledge follows 'Western' style networking in the sense that it is about technical and business knowledge. On the other hand it is also clearly a response to limitations in factors markets, e.g. liability of newness, which is rather China-specific (Krug & Polos, 2004).

The findings suggest that this competence is crucial for all sectors, but there are considerable differences in the type of knowledge (content), governance mode (mobilization / coordination) and level of formality. With respect to content, access to external knowledge can refer to both business knowledge (8%) and technological knowledge (28%). In terms of *business knowledge*, this competence utilizes the personal network of the CEO to share business information. Business information here refers mostly to information about new opportunities, market knowledge and sharing of solutions to managerial problems. This competence allows coordination of resources – knowledge – and this is done in a rather informal way. Furthermore, it also allows for coordination of work – customer projects – between local firms within the industry. This is another form of sharing resources, but also in an informal way.

Access to *technological knowledge* is another activity that this competence allows for. There is a variety of activities: cooperation with customers for developing new ideas, coordination of technological development within the industry, commercialization of university research, recruitment of new talents, research cooperation with university to develop new technologies and communication and collaboration with external experts. The first two activities refer to *coordination* of resources, be it via informal or formal

collaborations (20% of network antecedents). The latter four activities refer to the *mobilization* of resources, mostly in more formal ways (16% of network antecedents).

These different activities, in terms of governance, content and formality of sharing of resources, are used for different innovative activities. Our findings suggest that standard software development – radical, stand-alone innovation – requires a balanced use of variety of external sources, related to technical knowledge development and governed in both formal and informal ways. Middleware development – radical, modular innovation – on the other hand requires those activities that result in sharing of business knowledge, which is in line with the strategic flexibility competence that allows these firms to search for the right business model. Governance of such networked assets is predominantly informal. Enterprise software development – incremental, systemic innovation – focuses on activities that enhance cooperation with customers, commercialization of university research and accumulation of technical knowledge. Governance of the cooperation is usually formalized in contracts.

Reputation development refers to the ability that enables firms to pursue innovative goals by developing and subsequently employing 'reputational assets' in the market, i.e. creating visibility and credibility as a successful innovator (cf. Tylecote & Visintin, 2008). A firm's reputation often summarizes a lot of information and shapes the ideas of customers, suppliers, partners and competitors. The results show that: 1) a founder's entrepreneurial experience important for risky, radically innovative ventures; 2) the collective reputation of the firm is more important for less risky, incrementally innovative ventures; 3) this competence is strongly connected to the other competences; 4) this competence helps to overcome liabilities of newness: easier to convince customers and suppliers / business partners of the enterprise's innovative abilities.

In total 17% of all antecedents are related to reputation, but more important for middleware firms (22%) and standard software firms (18%) than for enterprise software (12%). Standing in the business or technical community and having 'reputational assets' enables firms to achieve various goals, such as innovation, in the market (Henderson & Cockburn, 1994; Teece et al., 1997), by identification of the value of the firm's previous efforts by external constituencies (Podolny & Philips, 1996) and via accumulated human – and social capital (Burton, Sorensen & Beckman, 2002). A founder's entrepreneurial experience plays a larger role in risky, radically innovative ventures – such as the middleware sector – than in moderately risky ventures, such as the enterprise software sector. In the latter, the collective reputation of the firm is more important.

This competence is strongly related to the other competences, as it for instance, enhances the chances to get access to (government and personal) finance and increases the likelihood of being a desired business partner. Moreover, it is a way to overcome liabilities of newness in two ways because it is easier to convince customers and suppliers / business partners of the enterprise's innovative abilities. Having a reputation for being innovative thus reinforces the other innovative competences.

Organizational integration refers to the ability to commit employees to the firm and contribute their resources to engage in firm-specific learning (cf. Whitley, 2002). The results show that: 1) it is important to commit employees to the firm and contribute their resources to engage in firm-specific learning; 2) collective coordination and learning (internalizing externally accessed knowledge and collectivizing the various individual personal knowledge sources); 3) organizational integration functions as a *coordination mechanism* (absorptive capacity and employee commitment).

In our study, the organizational integration competence is related to collective coordination and learning. Over 14% of all antecedents are related to organizational integration. However they are especially important for the enterprise software sector: 22% of all antecedents mentioned in that sector, compared to 6% and 9% for standard – and middleware sector respectively. This competence is particularly important for developing incremental, systemic innovations, such as in the enterprise software sector. The risky and innovative standard software and middleware sectors appear to have less organizational integration and more flexible and fluid human resource systems.

However, the importance of organizational integration as a competence for innovation directly flows from the need for internalizing externally accessed knowledge and/or collectivizing the various individual personal knowledge sources. In short, organizational integration as an innovative competence mostly functions as a *coordination mechanism* (cf Whitley, 2002; Lazonick, 2004; Nooteboom, 2004). For the more risky ventures this is mostly necessary to absorb new technical and business knowledge, or refers to what Cohen & Levinthal (1990) named 'absorptive capacity'. For the less risky, incrementally innovative ventures it is mostly necessary to socialize and commit employees to invest in collective knowledge and learning.

At first sight this innovative competence and strategic flexibility appear to be contradictory. However, enterprises exactly need both competences: On the one hand, strategic flexibility allows learning and acquiring new knowledge. On the other hand, given

their inexperience, limited resources and lack of legitimation, these enterprises need to internalize and collectivize this new knowledge and experience. The competence functions as an internal coordination mechanism. Therefore, there is a subtle balance and trade-off between flexibility and stability. Perhaps the best analogy is March's distinction between explorative and exploitative activities. Following Nooteboom's (2004) cycle of exploitation and exploration, enterprises need to explore first, searching for new knowledge, then consolidate this and generalize it within the enterprise boundaries to be able to exploit the new knowledge. All in all, this suggests a strong coherence among innovative competences.

Institutional Regimes

A crucial question then is why these five competences could be credibly developed in China's business environment. Which features of Hangzhou's business environment necessitate and/or allow these competences to be developed? The interviews suggest at least six features.

a) Incomplete labour market – Even though the potential talent pool in Hangzhou is significant with over 250.000 undergraduate students, 20.000 graduate students and a high level of IT literacy, Hangzhou's labour market for software professionals is relatively incomplete. On the one hand, the ICT industries (including the software industry) employ only 97.000 persons of the total 5 million (or 2%). This is a relatively small number compared to other sectors such as business services, retail, transportation, construction and telecommunications (Hangzhou Statistical Yearbook, 2007). On the other hand, our interviews suggest that it is rather difficult to locate and attract talented employees and the manage/retain their employees. One reason is the lack of legitimacy of these new and small firms in a newly emerging sector. Over half of the firms in our sample indicate that cost and quality of their employees is a main obstacle for the further development of their firm. This seems to be especially true for standard software firms (over three-quarter of the firms). Furthermore, over a third of the firms have too few employees and are unable to attract enough suitable employees. This suggests that actually the absolute number of potential employees is not the problem, but getting access to them. In other words, it seems that the allocation and distribution mechanism in the labour market is missing.

Our interview with the president of the Zhejiang Software Industry Association suggests that the talent pool is limited because there is only one good university – Zhejiang University – which can provide good quality employees, whereas for instance, Shanghai has

three or four universities. Second reason might be the high living costs in Hangzhou, most prominently, the high real estate prices. Many employees prefer Shanghai or Jiaxing. In such a business context the need for organizational integration is larger; i.e. firms want to commit employees to a greater extent to their firm as to prevent them from changing jobs and to make full use of the competences of the employees. Furthermore, reputation becomes more important. The better the reputation of the firm, the easier it is to attract new employees.

b) Incomplete financial markets – The overall investment climate in Hangzhou for both domestic and foreign firms is among the best in China. However, actual access to finance remains one of the main problems for entrepreneurs in Zhejiang province. In fact, it is not the amount of capital that is a problem – there is more than enough private (also foreign) capital in the province – it is getting access to that capital (as indicated by over half of the firms in the sample). Bank loans and venture capital investments are almost never used. In our sample, most investment are from (groups of) private investors. In other words, the financial markets are almost non-existent, whereas software sectors are usually VC driven or at least capital-intensive in terms of labour costs. Access to financial capital thus becomes a crucial competence. As indicated by our interviews, this is not access to banks or stock markets but to government subsidies and personal loans. Furthermore, the role of reputation is significant in order to attract capital, mostly from family or (friends of) friends.

c) Legitimacy of an emerging software market – The software industry in Hangzhou is emerging successfully with 23,7 billion RMB in 2005 sales revenues of software products (of the Zhejiang province total of 25,1 billion RMB; Hangzhou Statistics Online, 2007). Compare these numbers to other sectors in Hangzhou and we can only conclude that the software business is taking up a substantial part of the industrial landscape and has a solid position: retail/wholesale 33,7 billion RMB; banking 25 billion RMB, real estate 21 billion RMB. The software sector has not only been growing in the past and has established itself among Hangzhou's sectors, it is also likely that it will continue to grow in the future. A census among entrepreneurs by the Hangzhou statistics office shows that the software sector (and information transmission and computer service sectors) had the highest expectation rate (178 points) of all industries, leaving industry, construction, retail, real estate and tourism (on average 124 points) behind.

In this context both a flexible strategy and access to external knowledge are important competences. On the one hand, a flexible strategy allows a firm to quickly change strategic

directions and take advantage of possibilities in an emerging market and of the various beneficial policies. On the other hand, with such changing conditions it is the more important that firms have access to external knowledge. It is difficult to accumulate knowledge in a continuously changing context. Especially the coordination or sharing of knowledge across firm boundaries becomes an important competence. If there is a strong 'sharing'- culture in the market place, there is less risk of imitation. As one of the interviewees indicated, all the entrepreneurs have more benefit from an enlarged market at this stage of development.

d) Considerable legitimacy of private enterprises - Hangzhou is one of the centres for China's booming private sector. The other is Shenzhen, in the south of China in the prosperous Guangdong region. Whereas these and other cities' prosperity is driven by the proximity to Hong Kong and heavy inflow of investments from Hong Kong and Taiwanese entrepreneurs and investors, Zhejiang province developed more indigenously, relying on domestic key resources. The province traditionally had not many large state-owned companies that drew resources and attention from the central government and given the lack of natural resources and limited farmland, the central government more or less 'neglected' this region. Zhejiang locals thus were more dependent on their own than in other regions, stimulating entrepreneurship and innovation. Therefore, firms appear not to be hindered by having the 'private'-status, which is the case in other provinces (e.g. Krug, 2004).

e) Preferential policies and limited government intervention - The central government preferential policies for software firms are supportive of software entrepreneurs and the local government has embraced the potential of informatization and put it centre stage its strategy (Hartford, 2003). Moreover, although highly regulatory, the local government plays a behind-the-scenes role without strong central coordination or clear commitments to fund ventures unrelated to government department functioning (Hartford, 2003). Furthermore, the relatively high effectiveness of Hangzhou's government, in terms of few 'bureaucratic interactions days', low 'entertainment costs', low 'expectation of informal payments for loans' and other factors, suggests limited government interference (World Bank, 2006), creating latitude for market competition (Hartford, 2003).

Lastly, there are many supporting institutions – Zhejiang University, Science Park, Development Zones, National Software Base, etc. – that create an institutional infrastructure that is supportive of the development of high-tech industries. A flexible strategy is a strong competence in the sense that it allows the firms to respond to changing policies quickly and

benefit from potential preferential policies. Furthermore, preferential (taxation and subsidization) plans also increase possibilities for attracting financial capital. Furthermore, the direct consequence of limited government intervention is that firms do not have to deal with government officials too much, and, for instance, do not have to participate in the networks. Moreover, networks mostly can function as a way of mobilizing knowledge, and not political influence.

f) Weak intellectual property rights protection – Although it is impossible to analyse the actual IPR protection situation in Hangzhou, the Report on the Intellectual Property Rights Protection in Zhejiang Province in 2004 (State Intellectual Property Office of P.R.C, 2007) suggests that there has been much progress in patent, trademark, copyright and original product protection and enforcement. However, about one quarter of our firms indicated that weak IPRs is one of the main obstacles for the development of their firm. In fact, almost half of the firms fear imitation of their product. This situation makes it likely that firms focus more on organizational integration to build firm-specific knowledge that is hard to imitate and have a rather flexible approach to strategic directions. Flexible strategies allow firms to take advantages of possibilities in an early stage – perhaps be a first-mover – and then capture a part of the market before others can do so by creating entry barriers and switching costs for customers. **Table 5** summarizes the connections between these main features and the innovative competences.

INSERT TABLE 5 AROUND HERE

DISCUSSION

Acknowledging the significance of innovation for the emerging private sector in China's transition economy, we set out to explore what kinds of innovative competence are credibly developed by Chinese private entrepreneurs. Drawing on the dynamic resource-based – and comparative institutional perspectives, we explain firm-level mechanisms of innovative competence development while taking into account institutional constraints. We start with a summary of the key findings and benchmark the pattern of innovative competences, then discuss the key contributions to the theoretical and empirical literature and end with a discussion of the explanatory power of this study.

Summary Of Findings

The empirical comparative case study of 45 software entrepreneurs in Hangzhou provides evidence for specific innovative competences across three distinct sectors. The findings point at five competences as particularly important for innovation: financial commitment, organizational integration, external knowledge transformation, reputation development and strategic flexibility.

It is useful to discuss the differences in importance of these competences. The percentage indicate relative importance, i.e. how important each competence is compared to the other competences. For instance, the findings indicate that external knowledge transformation (36%) is roughly two times more important for firms' innovation potential than the other individual competences (on average 15%). In essence this means that the ability of firms – as measured by the antecedents named by the respondents – to transform and use external knowledge is the most crucial competence. However, this competence is necessary but not sufficient, i.e. all five competences are needed for firms to innovate. The different levels of importance merely indicate how much effort – for instance in terms of capital investment – was given to the different competences for successful innovation. The relative importance of the competences also varies across sectors. For instance, organizational integration is more important (22%) for enterprise software firms than for standard software firms (6%). Again, this indicates that firms in distinct sectors differentiate their efforts accordingly.

The second set of findings suggest that innovative competence development shows sectoral variety, as expected from our working theory. Moreover, Hangzhou's institutional arrangements facilitated the credible development of these competences. Summarizing, Hangzhou's institutions provides enough capital, labour and knowledge resources, i.e. sufficient collective competition goods at the local level. However, the mechanisms that link these resources to economic actors, i.e. governance mechanisms, are incomplete and ambiguous. In response to these 'missing links' firms develop competences to act as functional equivalents of such mechanisms. The findings add important empirical and conceptual insight to the literature on innovative competences and comparative institutional analysis.

Benchmarking The Pattern Of Innovative Competences

It is worthwhile to compare the patterns of innovative competences in our sample to out-of-sample examples of successfully innovating firms. The work of Lu (2000) and Lazonick (2004) on non-governmental computer firms Stone, Lenovo, Founder and Great Wall

provides strong evidence for organizational integration and financial commitment as crucial competences, but less so for external knowledge transformation for successful innovation. This difference is explained by the fact that the key source of knowledge for these non-governmental firms is the state's S&T knowledge base to which they had unlimited access via their special governance mode with a collective/public nature as a result of their origins in the state socialist economy. The reputation benefits, exemplified by the ease with which they secured markets, are considerable (Lazonick, 2004). Our private firms on the contrary have to focus on external knowledge transformation – the inputs - in the absence of such 'hidden subsidies'. At the same time, the development of reputation to secure new markets – the outputs - then becomes a crucial competence.

It is also useful to compare our results with the successfully innovating Huawei, a privately established network solutions provider. The key capabilities of Huawei are found in the widespread cooperation with key industry players and major universities (cf. external knowledge transformation), their own R&D capacity and a strong organizational commitment (cf. organizational integration) via teamwork culture, bonus and stock options and on the job training (Lau et al., 2002). On a more general level, successful knowledge management, which is at the core of innovation, in large high-tech firms in China is facilitated by social capital and absorptive capacity (Lau et al., 2002). These successful large firms (Huawei, Founder, Lenovo, Stone, Great Wall and others) appear to exemplify the importance of external knowledge transformation, financial commitment and organizational integration. The importance of reputation development and strategic flexibility for the firms in our sample is necessarily related to size and experience. Whereas the large firms built upon their established reputation, smaller entrepreneurial firms need to build reputation and capture a market using strategic flexibility. In sum, by benchmarking our pattern of innovative competences with out-of-sample examples we strengthen the reliability of our findings.

Contributions

The findings of this study suggest three contributions to the conceptual and empirical literature. First, the findings contribute to the competence and capability literature by suggesting that there are various interconnections between the competences. Specifically, the innovative potential of a firm in a transition economy depends on the complementarity of innovative competences, i.e. all five are necessary for innovation. Prior research has focused on technology and R&D competences, largely neglecting the potential value of other competences. There´s also a large body of research that stresses the valued combination of

R&D and marketing competences as firm specific competences (Lee, Lee & Pennings, 2001; Gatignon & Xuereb, 1997). However, our findings stress that the key is to have a coherent set of competences that give firms innovative potential in a specific institutional environment.

Second, by exploring the link between institutions and innovative competences, this study contributes to a growing literature on the connection between micro-macro level mechanisms (Whitley, 2006; Casper & Murray, 2003). Several links are empirically identified in this study. On the one hand, competences are constrained and shaped by institutional arrangement, which is in line with the general literature on the institutional structuring of competences. On the other hand, competences complement institutions. The institutional regime appears to provide enough capital, labour and knowledge resources, however does not provide the mechanisms of allocation and distribution. The results suggest that innovative competences take over this function and 'fill the institutional voids' by mobilizing and transforming resources. These result deserve further study on the co-evolution of competences and institutions and the role of organizational competences in shaping institutional regimes (cf. Krug & Hendrischke, 2008; Lewin & Volberda, 1999).

Last, the findings suggest that a combination of the innovation system perspective (i.e. technological regimes) with comparative institutional perspectives (i.e. institutional regimes) is worthwhile. First, all five competences are important for developing innovations across the sectors to the effect that these five competences are credibly developed within this local institutional regime. Second, the extent to which these competences play a role varies across sectors. Our findings support and qualify the roles of both technological - and institutional regimes in a transition economy and how they can be usefully combined, as was advocated by Lundvall (1999) and Whitley (2007). Institutional regimes affect the overall pattern of credibly developed innovative competences while technological regimes affect the extent to which these play a role across distinct sectors.

Explanatory Power

Our study's explanatory power is constrained by the location, time period of the research and sectors. First, the study is done in Hangzhou; for the purpose of this study Hangzhou is an appropriate research setting. However, the findings for the sectoral development cannot directly be used in other institutional settings. Even though the mechanisms are likely to be the same, the extent or type of constraints might differ across institutional settings. Therefore, it is expected that innovative competences also differ in response to different institutional constraints. However, it is likely that the mechanisms are similar. In line with Manion (1994),

we expect that the lessons learnt from local samples can tell us something about mechanisms, or relations between variables, even though the local contexts might differ. It must be noted that Hangzhou is at the forefront of economic and technical developments and therefore is likely to be a benchmark for other regions, which increases the potential generalizability of this study. Nevertheless, further research in other localities should validate this expectation, preferably in the same industry. Beijing, Shanghai and Shenzhen are candidates for a comparative study but also Nanjing and Dalian are important cities for software development.

Second, the study is time-bound. Innovation involves creativity which involves surprise and uncertainty. As a newly emerging software industry is dynamic and changing continuously, it is hard to predict to what extent constraints, technologies and regulations change. Even though we took a process explanation of innovation in the software sectors, it remains hard to predict where the sectors will be heading. We don't know precisely how the sectors will evolve beyond the time period studied in this project. Nevertheless, the mechanisms that were uncovered at least explain the underlying processes and it is unlikely that those mechanisms will change rapidly. Subsequent empirical studies should incorporate longer time periods and include follow ups of this research to see how and why the sectors developed. Furthermore, the findings should be tested in other emerging sectors, such as biotechnology, where the technical constraints are different.

Third, the study is limited to successful firms. Successful in this study refers to firms that succeed to innovate at least once successfully. However, the explorative, inductive nature of our empirical study does not allow for comparing the patterns of innovative competences of these successful firms with unsuccessful – in terms of innovation – firms. Moreover, we did not differentiate successful innovators from extremely successful innovators. Lastly, future research should also take into account 'serial' innovators or continuous innovation as opposed to the discrete types of innovation considered in this study. Nevertheless, our study identified several patterns of innovation at the firm level in relation to institutional conditions that we hope form a useful basis for further research.

CONCLUSION

We propose a working theory of innovative competence development in a transition economy. We explained firm-level mechanisms of innovation in China's emerging private business sector. Moreover, we explained that the development of innovative competences in China's emerging private business sector is shaped by technological – and institutional conditions. In general, the findings suggest that the combination of resource-based, technological and

institutional perspectives provides valuable insights into the development of innovative competences. Two findings stand out: First, the complementarity of innovative competences determines the potential of a firm to innovate. Moreover, technological and institutional conditions influence the potential range of credibly developed innovative competences. Future research should test and verify the working theory proposed here. Second, we have explored the link between innovative competences and the institutional arrangements in an emerging business system. The results suggest that competences can be functional equivalents of institution. This result deserves further study on the co-evolution of competences and institutions and the role of organizational competences in shaping institutional regimes. In general, by expanding the research on innovation and competences into a novel institutional context, i.e. that of a transition economy, we could at the same time explore existing theories and develop new insights. The value of these new insights needs to be further explored and formally tested.

NOTES

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1. Capabilities and competences are increasingly seen as overlapping and highly complementary (e.g. Buenstorf & Murmann, 2005).
2. A review of the extensive literature and definitions of competences and capabilities is beyond the scope of this paper. For excellent reviews of resource- and capability based approaches I refer to Eisenhardt & Martin, 2000; Wang & Ahmed, 2007; Winter, 2003.
3. There are indications that this list is incomplete. Different sources report between 300-2000 software firms in Hangzhou. However, only the CSIA data contains relatively detailed information on the local industry structure. From: interview with the president of Zhejiang Software Industry Association, September 26, 2007.
4. The survey included empirical and conceptual studies from management, economics, sociology and Asia/China-specific academic journals and books.

REFERENCES

Aldrich, H. E., & Fiol, C. M. 1994. Fools rush in? The institutional context of industry creation. ***Academy of Management Review***, 19(4): 645-670.

Amit, R. & Schoemaker, P.J.H. 1993. Strategic assets and organizational rent. ***Strategic Management Journal,*** 14: 33-46.

Asian Development Bank (2006) **People's Republic of China: Country strategy and program update (2007-2008)**, Manila: Asian Development Bank.

Batjargal, B. 2007. Internet entrepreneurship: Social capital, human capital, and performance of Internet ventures in China. ***Research Policy,*** 36(5): 605-618.

Buenstorf, G. & Murmann, J.P. 2005. Ernst Abbe's scientific management: theoretical insights from a nineteenth-century dynamic capabilities approach. ***Industrial and Corporate Change,*** 14(4): 543-578.

Burton, M.D. Sorensen, J.B. & Beckman, C.M. 2002. Coming from good stock: Career histories and new venture formation. ***Social structure and organizations revisited***. 19: 229-262.

Casper, S. & Whitley, R. D. 2004. Managing competences in entrepreneurial technology firms: A comparative institutional analysis of Germany, Sweden and the UK. ***Research Policy*** ,33: 89-106.

China Software Industry Association (2005), Beijing.

Coriat, B. & Weinstein, O. 2002. Organizations, firms and institutions in the generation of innovation. ***Research Policy***, 31, 273-290.

Damanpour, F. 1991. Organizational innovation: A meta-analysis of effects of determinants and moderators. ***Academy of Management Journal*** ,34(3): 555-590.

Dhanaraj, C. & Parkhe, A. 2006. Orchestrating innovation networks. ***Academy of Management Review***, 31(3): 659-669.

Dosi, G. 1988. Sources, procedures, and microeconomic effects of innovation. ***Journal of Economic Literature,*** 26(3): 1120-1171.

Edquist, C. (ed.) 1997. ***Systems of innovation: Technologies, institutions and organizations***, Frances Pinter, London.

Eisenhardt, K.M. & Martin, J.A. 2000. Dynamic capabilities: what are they? ***Strategic Management Journal***, 21: 1105-1121.

Fagerberg, J. (ed) (2007), ***The Oxford handbook of innovation***, Oxford University Press: Oxford.

Gao, G.Y., Zhao, K.Z. & Yim, C.K. 2007. On what should firms focus in transitional economies? A study of the contingent value of strategic orientations in China. ***International Journal of Research in Marketing***, 24: 3-15.

Gatignon, H. & Xuereb, J. 1997. Strategic orientation of the firm and new product performance. ***Journal of Marketing Research***, 34: 77-90.

Goodman, D.S.G. (1997) ***China's provinces in reform: Class, community and political culture***, London: Routledge.

Gu, S. (1996), 'The emergence of new technology enterprises in China: A study of endogenous capability building via restructuring', ***Journal of Development Studies***, 32 (4), 475–505.

Hage, J.T. & Hollingsworth, J.R. 2000. A strategy for the analysis of idea innovation networks and institutions. ***Organization Studies***, 21, 5, 971-1004.

Hall, P. & Soskice, D. (eds) 2001. ***Varieties of Capitalism: The Institutional Foundations of Comparative Advantage***. Oxford: Oxford University Press.

Hangzhou Statistics Online. 2007. [28 February] Available from URL: http://www.hzstats.gov.cn/english/.

Hartford, K. 2003. West Lake Wired: Shaping Hangzhou's information age. In: C. Lee (ed.) ***Chinese media, global contexts*** London: RoutledgeCurzon.

Henderson, R. & Cockburn, I. 1994. Measuring competence? Exploring firm effects in pharmaceutical research. ***Strategic Management Journal,*** 15: 63-84.

Hollingsworth, J.R. & Boyer, R. 1997. ***Contemporary capitalism: The embeddesness of institutions***, Cambridge: Cambridge University Press.

Iansiti, M. & Clark, K.B. 1994. Integration and Dynamic Capability: Evidence from Product Development in Automobiles and Mainframe Computers. ***Industrial and Corporate Change***, 3(3), pp. 557-605.

Kogut, B. & Zander, U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. ***Organization Science,*** 3: 383-397.

Khanna, T. & Palepu, K. (2000). 'The future of business groups in emerging markets: long-run evidence from Chile'. ***Academy of Management Journal***, 43, 268–85.

Krug, B. & Polos, L. 2004. Emerging markets, entrepreneurship and uncertainty. In B. Krug (Ed.), *China's* ***Rational Entrepreneurs: The development of the new private business sector***, pp. 72-96. London: RoutledgeCurzon.

Krug, B. (ed.) 2004. ***China's Rational Entrepreneurs: The development of the new private business sector***, London: RoutledgeCurzon.

Krug, B. & Hendrischke, H. (eds.) 2007. ***China's Economy in the 21st century: Enterprise and business behaviour*.** London: Edward Elgar.

Krug, B. & Hendrischke, H. 2008. Framing China: Transformation and institutional change through co-evolution, ***Management and Organization Review***, 4(1), pp. 81-108.

Lau, Chung-Ming, Y. Lu, S. Makino, X. Chen, & Yeh, R. 2002. Knowledge Management of High-Tech Firms,' in A.S. Tsui and C. Lau (eds.), ***The Management of Enterprises in the People's Republic of China***, pp. 183– 210 Dordrecht: Kluwer.

Lazonick, W. 2004. Indigenous Innovation and Economic Development: Lessons from China's Leap into the Information Age, ***Industry and Innovation***, 11(4), pp. 273-297.

Lee, C., Lee, K. & Pennings, J.M. 2001. Internal capabilities, external networks, and performance: A study on technology-based ventures. *Stra**tegic Management Journal,*** 22: 615-640.

Levinthal, D. (1990) Absorptive capacity. A new perspective on learning and innovation, ***Administrative Science Quarterly***, 35(1), pp. 128

Lewin, A. Y & Volberda, H.W. 1999. Prolegomena on coevolution: a Framework for Research on Strategy and New Organizational Forms, ***Organization Science***, 10(5), pp. 519-534.

Li, H. & Atuahene-Gima, K. 2002. The adoption of agency business activity, product innovation, and performance in Chinese technology ventures. *Strategic* ***Management Journal,*** 23: 469-490.

Li, J. & Kozhikode, R.K. (2008) Knowledge management and innovation strategy: The challenge for latecomers in emerging economies, ***Asia Pacific Journal of Management***, 25(3), pp. 429-450.

Liu, X. & Buck, T. (2007) Innovation performance and channels for international technology spillovers: Evidence from Chinese high-tech industries, ***Research Policy***, 36(3), pp. 355-366.

Liu, X. & White, S. (2001) Comparing innovation systems: a framework and application to China's transitional context, ***Research Policy***, 30(7), pp. 1091-1114.

Lu, Q. 2000. ***China's leap into the information age***. Oxford: Oxford University Press.

Lu, Q. & Lazonick, W. (2001) The organization of innovation in a transitional economy: business and government in Chinese electronic publishing. ***Research Policy***, 30(1), pp. 55-77.

Lundvall, B.A. (1999) National Business Systems and National Systems of Innovation, ***International Studies of Management & Organization***, 29.

Maeki, U. 1993. Social theories of science and the fate of institutionalism in economics. In U. Maeki, B. Gustafsson & C. Knudsen (Eds.), ***Rationality, institutions and economic methodology****:* 76-109. London: Routledge.

Malerba, F. and Orsenigo, L. 2000. Knowledge, innovative activities and industrial evolution, ***Industrial and Corporate Change***, 9, 2, 289-314.

Malerba, F. (2004), ***Sectoral systems of innovation: Concepts, issues and analysis of six major sectors in Europe***, Cambridge University Press: Cambridge.

Manion, M. 1994. Survey research in the study of contemporary China: Learning from local samples. ***China Quarterly***, 139: 741-765.

Meyer, K.E. & Peng, M.W. 2005. Probing theoretically into Central and Eastern Europe: transactions, resources and institutions. ***Journal of International Business Studies,*** 36: 600-621.

Nee, V. 1992. Organizational dynamics of market transition: Hybrid forms, property rights, and mixed economy in China. ***Administrative Science Quarterly***, 37: 1-27.

Nooteboom, B. 2004. ***Inter-Firm Collaboration, Learning & Networks. An Integrated Approach***. New York, London: Routledge.

Parker, R. & Tamaschke, L. 2005. Explaining regional departures from national patterns of industry specialization: regional institutions, policies and state coordination. ***Organization Studies***, 26(12): 1787-1807.

OECD (2007) ***Business for Development: Fostering the Private Sector***, Paris: OECD Publications.

Peng, M.W. 2003. Institutional transitions and strategic choices. ***Academy of Management Revieww*** 28(2): 275-296.

Podolny, J.M. and Phillips, D,J, 1996 The Dynamics of Organizational Status. ***Industrial and Corporate Change,*** 5:453–72.

Priem, R.L. & Butler, J.E. 2001. Is the resource-based "view" a useful perspective for strategic management research? ***Academy of Management Review,*** 26(1): 22-40.

Rothaermel, F.T., & Hess, A. (2007). Building dynamic capabilities: Innovation driven by individual, firm, and network-level effects. ***Organization Science***, 18(6): 898-921.

Qian, Y. 2000. The Process of China's Market Transition (1978-98): The Evolutionary, Historical, and Comparative Perspectives. ***Journal of Institutional and Theoretical Economics,*** 156(1): 151-171.

State Intellectual Property Office 2007. [28 February] Available from URL: http://www.sipo.gov.cn/sipo_English/default.htm.

Tan, J. 2005. Venturing in turbulent water: a historical perspective of economic reform and entrepreneurial transformation. ***Journal of Business Venturing*** 20: 689-704.

Teece, D.J. 1986. Profiting from technological innovation. ***Research Policy***, 15:6, 285-305.

Teece, D.J., Pisano, G. and Shuen, A. 1997. Dynamic capabilities and strategic management. ***Strategic Management Journal*** 18: 509-533.

Tsui, A.S., Bian, Y., & Cheng, L. 2006. ***China's domestic private firms: Multidisciplinary perspectives on management and performance***, London: M.E. Sharpe.

Tylecote, A. & Visintin, F. 2008. ***Corporate governance, finance and the technological advantage of nations***. London: Routledge.

Uzzi, B. 1997. Social structure and competition in interfirm networks: The paradox of embeddednes. ***Administrative Science Quarterly,*** 42: 35-67.

Venkatraman, N. (1989) The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence, ***Academy of Management Review***, 14(3), pp. 423-444.

Wan, W.P. 2005. Country resource environments, firm capabilities, and corporate diversification strategies. ***Journal of Management Studies,*** 42(1): 161-182.

Wang, C.L. & Ahmed, P.K. 2007. Dynamic capabilities: A review and research agenda. ***International Journal of Management Review,*** 9(1): 31-51.

Whitley, R. 1999. ***Divergent capitalisms***. Oxford: Oxford University Press.

Whitley, R. 2000. The institutional structuring of innovation strategies: Business systems, firm types and patterns of technical change in different market economies. ***Organization Studies,*** 21(5): 855-886.

Whitley, R. 2002. Developing innovative competences: the role of institutional frameworks. ***Industrial and Corporate Change,*** 11(3): 497-528.

Whitley, R. 2006. Understanding differences: Searching for the social processes that construct

and reproduce variety in science and economic organization. ***Organization Studies***, 27(8): 1153- 1177.

Whitley, R. 2007. ***Business systems and organizational capabilities***, Oxford: Oxford University Press.

Winter, S.G. 2003. Understanding dynamic capabilities. ***Strategic Management Journal,*** 24: 991-995.

World Bank. 2006. ***Governance, investment climate, and harmonious society: Competitiveness enhancements for 120 cities in China***. Washington, DC: World Bank.

Zhou, K.Z. & Li, C.B. 2007. How does strategic orientation matter in Chinese firms? ***Asia Pacific Journal of Management***, 224: 447-466.

Zhou, K.Z., Yim, C.K. & Tse, D.K. 2005. The effects of strategic orientations on technology- and market-based breakthrough innovations. ***Journal of Marketing***, 69: 42-60.

Appendix I: Antecedents for innovation

USA / Western Europe †	*Chinese economy* ‡
Acquisition of new technology from other firms and institutes	(Informal) partners for resource mobilization
Use of external partners for new knowledge	Coordination with government
Recruiting expert employees with diverse backgrounds	Strategic swiftness: opportunity recognition, short term behaviour and opportunism
Coordination of innovation networks	Founder experience and pre-existing network
Access to finance	Incremental organizational transformation
Reputation in knowledge markets	Technical absorptive capacity
Technical capacity	
Flexible strategy	
CEO experience in entrepreneurship and innovation	
Organizational integration / commitment	
Innovation orientation: ability to recognize opportunities	

† Example studies: Rothaermel and Hess, 2007; Lee, Lee and Pennings, 2001; Henderson and Cockburn, 1994; Lazonick, 2004; Dhanaraj and Parkhe, 2006; Damanpour, 1991; Kogut and Zander, 1992; Eisenhardt and Martin, 2000; Casper and Whitley, 2004; Whitley, 2002.

‡ Example studies: Krug, 2004; Li and Atuahene-Gima, 2002; Wan, 2005; Tan, 2005; Peng, 2003; Batjargal, 2007.

Appendix II: Interview protocol

(I) FOUNDING OF THE FIRM & STRATEGY

1. Please describe how the firm was established
2. How does the firm try to compete?
3. Did the firm have to make any significant specific investments?

(II) INNOVATIVE COMPETENCES

Please tell us about the firm's innovations

4. Does the firm consider itself a pioneer, good at spotting new opportunities?
5. What type of innovations did the firm introduce?
6. Please describe one innovation that is / has been crucial for the firm's development
7. Please explain which factors were important for the development of this innovation
8. What were the key challenges for this innovation and how did you manage these challenges?
9. Did the firm have to make significant specific investments for this innovation?
10. Did the firm have to attract new personnel for this innovation? If yes, how much and from where?
11. Did the firm get patents for this innovation?
12. Are collaborations with external partners necessary for innovation in your firm?

External partners

13. For the following we would like you to focus on several particular business relation which are, or have been, especially important to innovation in your firm. Please explain why and how each partner is important: type of partner; main purpose of cooperation; duration of cooperation (in years); frequency of contact; use of formal contract; why with this partner?; costs / disadvantages of cooperation with this partner; size of partner (small/large); sector (same/other); ownership.

Organization of work

14. How does the firm organize a typical assignment/project?

15. How do you know you hire good people?
16. How do you keep your employees?
17. How important is practical training as opposed to formal education?
18. Does the firm provide on-the-job training?
19. Does the firm use vocational training?
20. To what extent are employees involved in decision making?
21. What are the key challenges of the organization of work (HRM) and how do you manage them?

(III) BUSINESS ENVIRONMENT

Competitors

22. Who are the firm's main competitors?
23. Do these competitors often introduce new products/services? Give examples.
24. Can competitors easily copy the firm's products/services?
25. Do the competitors offer substitute products/services? Give examples.
26. How does the firm learn about the behaviour of its competitors?

Customers

27. Who are the firm's main customers?
28. Do the customers' preferences frequently change? Give examples.
29. Are the customers frequently looking for new products/services?
30. Are the customers loyal to the firm's products/services?
31. How does the firm learn about the behaviour of its customers?

Technology and knowledge base

32. Were there any significant changes in technology or knowledge base since the firm started its operations? Give examples.
33. How important are such changes for the development of your industry?
34. How important is it for the firm to match these changes?
35. Did the firm have to change the way it produces products or delivers services?
36. How does the firm learn about these changes?

The legal and administrative environment

37. Is it clear who the supervisory (administrative/legal) agent of your sector is?
38. Are the national/local regulatory requirements straightforward?
39. Is the amount of regulation and policies to which the firm needs to comply high?
40. Are there any preferential policies that your firm also benefits from?
41. Are there any policies that inhibit the further development of your firm?
42. Do changes in national/local requirements/policies occur often?
43. How do you keep track of the (changes in) policies and requirements?
44. Are you confident that legal mechanisms safeguard your firm's interests?
45. How important is (frequent) interaction with the government?
46. Are any other interactions with administrative agents, like trade unions, workers' associations, business associations important?
47. How dependent is your firm on state actions and policies?
48. Does the firm need approval by a state agency, bank, etc. for any of the firm's decisions?
49. Would changes in local administration or government pose a threat to the firm?

New industry

50. The software industry is a young and new industry. Can you tell us about the challenges en uncertainties of operating in such a new industry?
51. Can the firm look to and learn from other firms in the industry?
52. Are there many successful firms that could serve as an example to the firm?
53. Do you think your firm has enough experience to operate properly?

Challenges

54. Please describe what the firm's biggest challenge is and how you plan to manage such a challenge.

Figure 1: Working theory of innovative competence development in China

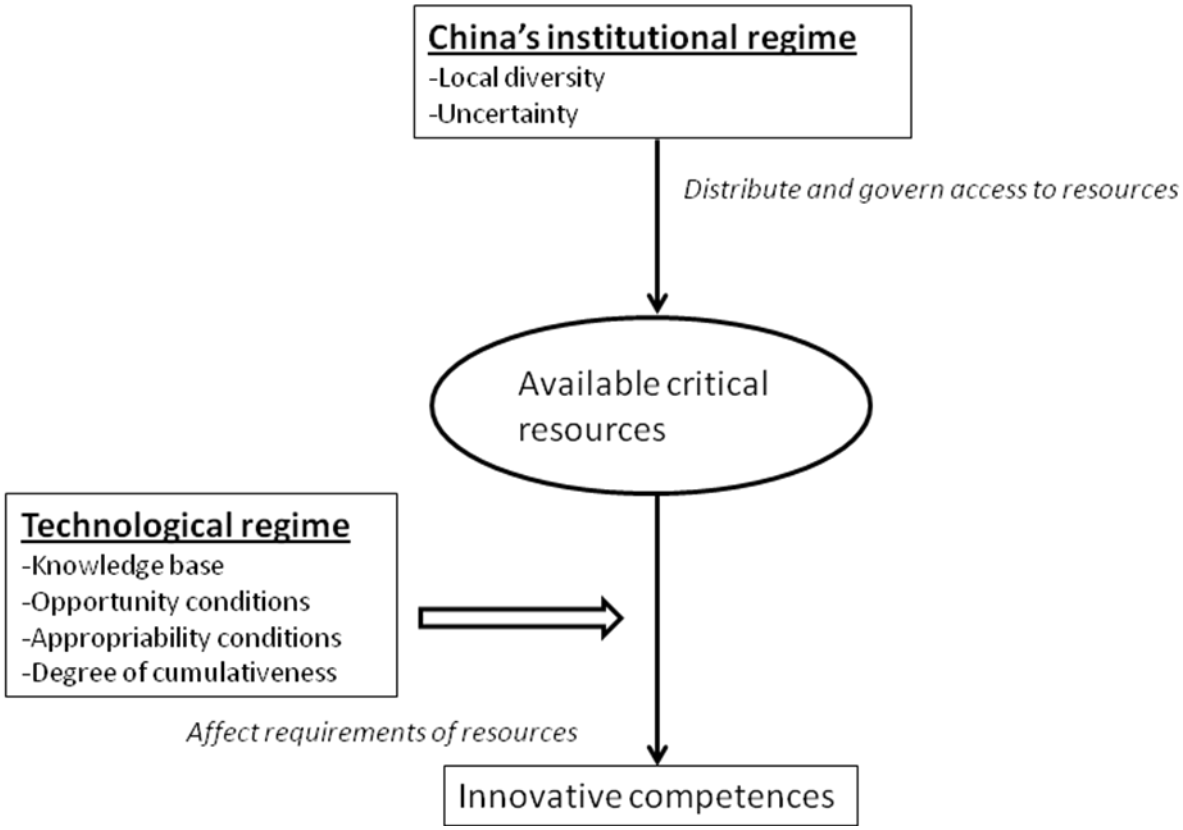

Table 1: Characteristics of software sub-sectors

	Enterprise software	*Standard software*	*Middleware*
Product/service	'Total-solution' (e.g. ERP†)	Novel product (e.g. Computer games, CAD‡)	Application, interface (e.g. Search engine, secure payment)
Customers	Few, heterogeneous	Many, homogenous	Very few, many users, homogenous
Cost model	Service contract, initial sale, upgrade	Sale, licensing	Revenues of users
Customization	High	Low	Low
Innovation Pattern	Incremental, systemic	Radical, stand alone	Radical, modular
Capabilities	Knowledge of full process; collective/firm capabilities	Novel, creative development; individual capabilities	Coordinating innovative activities; individual capabilities

† Enterprise Resource Planning
‡ Computer Aided Design

Table 2: sample versus population **size** characteristics

	Population	Sample
Standard software	Mean: 65; sd †: 53	Mean: 46; sd: 27
Middleware	Mean: 75; sd: 61	Mean: 95; sd: 85
Enterprise software	Mean: 62; sd: 79	Mean: 73; sd: 62
All	*Mean: 67; sd: 64*	*Mean: 71; sd: 58*

† sd = standard deviation

Table 3: Empirical findings – comparison of antecedents and innovative competences of Chinese private software firms (2007)

	Standard software	Middleware	Enterprise software	*Total (100%)*
Financial commitment				
financial commitment of private investors	9%	5%	6%	*6%*
government subsidies	6%	2%	6%	*4%*
venture capital investment	6%	2%		*2%*
founder financial capital commitment		3%		*2%*
Total	*21%*	*12%*	*12%*	*14%*
Organizational integration				
in-house training	3%	5%	12%	*8%*
in-house expertise			3%	*1%*
organizational learning	3%		3%	*2%*
organizational commitment		3%	1%	*2%*
clearly defined work routines			3%	*1%*
Total	*6%*	*9%*	*22%*	*14%*
External knowledge transformation				
founder personal contacts sharing business information		14%		*5%*
coordination of business within the local industry			7%	*3%*
cooperation with customers for innovation	9%		13%	*8%*
commercializing university research			13%	*6%*
coordination of technologies within the industry	9%	7%		*4%*
attracting new employees	9%		6%	*4%*
research cooperation with university	9%	3%		*3%*
communication with experts outside the firm	3%	3%	1%	*3%*
Total	*39%*	*28%*	*41%*	*36%*
Reputation development				
organizational reputation	9%	10%	7%	*9%*
reputation for strong technology	6%	2%	1%	*3%*
founder experience		9%	3%	*4%*
membership of industry association	3%	2%		*1%*
Total	*18%*	*22%*	*12%*	*17%*
Strategic flexibility				
first-to-market strategy	6%	12%	1%	*6%*
flexible strategy	3%	7%		*3%*
imitation of foreign technology		5%		*2%*
benchmarking other firms' operations and technology			4%	*2%*
acquiring firm for technology		3%	1%	*2%*
Total	*9%*	*24%*	*5%*	*15%*
All others	*7%*	*5%*	*8%*	*4%*

Table 4: types of innovation in sample

	Enterprise software	Middleware	Standard software
Opening new market	7%	20%	25%
Process innovation	29%	0%	8%
New product/service	57%	27%	58%
New business model	7%	53%	8%
Radical / incremental	Incremental	Radical	Radical
Stand-alone / modular / systemic	Systemic	Modular	Stand-alone

Table 5: Connections between institutional features and innovative competences

Organizational integration:	• Incomplete labour markets : recruiting and keeping / motivating employees • weak IPRs: need to build strong organization specific advantages • lack of experience and knowledge base: need to accumulate knowledge within the firm
Financial commitment:	• Weakly developed financial market, classically VC driven sectors, not working properly so, financial access is extra important; no bank loans • Emerging sector with need for capital, especially for labour costs • Preferential policies, government subsidization and tax benefits
External knowledge transformation:	• Lack of market know how, especially finding customers (business knowledge) • Limited accumulated knowledge, need for external sources • Inexpensive way of learning • Emerging sector with new technologies and knowledge • Lack of government intervention / interaction: knowledge instead of influence
Reputation development:	• lack of market knowledge, so larger role for reputation • individual experience: a valuable asset given the 'newness' • organizational reputation necessary for getting finance, labour and knowledge in relatively incomplete labour and financial markets
Flexible strategy:	• many opportunities in emerging market • lack of institutional and business rules: searching for gaps and ways how to do things • changing (institutional) rules, need to be adaptive • Preferential policies, government subsidization and tax benefits • weak IPRs, so swiftness and first-to-market advantages are significant

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