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Innovation Policies for Small and Medium Size Enterprises in Asia: An Innovation Systems Perspective

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Abstract

The point of departure for this chapter is that in developing countries SMEs2 are responsible for the largest part of employment and a significant share of added value. And that innovation policy supporting the particularities of SMEs has been widely ignored (occasionally SMEs have even been discriminated). This chapter aims at shedding some light on the immensely complicated issue of innovation policy for SMEs in developing countries, or more specifically Asian SMEs. The chapter applies the so-called regional innovation systems approach. In this paper, we analyze four clusters of SMEs that have been especially successful in entering the global market; special attention is paid to the so-called soft infrastructure, the industry specific needs for cluster (e.g. interaction) and RIS dynamics/polices (e.g. needs for devolution; industry specific needs for building knowledge creating institutions).The chapter is structured as follows. After introducing stylized facts on SMEs innovative performance attention is turned to the theoretical framework. Taking into account the localized nature of SMEs economic activity, our level of analysis is the regional system of innovation (RIS). We provide a general introduction, contextualize this to Asian situation, and introduce the industry differences (inspired by Pietrobelli and Rabelotti's typology). Then we turn to the empirical section where special attention is paid to the four cases. Finally, we turn to drawing general conclusions on innovation policies and need for restructuring of Asian innovation systems (the accent is on the former).

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1. Introduction

Among policy-makers and academics the current consensus suggests that innovation is a crucial factor in generating economic growth and development in the developed world (Lundvall 1992, Von Hippel 1988). Traditionally, the importance of innovations is ascribed to the new competitive landscape stemming from increased economic globalization, new types of regulation of international trade (often misleadingly labeled deregulation, Amin 2004), improved ICT-technologies and lower prices on transportation (Fröbel et al 1980). In this structural explanation firms in the developed world are forced to innovate to maintain their competitiveness since firms located in developing countries can catch-up by applying imitation-based strategies and produce almost identical products to those manufactured in the developed world at a cheaper price (Asheim and Vang, forthcoming). Since firms in developing countries have been conceptualized as imitators it is not surprising that the importance of innovation for developing countries has only recently begun to be acknowledged. Traditionally, growth, catching up and development in less industrialized countries has been considered a matter of exploiting their comparative advantage in terms of low factor costs (especially labor costs). We do not wish to debate the reasons for focusing on countries' comparative advantages. However, we argue that the models still suffer on several accounts. They tend to assume a mechanistic process which ignores the importance of firm's innovative practices in the process of upgrading in the value chain, the particularities of firms in developing countries and how the (lack of) systemic features in the institutional support system affects these innovative practices. Thus the increasing interest of the governments in the developing countries on innovation policies should be welcome. But before uncritically embracing these initiatives there is a need to throw Poison Hemlock in the mug.

The problem is that in developing countries the general trend has been to follow the innovation policies of the developed world which, we will argue, might not be the most appropriate thing to do. In the developed world innovation policy has been largely dominated by technology policy (Lundvall and Borrás 2004), initially as a consequence of the so-called linear model of innovation which place R&D in the center of the innovation process and primarily focus on (radical) product innovations. Following this model, governments have supported mainly fast growing and large firms in technology intensive industries, such as Information and Communication

Technologies (ICT), Biotechnology or Nanotechnologies that showed rapid growth and high added value.

Following the innovation policy of the developed countries, many governments in the South decided also to implement large programs on ICT, Biotech or Nanotech to stimulate growth and catch up with the industrialized world. It is not the purpose of this article to discuss the adequacy of these high-tech oriented policies in the developing world as such and we do acknowledge that some of the countries have obtained very successful results (India, Korea or Singapore are crucial examples). However, we argue that most economic activity in developing countries is outside the high-tech industries and is based on small and medium sized firms (SMEs). Clarysse and Uytterhaegen (1999) estimate that only 3% of the SMEs are in high-tech industries and receive the attention of policy makers[1]. If the government wants to support innovation in other industries a set of complementary policies is needed targeting the main economic actors (SMEs) and most important industries (usually traditional and natural-resource based) in the economy.

The point of departure for this chapter is that in developing countries SMEs[2] are responsible for the largest part of employment and a significant share of added value. And that innovation policy supporting the particularities of SMEs has been widely ignored (occasionally SMEs have even been discriminated).

This chapter aims at shedding some light on the immensely complicated issue of innovation policy for SMEs in developing countries, or more specifically Asian SMEs. In other words one can say that the purpose of this chapter is to discuss the type of innovation policy needed to reach the 65% potential innovators which have been ignored by current policies. Based on historical examples it is not surprising that Asian SMEs should be targeted. The Asian SMEs have played a vital role in the development of the tiger economies in East Asia (Taiwan, South Korea) and their younger siblings in South East Asia (Malaysia, Thailand) and are among the most important sources of employment in the rest of Asia, hence there are good reasons to look into the type of innovation policy that is needed to facilitate their growth and

[1] Currently the specific programs targeting SMEs in Asia found in almost all countries are high-tech oriented. Most of them (if not all) are targeting specific groups of firms (start-ups) or specific sectors (ICT, software) where there is a high probability of finding high-tech SMEs. This group however only represents about the 3% of the SME population. This means that the majority of SMEs is ignored almost completely by all innovation policies. Of the remaining 87%, approximately 65% are considered to be technology users or potential innovators (Clarysse and Uytterhaegen 1999).

[2] How is the concept SME used in this paper? SMEs is constituted by a variety of types of firms in terms of size of financial assets and/or number of employees. No single coherent definition exists (OECD 2002). The SMEs range from formally established firms engaged in traditional manufacturing over semi-formal sweatshops to informal – and occasionally criminal – activities involving the house or family only. Moreover, some are producing intermediaries to firms in global value chains while others produce end-products to their regional markets only. The definitions used in national statistics are also different from each country in Asia (and the rest of the world for that matter). Currently the SME department of the World Bank considers the following definitions: microenterprises (up to 10 employees, total assets of up to $10,000 and total annual sales of up to $100,000); small enterprises (up to 50 employees, total assets and total sales of up to $3 million; medium enterprise (p to 300 employees, total assets and total sales up to $15 million). We focus on the formal sectors of SMEs in this chapter.

competitiveness. As the Asian innovation systems are primarily developed around supporting the large firm or high-tech firms there is also an urgent need to pay attention to redesigning the innovation systems to integrate the small and medium size firms. Since these issues are as said immensely complicated and calls for both theoretical and empirical novelty the paper will be explorative in nature, hence cannot do full justice to the diversity of conditions shaping the innovation-based competitiveness of Asian SMEs.

Asian SMEs have traditionally tended to concentrate spatially with other SMEs operating in the same industry. And this is especially clear in traditional industries and resources based industries in Asian countries. The regional dimension is crucial as Asian SMEs tend to be more dependent on regional conditions and regional support. This is partly due to the fragmentation and the transitional character (Lundvall et al, forthcoming) of the national innovation system in many Asian countries.

The chapter applies the so-called regional innovation systems approach. Regional Innovation systems can be seen as a "constellation of industrial clusters surrounded by innovation supporting organizations" (Asheim and Coenen 2005). In this sense, industrial clusters represent the production system/part of the regional innovation system. In the RIS approach industrial clusters are defined as the geographic concentration of firms in the same or related industries (Porter 1998, Pietrobelli and Rabelotti 2004, for a critique see Martin and Sunley 2003). In well-functioning clusters proximity facilitates the knowledge and information circulation which is needed in the particular industry in the particular context. The recent adaptation of the RIS approach to the Asian context (Asheim and Vang, forthcoming) will be used as a departure point in the discussion.

In the context of RIS two important aspects need to be highlighted. Contrary to more traditional approaches to innovation and upgrading a RIS approach stresses that supporting SMEs in their innovation-oriented upgrading process is not only a matter of facilitating the access to technology but of providing what we later refer to as soft infrastructure (increase qualification of the human resources, facilitate organizational change, support social capital). Most small firms will not be able to handle this process alone. They rely on interactive arrangements of horizontal or vertical character that assures the appropriate information and knowledge transfer. Arrangements such as subcontracting, clustering or collective support systems underpin the needed information and knowledge circulation (Berry et al 2002).[3] Furthermore, collective arrangements facilitate the access to the resources needed in the innovation process (qualified human capital, technology, financial capital, etc).

In this paper, we analyze four clusters of SMEs that have been especially successful in entering the global market; special attention is paid to the so-called soft infrastructure, the industry specific needs for cluster (e.g. interaction) and RIS dynamics/polices (e.g. needs for devolution; industry specific needs for building knowledge creating institutions). Case studies as the standard reasons constraining SMEs innovative performance are considered to be rather well-known. By applying Pietrobelli and Rabelotti's SMEs typology (specialized suppliers, complex production systems,

[3] Malmberg and Maskell (2004) recently reduced interaction in clusters to be based on observability only; this might be relevant in some industrial clusters but mainly for a minor segment based on physical production.

resource-based industries and traditional manufacturing industries) we strive towards providing some degree of totality of (relevant) industries. One case pr. industry is included. More specifically Bangalore's Software industry is presented as an example on specialized suppliers. The Thai automobile industry's clusters are examples of a complex production system. Taiwan's orchid industry as a case of a resource-based industry, and the Jepara furniture cluster in Indonesia illustrates a traditional manufacturing industry.

The rest of the chapter is structured as follows. After introducing stylised facts on SMEs innovative performance attention is turned to the theoretical framework. Taking into account the localized nature of SMEs economic activity, our level of analysis is the regional system of innovation (RIS). We provide a general introduction, contextualize this to Asian situation, and introduce the industry differences (inspired by Pietrobelli and Rabelotti's typology). Then we turn to the empirical section where special attention is paid to the four cases. Finally, we turn to drawing general conclusions on innovation policies and need for restructuring of Asian innovation systems (the accent is on the former).

2. Stylized facts on Asian SMEs innovative performance

No matter which indicators one use SMEs comes out as constituting one of the most important sources of economic growth and development in Asia (and developing countries as such) (see table 1). SMEs account for one third to two thirds of the turnover of the private sector (OECD 2002) and constitute the vast majority of the business establishments and the entrepreneurs in Asian countries (Dhungana 2003).

--insert table 1 here ----

The SMEs are responsible for around 80% of the workforce within the industrial sectors (Das 2003), which in turn has an impact on their ability to grow and innovate as SMEs often facilitate the birth and expansion of large-scale industries. The Asian dragon economies provide ample amounts evidence in support of this. Das, for example, finds that in the South Korea "*much of the increase in employment of factories with 100 or more workers since 1960s came from small firms that grew larger and larger over time*" (Das 2003).

While the SMEs plays a prominent role in most industries in developing countries and has been an integrated part of the high tech industries in Taiwan, Hong Kong and Singapore it should be emphasized that most of the added value is concentrated in a few traditional or natural-resource based industries. Usually the SMEs are found in industries producing food and beverages, jewellery, leather, textiles, wood and furniture and handicrafts, and so forth (Dhungana 2003).

Thus although some studies (Gellman Research Associates 1976 and 1982 cf OECD 2002 and Audretsch 1995) suggested that SMEs are more innovative that large firms, at least when counting innovations per employee, the majority of studies show that large firms are responsible for the greatest part of the inputs and outputs of innovation. Large firms account for the largest proportion of national expenditure in innovation and R&D and provide the greatest number of new products and services and the proportion of exports and turnover due to new products and services increases with

the size of the firm (Kaufmann and Tödtling 2002) and the multiple analysis on the Community innovation survey).

To the extent the experience from the developed world could be seen as relevant for Asian countries two conclusions seems to have come to the policy-makers mind. Asian countries suffer a serious draw back due to the dominance of SMEs and traditional industries (see table 1) and their innovation policies should focus on the large firms. Without wanting to idealize the SMEs this would be a premature conclusion, as the previously mentioned research tend to ignore that SMEs show better innovation performance than large firms in relative terms**.** That is, relative to their investment in R&D and innovation, they introduce more process and product innovations (Acs and Audretsch (1990), Sanchez and Chaminade 1998, Andreassi 2003). This puzzling result seem to be pointing out that in SMEs, non-technological factors such as the managerial skills, the qualification of the employees, the organizational changes or the informal and formal networks are crucial elements explaining successful innovation and not R&D. Moreover, investment in innovative activities in SMEs is growing at a faster path than that of large firms. Between 1985 and 1995 in the US, investment in R&D by SMEs tripled, while the growth rate for large firms was only 20%. Evidence also suggests that the propensity to patent increases as firm size decreases (OECD 2002).

This claim is also supported by a methodological consideration. The case studies and country surveys used in support of large firms usually rely on formalised innovation indicators. But it is generally accepted that innovation processes in SMEs tend to be less formalised that in larger firms[4]. Often SMEs do not have a formal innovation strategy, R&D department or scientific and engineering staff, and this is especially true for developing countries (Oyelaran-Oyeyinka and Lal 2004). For this reason national and international statistics on R&D tend to underestimate the innovation effort of SMEs as SMEs always show very poor R&D performance. Innovation takes place in the form of incremental innovations, that is, small gradual changes less likely to be the result of heavy investments in R&D (RICYT 2001) but more soft factors" such as organizational change, increased qualification of the human resources or the participation in formal or informal networks.

Hence, to conclude this section we will argue that, when analysing innovation in SMEs, specially in Asian and other developing countries, it is necessary to go beyond traditional indicators on R&D investment (technology) and focus on non-technological factors such as the skills of the human resources, the organisation and the formal and the external relationships of the firm –that is, what we consider as soft infrastructure of the RIS. By doing so, it is possible to explain why SMEs with low R&D investment have relatively better performance in terms on new products and services than large firms and subsequently why and how Asian countries can benefit from targeting their innovation policies to SMEs.

3. Theoretical framework – SMEs in Regional Innovation Systems

This section introduces RIS and contextualizes it to the Asian context. The point of departure for all innovation systems research is that innovation is the result of an

[4] Although there are important differences by sectors, as we will argue later in this report.

interactive learning process (Lundvall 1992). Regional innovation systems stress the regional clusters which is crucial for Asian SMEs. Their interaction - at best - often takes place at the local level, with firms and other institutions located in the same geographical area. The extensive literature on regional innovation systems and clusters has long acknowledged the role of regional embedded networks in the innovation process of SMEs (Asheim et al. 2003, Cooke and Morgan 1998, Cooke and Will 1999, Schmitz 1992), also in developing countries (Albu 1997, Bitran 2004, Giuliani 2004, Pietrobelli and Rabellotti 2004; UNIDO 1997 and 2004, Giuliani and Bell 2005). Moreover, this literature explicitly finds that mostly SMEs external relations are more confined to the region than those of large firms (Cooke and Morgan 1998, Asheim et al. 2003). Kaufman and Todtling argue that one of the reasons for this is that SMEs are more dependent on tacit knowledge and less capable of searching for and using codified knowledge which forces them to rely more on personal ways of transferring (tacit) knowledge and on learning-by-doing and –interacting..

In addition we emphasize in accordance with Pavitt (1984), Archibugi and Pietrobelli (2003), Asheim and Gertler (2003) and Pietrobelli and Rabellotti (2004) that the interaction and need for institutions providing knowledge support for SMEs is industry specific. This is evident in the Asian cases discussed in this paper, as SMEs in Asia tend to concentrate geographically with other firms operating in the same (often craft) industry.

3.1. What is meant by RIS?

According to Cooke et al., 1998 a RIS is defined as a system in which firms and other organizations are systematically engaged in interactive learning through an institutional milieu characterized by embeddedness. The crux of this definition lies in the notion of embeddedness. This refers to the importance of personal relations and networks ingrained in local social and cultural institutions (Granovetter 1985). Without it the definition would equal the definition of a national innovation system written small.

Additionally, a regional innovation system can be conceptualized as regional clusters surrounded by ‘supporting’ knowledge organizations (Asheim and Isaksen 2002). Thereby the regional innovation system is boiled down to two main types of actors and the interactions between them. The first actors concern the companies in the main industrial clusters in a region as well as their support industries (e.g. customers, suppliers). The second type of actors backing up the innovative performance of the first type of actors include research and higher education institutes (universities, technical colleges and R&D-institutes), technology transfer agencies, vocational training organizations, business associations, finance institutions etcetera. These knowledge creating and diffusing organizations hold important competence, train labor, provide necessary finance etc. to support regional innovativeness.

The notion of a regional innovation system involves a strategic institutionalization of innovation between the private and public sectors in a systemic way, constituting an institutional infrastructure as a ‘superstructure’ to the production structure of a region. The concept ‘region’ recognizes the existence of an important level of industry

governance between the national and the local (cluster or firms) (Asheim and Cooke 1999). Regions are, thus, seen as important bases of economic coordination at the meso-level: 'the region is increasingly the level at which innovation is produced through regional networks of innovators, local clusters and the cross-fertilizing effects of research institutions' (Lundvall and Borrás 1997, p. 39). To varying degrees, regional governance is expressed in both private representative organizations such as branches of industry associations and chambers of commerce, and public organizations such as regional ministries with devolved powers concerning enterprise and innovation support, particularly for SMEs.

The systemic dimension of 'RIS' derives in part from this partner-based character associated with innovation in networks. While, as Lundvall (1992) puts it, an innovation system is a set of relationships between entities or nodal points involved in innovation, it is really much more than this. Such relationships, to be systemic, must involve some degree of inter-dependence; not all relationships may be equally strong all of the time, but some may be. Stressing interdependency is crucial in a developmental context where, as we have explained above, the development model to a large extent is based on indigenous (in at least initial phases) capital and knowledge sources. The challenge is thus for most clusters in developing countries to attract TNCs (and other capital influxes) and gradually develop a situation of interdependency between the TNC and the local/regional small firms as well as between the TNCs and the institutional support system.

Finally, RIS stresses the importance of interactive learning. The system of innovation perspective highlights the behavior of local actors with respect to three key elements in the innovation process (Mylteka and Farinelli 2000): learning, linkage and investment. Learning refers to the absorptive capacity of the organizations participating in the system, their ability to capture and use the knowledge available in the system. Linkage refers to the formal and informal interaction with other organizations in the system of innovation and investment, refer to the access to the required financial resources for innovation.

A developed and continuously developing absorptive capacity is a prerequisite for firms and regions to engage efficiently in interactive learning (Cohen and Levinthal 1990, Zahra and George 2002). Absorptive capacity as conceptualized in this paper is considered as a dynamic capability (capability because it refer to the skills, routines and habits constituting the absorptive capacity (Nelson and Winter 1982) that allows firm and/or region to take advantage of knowledge and information in their environment, process it and commercialize it (subsequently making organizations change allowing firms to take advantages of new information). We suggest that a) a firm's absorptive capacity is a function of its prior internal knowledge – being tacit or codified – and the institutional setting (referring to among other aspects how social capital allows for knowledge to circulate and how public institutions serve this knowledge circulation) and b) that a region has an absorptive capacity (which is a function of the individual firms absorptive capacity, human capital (formal and tacit), social capital and financial capital), hence we oppose seeing regional absorptive capacity as simply an aggregate of the individual firms absorptive capacity. Contrary to more traditional definitions we stress the need for firms, government organizations and institutions to be dynamic. Being dynamic refer to changing the organizational structure, support systems etc. according to needs for producing new products; not

just the use of knowledge from the environment by static firms to produce new products. Absorptive capacity building is about investing in training (human capital) and engaging in collaboration between firms and university (not necessary co-located universities due to the high reliance on codified practices and modular processes). This allows the firms to both develop its internal absorptive capacity as well as utilizing other firm's and organizations results of their absorptive capacities. From a policy maker perspective, building absorptive capacity apart from transforming organizations (private and public) into organizations more tuned into learning (striking a balance between exploration and exploitation, as March would coin it) depends on creating social capital. Inclusive social capital allows for exchange of complex and important information, which cannot be written into contracts.

SMEs potential to benefit from this regional or local system of innovation is more limited than large firms and, at the same time, they depend much more than large firms on the conditions of the regional innovation system. Large firms usually have the resources to access the required technology, hire qualified human resources by their own or introduce new managerial techniques. SMEs, especially in developing countries, on the other hand, usually need to coordinate collective actions to for example, share the costs of the acquisition of machinery that will be used by all, access financial resources, as they will not be able to do it on their own. These collective actions usually take place between producers localized in a certain area, in some cases, based on existing long social relationships that have built trust and through the initiative of more qualified entrepreneurs or the support of the government. The role of the regional innovation system for SMEs in developing countries is crucial.

3.2. RIS and Asian Countries

In this section we point to the stylized facts of constrains to economic development in Asian countries in a RIS perspective; the limited size of the paper prevents of from paying much details to the different degrees of industrialization/development in the Asian countries. In accordance with most studies in development research RIS stresses the importance of physical capital (hard infrastructure), social capital (soft infrastructure), human capital (education and training) and financial capital. What RIS adds to this is the systemic propensities and emphasis on interactive aspects in a territorial and industry context. The hard infrastructure we consider more of a contingency than an actual part of the more theoretical aspects; thus it will only be treated in this manner. Most attention will be paid to the latter aspects; and to repeat special attention is paid to absorptive capacity and the development of local embededness of the transnational sources of capital, technology and knowledge for SMEs upgrading. The importance of the different factors varies according to the dominating industrial knowledge base in the region in question and naturally the already existing 'endowment' of the particular factors.[5]

3.2.1. Human capital and organizational capabilities (soft infrastructure) in the Asian context

[5] Physical capital as infrastructure is crucial for economic development but this is not the core area of RIS hence we just refer to UNDP 2004 for detailed elaborations on this topic.

According to Gary Becker – the grand old man of human capital – 'Human capital refers to the skills, education, health, and training of individuals' (1998, p. 1). Human capital is considered a corner stone in development (Romer, 1990). One of the most important drawbacks of developing countries is the poor supply of qualified general and subsequently industry specific human capital. As a proxi for the lack of general human capital one can use illiteracy-rates. And adult illiteracy still reaches the two digits in some countries such as Indonesia and Malaysia (World Bank, 2003). Enrolment in secondary education is around 50%[6] while most of the developed world reaches 90-100 per cent and, with the exception of some countries like Korea, the enrolment in tertiary education is between 10-20 per cent. The lack of basic education is constraining the acquisition of firms and industry specific knowledge which is a prerequisite for innovative activities. This is especially so for SMEs, as Kaufmann and Todlingdt point out, SMEs need to use the human resources more intensively than large firms in their innovation process. But as a consequence of the poorly developed educational system SMEs in Asian countries have to rely on employing a significant portion of poor and low-skill workforce (Das 2003). This constrains the firms absorptive capacity i.e. the ability to utilise available information and the information and knowledge that comes from interaction with users.

Competencies when it comes to incremental improvement, reorganization of production processes or cultivating craftsmanship knowledge, are highly limited. This means that firms have a limited prior knowledge, to paraphrase Cohen and Levinthal (1990), of modern production, thus only limited absorptive capacity facing quite severe challenges when building the absorptive capacity.

But what is the impact of a rich or poor RIS in terms of the supply of timely and qualified human capital for the Asian SMEs? The lack of qualified human resources, the poor managerial skills of the manager and the difficulties accessing strategic information are considered to be the main obstacles to innovation in SMEs in Asian countries. But there are successful stories in Asia that demonstrate that upgrading is possible. The amount of training of the management can influence the performance and survival of firms, specially SMEs (Murphy 2002). For example, Taiwanese SMEs, have undergone a tremendous upgrading in the formal competencies of the management in the last years.

Even when the RIS provides the necessary supply of human capital, SMEs will only benefit from qualified human capital if the right organisational setting is in place. Both human capital and organizational issues determine the absorptive capacity of the firm and the region. As the OECD states "*[O]ne key element of innovation is organisation. … Organisation is essentially a process for the gathering, management and use of information, and for the implementation of decisions based on such information. Such processes have a strong intangible dimension, but taken together they make up the learning capacity of the firm and as such are a central element in innovation capability. These are specific institutional "rules of the game" which regulate possible modes of organisation on a broad level"*. (OECD 1997: 43)

[6] Korea, Singapore and Taiwan are the exception, with net enrolment rates in primary school close to 100%.

Understanding that organizational issues also play a role in the absorptive capacity of the firms is important from the RIS perspective. And this is not because governments can supply "organizational capabilities" -as they can provide human capital-, but because investing in training is only one variable in the equation; if firms in the RIS do not have the ability to absorb the skilled labor and use it to upgrade (move up in the value chain), all training efforts will be dismissed. In other words, the soft infrastructure of a RIS comprises both the provision of skilled human capital and the absorptive capacity of the firms, which in turn also depends on their employees and organizational issues.

SMEs organisational issues differ substantially from large firms in their degree of formalisation and in the strong dependencies from the manager (owner/founder of the firm). The strategy, the culture or the decision making procedures are mostly tacit. Knowledge is transmitted inside the firm by learning by doing and consequently face-to-face interaction. Also decision making process differ significantly between large and small and medium-sized enterprises. In the former no single individual is responsible for the decisions. In SMEs, on the other hand, almost all decisions are taken by the owners or the managing director (Oyelaran-Oyeyinka and Lal 2004), as argue above. This implies that decisions made by small firms are highly influenced by the qualifications and skills of the manager director

In sum, one of the key elements in the RIS in Asia is the provision of timely and qualified human capital to support the industries settled in the region. For Asian SMEs, being located in a "human capital rich region" is definitively an advantage, as the qualification of the human capital is one of their main constraints to innovation and growth. But in order to benefit from the local conditions, Asian SMEs need to develop their absorptive capacity, creating an organization that nurtures innovation.

3.2.2 Social capital and networks (soft infrastructure) in the Asian context

The soft infrastructure varies significantly and is strongly dependent on the local culture (however heterogeneous and dynamics that might be measured in terms of value and subsequently behavioral regularities). Following the World Bank

"Social capital refers to the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions... Social capital is not just the sum of the institutions which underpin a society – it is the glue that holds them together"(World Bank 1998).

Social capital refers both to "structural social capital" and "cognitive social capital" (World Bank 2002). Structural social capital refers to "relatively objective and externally observable social structures, such as networks, associations, and institutions, and the rules and procedures they embody. Cognitive social capital comprises "more subjective and intangible elements such as generally accepted attitudes and norms of behavior, shared values, reciprocity, and trust[7]. Cognitive

[7] "Although these two forms of social capital are mutually reinforcing, one can exist without the other. Government-mandated organizations represent structural social capital in which the cognitive element is not necessarily present. Similarly, many relations of mutual trust persist without being formalized in

social capital can explain the raise of ethnical based networks of SMEs in Asian countries (of Indians, Chinese, etc) which provide the resources needed for the firm.

Social capital consists of – at least – two dimensions: a) Trust, which can be divided into generalized trust and special trust, and the latter in turn into trust in the law enforcement system, trust in the political and administrative system, and local trust and b) cooperative ability, which is people's ability to work together (Paldam 2000). Moreover, it is crucial whether the trust is specific (constrained to one group) or generalized (to society as such).

Social capital (and the related concept as trust) has implications for the interaction between agents/nodes in the RIS. Contrary to envisioned by standard economists economic interaction is not primarily a market-based exchange of (tangible) goods by anonymous agents regulated by a complete contract (in the context of efficient contract enforcement). On the contrary, exchange relies on incomplete contracts either due to the lack of possibilities for creating complete contracts, because of the disadvantages in terms of a low degree of flexibility build into complete contracts, or because of inefficient contract enforcement, depending on the mutual trust of the partners involved in the transaction.

Unless there is a high degree of social capital cooperation, communication and thus mutual learning is limited. In short, absence of social capital in turn reduces the local firms prospects of getting access to important knowledge, knowledge sharing and interactive learning and hence from entering a virtues development circle.

Social capital also underpins the development of a regional (or local) absorptive capacity. Through localized knowledge sharing and interactive learning knowledge can be disseminated locally/regionally and provide the crucial insight local firms need to move up the global value chain;

Social capital is the main tie in many clusters of SMEs in Asia. For example, in the Karanggeneng tile cluster in Indonesia (Sandee and Rietveld 2001) most producers have several relatives involved in tile production. Producers can accept orders that exceed their production capacity trusting that some other (family related) producer in the cluster will complete the order. Social capital has also been the basis for trade credits between SMEs and suppliers in Sri Lanka and Bangladesh, for example (World Bank 2002).

As illustrated before, social capital is very important for SMEs as it can facilitate the access to the human, organizational and financial resources needed for innovation. For SMEs knowledge transfer mechanisms are informal and revolve around the transmission of tacit knowledge. This informality might provide the SME with a comparative advantage in terms of flexibility and speed of change, but it can also constrain the innovation potential of the firm, especially if the manager is not aware of the potential sources of innovation. In this sense, organizational issues in SMEs in developing countries seem to be very intertwined with the qualification of the owner. Thus leading to the relevance of training on managerial and organizational aspects of

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organizations. This description of social capital according to its forms has proven quite useful as a basis for empirical analysis" World Bank, 2002: 3.

the manager of the SME. The participation in formal and informal networks can in many cases facilitate the access to human and organizational skills necessary to upgrade in the innovation process.

In summary, social capital constitutes one of the elements of the regional system of innovation that can support the emergence and development of clusters of SMEs, and their upgrading. Social ties might facilitate the access to the required hard and soft resources for innovation (machinery, capital, skills, knowledge etc) as well as provided the required flexibility to cope with fluctuations in the market in terms of quantity.

3.2.3 Financial capital (hard infrastructure) in the Asian context

Financial capital, especially foreign capital, is a scarce resource in Asian countries; especially after the financial crises in the late nineties. Moreover, even when those funds reach the productive systems, SMEs usually find great difficulties accessing them. Financial capital is crucial for investing in human capital and might even work as a useful mean when building up social capital. For SMEs it is also the way to acquire more sophisticated technology (or in some cases simply introduce some machinery) in their production processes.

In Asian countries risk willing capital that deliberately aims at upgrading industrial production is crucial and often a precondition for local firms getting the possibilities for experimenting with new products or process innovation, and subsequently of reducing their dependency on the TNCs, is a scarce resource. Moreover, when capital is scarce it is tempting to use the available capital for satisfying short term needs, thus not investing in innovative projects, competence building etc., which is needed for long term growth.

Additionally, SMEs usually do not fulfill the requirements (in terms of assets) posed by the financial institutions to obtain a loan (hence, of rely on localized informal financial institutions). Social capital can facilitate the access to financial resources, as some examples in Asia show. When there is not a reliable infrastructure to provide SMEs with risk capital or when the SMEs do not fulfill the formal demands from the financial institutions, social networks might provide the access to micro-credits and loans. Lead firms in the cluster, suppliers or buyers can finance the acquisition of technology or even the training of the human resources.

In summary, SMEs are bounded to their local conditions, in particular to their regional system of innovation and their cluster. When discussing the role of the RIS in Asian countries, and its impact on local SMEs it is important to take into account different forms of capital and their relationships: social capital, human and organizational capital, financial capital and physical infrastructure (infrastructure). Upgrading of SMEs in developing countries in general is possible when these four forms of capital are present and the SME can find in the local milieu (RIS) the resources needed to innovate.

It is important to highlight the strong interaction and dynamism between the different forms of capital and the impact on SME development. A cluster of SMEs might be

based in strong a very well functioning social ties. The most successful producers in the cluster might provide financial support to other producers for the acquisition of technology. Successful producers might even buy machinery that they rent out to other producers in the cluster, therefore facilitating the technology upgrading to a greater number of SMEs. The technological upgrading may attract the attention of international buyers and human capital, thus reinforcing the overall growth of the cluster. Far from being a hypothetical picture, this process can be observed in several clusters of SMEs in Asia and points out to the systemic character of the different elements of the regional innovation system. However there is not one single best case in upgrading clusters of SMEs but rather there seem to be important differences between industries, as we will discuss in next section.

3.3. RIS's industry specific dimension in the Asian context

Since the acquisition and transformation of knowledge required for innovation and the learning processes differ significantly across industries the SMEs are involved in (Pavitt 1984, Asheim, Coenen et al. 2003; Asheim and Gertler 2004, Tunzelmann and Acha 2004) it is necessary to distinguish between different types of industries. According to Pietrobello and Rabellotti there is a need to differentiate between four categories of clustered SMEs: traditional manufacturing, resource-based industries, complex product systems and specialized suppliers. Some of the clustered SMEs rely on indigenous capabilities while others have to rely on exogenous sources, especially TNCs and – to a minor extent – members of transnational communities play an important role in this. Moreover, the impact of the large firms on the indigenous SMEs varies significantly across cases. Sometimes, SMEs establish a cooperative agreement with the large firms, in which both groups are in even terms and share the technology, infrastructure, capital or knowledge available for the firms in the cluster. In other occasions, SMEs are acting only as subcontractors of large firms, and the transfer of knowledge is very limited. The role of the large firms in the local cluster will be discussed and illustrated in the cases.

3.3.1. Traditional manufacturing

Traditional manufacturing and natural resources-based industries are the most numerous in most Asian countries (Dhungana 2003) as table 2 shows. Food and beverages and Textiles are the most important industries in terms of employment and added value in manufacturing at least in India, Indonesia, Philippines, China, Sri Lanka and Thailand. Only some of the most advanced economies of the region (Korea and Singapore) are not so dependent on these two industries. The economic weight of the traditional manufacturing and natural-resources based industries in the area justify a deeper analysis of the innovation patterns in these two types of industries, mainly dominated by SMEs.

--- Insert Table 2 around here -----

Technological innovation in traditional manufacturing industries is mainly process innovation often introduced by the suppliers of inputs. Firms innovate through the acquisition of technology, being the main suppliers the machinery and chemical industries. In those cases in which the SME acts as a subcontractor of a TNC, change might be driven by the demands on the lead firm, both in technological and non-

technological terms (compliance with international quality standards, for example). Product innovation might also take place. In this case, innovations are usually of an incremental nature through the introduction of new product design or improvements in the quality of the product or the components.

Competition in this industry is on costs, primarily labour costs. Clustering externalities involve the access to workers with specialized skills necessary for the industry, the linkages with specialized local supply of inputs and services, the dissemination of specialized know-how and information, shared machinery and infrastructure and, to a lesser extent, market access. Clustering of activities might also facilitate the adoption of more flexible forms of organisation, reducing the stock of products and transferring buying orders to competitors when they exceed the production capacity of the SME (Sandee and Rietveld 2001).

Information flows through informal channels facilitated by the local cohesion within the cluster as well as a result of the rotation of workers among the firms in the cluster.

3.3.2. Natural resource-based

Natural resource-based industries are very numerous in Asian countries. They comprise the industries based on natural resources, including agro-industrial activities. In the developing world one can find very good examples of upgrading of resource based clusters and their insertion in the global value chains[8]. Most innovations and growth of these clusters are the result of the cooperation with scientific institutions. In this sense, the upgrading in this type of industries is dependent on the development and acquisition of scientific knowledge and its application to both product and processes.

The linkages with basic and applied research institutions are crucial in the innovation of these industries. In most cases it is not about the creation of fundamentally new knowledge or new technology but to the adaptation of an existing technology already available in developing countries to the local conditions.

Basic research is carried out by universities and in the research labs of large firms in the biotech, chemical and food firms, while SMEs are mostly responsible for the incremental improvements.

Upgrading of SMEs in these clusters can be with or without the intervention of a large firm. In some cases, upgrading is the result of joint technology development and coordinated actions between firms, business associations, universities and other actors. In some others, TNC provide the technology and knowledge required for the upgrading of the local SMEs.

3.3.3. Complex product systems (CoPS)

SMEs in complex product systems are highly specialized firms anchored to a large assembler, which operates as the leading firm. Innovation in the network of CoPS is highly dependent on the strategy and the directions of the assembler. As Pietrobelli

[8] For example, the Chilean salmon cluster, the Orchid cluster in Taiwan, the apple cluster in Brazil, etc.

and Rabelotti (2004) argue, first tier suppliers which are owned by foreign companies, are the ones benefiting directly from the collaboration with the leading firm. They are technology intensive firms that design and produce subsystems and components for the assembler. Most SMEs operate as second and third tier, with very limited benefits (in terms of innovation) for their participation in the CoPS.

Technological innovation is process innovation. As in traditional industries, local SMEs are usually required to compile with international quality standards in order to participate in the network. Large assembler firms usually determine the scope of change of the local network of subcontractors.

Externalities for geographical concentration are scarce, as both the leader firm and the assembler operate globally. Most knowledge needed in the production process is codified thus the need to interact with local suppliers is limited.

3.3.4. Specialized suppliers

Pietrobelli and Rabellotti (2004) only consider software in this category. Innovation is market-driven and the interaction with the users is very intense. SMEs in this category tend to concentrate geographically to gain access to the labour market and the consumers. Formal joint cooperation between firms is limited.

Technological innovation is fundamentally product innovation although upgrading is also the result of non-technological innovation such as joint marketing initiatives or changes in the organisation. The mobility of human resources among the different firms is an important channel for knowledge diffusion across the cluster and facilitates the dissemination and adoption of non-technological innovations.

4. Empirical cases

This section turns to the fours cases representing the different types of industries. The cases are just minor illustrations only and their complexity cannot be dealt with in its totality. The cases serve to illustrate the need for industry specific policies.

4.1. Traditional industry – The Jepara furniture cluster (Java, Indonesia)

Indonesia has a very long tradition of clusters of SMEs around similar activities. Craft industries are usually geographically concentrated, emulating ancient guilds. This is also the case of the furniture cluster in Jepara.

The Jepara furniture cluster in Java Indonesia is a large cluster. In the mid nineties the cluster comprised more than 2000 small enterprises and 100 large and medium ones and employing over 40,000 permanent workers (Sandee et al. 1998). Firms are dispersed across 80 villages in the Jepara region. About 70 percent of the production goes to international markets, and the rest to domestic markets. Domestic firms account for 75% of the exports while foreign firms are only responsible for 25 per cent (Berry et al 2002).

Often members of the same large family own different SMEs in the cluster. Social and family ties are very strong and, as we shall discuss, explain the success in collective strategy.

Regional autonomy in the Jepara cluster (RIS)

The geographical fragmentation of Indonesia in multiple islands with different history and ethnic roots has traditionally favored a great regional autonomy. National policy is very limited and regional governments are the ones designing and implementing the different policies in the region. This is why, as argued by many authors, it is almost impossible to talk about a national innovation system, but an array of regional innovation systems at most.

Strategies behind SMEs upgrading in the cluster

Traditionally SMEs in the cluster have focused on the domestic market, where quality standards were low and requirements in terms of design were often not fitting the taste of the international customer. The situation changed in the mid eighties, when the government sponsored the participation of Java furniture producers in an international fair in Bali. As a consequence, international buyers started to show interest in the local production.

Since then, the cluster has been dominated by large international buyers (IKEA is one example of them) who ”translate” the demands of the final international customer to the local producers. The indigenous SMEs have followed two types of strategies to access the global market (Loebis and Schmitz 2005): although the majority of producers opted to reduce costs (low salaries, illegal raw materials, avoid taxes), few furniture makers opted to compete by upgrading processes and products. The later strategy has implied the introduction of new managerial and organizational changes, including the compliance with international quality and environmental standards. These indigenous SMEs and large firms have privileged access to information and knowledge from the international buyer.

Human Capital

For those SMEs that have not strong ties with international buyers, knowledge creation is basically through apprenticeship and learning by doing in general.

There is a limited number of very skilled craftsmen, who are employed by joint ventures of SMEs or larger foreign firms (Sandee et al. 1998).

Most SMEs are family based. The father of the family is usually the owner and manager. His knowledge is often limited to technical knowledge about furniture crafting; managerial and marketing skills are often lacking, which seriously limits the absorptive capacity of the firm.

In some cases, the employment of expatriates has been a mechanism to acquire technological capability in the rattan firms. Foreign immigrants have better access to market, technology and financing sources (Supratikno 2002 cf Tambunan 2005). Knowledge on customer tastes, technology and access to financial resources might be

transferred through social ties. Usually the different members of the family of expatriates are the first one accessing this knowledge.

Social capital and networks

Joint action among producers is well developed. Social capital is strong and based on family relations and historical cooperation between families. Small firms participate in networks that share workers, equipment and market channels (Burger et al 2001: 297). These networks of SMEs are usually linked to a large firm or trader that acts as a broker between the group of SMEs and the large international buyers. These later form of relation is too weak and indirect to sustain learning by interaction.

When SMEs collaborate with large firms is usually as subcontractors, although there are some cases of joint-ventures between a local firm and a foreign enterprise. Subcontracting has been crucial to harness traditional skills for export production. Subcontracting is often based on social capital and as identified by Berry et al (2002) often based on kinship, friendship or former business contacts. Many of the local producers belong to extended families with a long history of cooperation.

The furniture industry is customer driven. User-producer interaction is a very important source of innovation. However, many firms in the cluster do not have direct access to their customers. Large firms in the cluster benefit from information received from the international buyers, with whom they relate directly. SMEs, on the other hand, usually do not have access to the international buyer directly but through traders that connect many small firms with international buyers. Their access to information on new designs, new technologies, etc is very limited. They main mode of learning is learning by doing and due to the close interaction some imitating also exists (Loebis and Schmitz, 2005), hence new techniques and designs spill over locally.

Collaboration with suppliers, private consultants and industry associations were not relevant for the upgrading of the sector.

Financial capital

Financial capital is scarce. The region does not provide the financial support that most SMEs would need to upgrade their skills (managerial, marketing) and technology. Once again, social networks have provided SMEs with access to financial capital. SMEs might get financial support from other SMEs in the network (family members that have been more successful).

The cluster has recently benefited from direct investments made by foreign immigrants (Supratikno 2002 cf Tambunan 2005). Additionally, few SMEs participating in joint ventures with foreign firms might have also received financial support from them.

Policies

The role of the regional and local government in the provision of hard and soft infrastructure for the cluster has been significant. The local government has been responsible for several infrastructure projects, including the improvement of the

harbor to facilitate international shipping of the orders, container facilities, roads and telephones (Tambunan 2005). Without these infrastructure improvements the internationalization of the cluster would have been severely constrained.

Technical and management training is provided by a specific academy created with the support of the regional government. Additionally, the government sponsored the participation of local furniture makers in international trade exports, which facilitated the access to international buyers and markets for Small and medium size enterprises (Berry et al 2001).

However, sustaining the advantage of the cluster as an international furniture provider will only be possible if some additional measures are taken:

In terms of the soft infrastructure, the cluster provides strong social capital. However, not all these social networks lead to the development of SMEs as not all of them involve the exchange of information on markets, technology or skills. The local government could support collective actions that involve the most advanced SMEs in the clusters, notably those managed by expatriates that have access to international markets, technology and finance.

Qualified human capital is scarce and only available to a number of SMEs that have joint access to the skilled labor and large firms. Knowledge is in most cases limited to technical (craft) knowledge, with a clear lack of managerial, design and marketing skills. The consequence is the limited absorptive capacity of the firms in the cluster. The government can contribute to the development of the SMEs by providing or supporting the development of business development services such as training, testing, supply chain management and certification. Training targeted to soft elements of the innovation processes, usually marketing or managerial skills or organizational change is clearly needed. The strength of the local networks can facilitate the dissemination of successful managerial practices.

SMEs are keener to listen to buyers than to local government, but the Government can facilitate and encourage the participation of indigenous SMEs in international markets, as it has done in the past.

Finally, the government has a role to play in ensuring the access to sustainable raw material and preventing the use of illegal (and cheaper) raw material in the cluster. Upgrading the environmental standards of the cluster as well as the quality standards of the production is also needed.

4.2. The Floral industry in Taiwan

Taiwan floral industry has experienced a fast growth over the last decade due to a strong domestic market and the increases in cut flower exports, especially to Japan and the US (Tsai 2001). Today Taiwan competes in international markets in the same segment with Thailand or China.

The sector is clearly dominated by SMEs. Traditionally, there has been a clear division of labor between the production and commercialization of flowers. Producers

are small in size (usually the average farm size per family is one hectare) due to the high cost of the land. Producer SMEs tend to cluster geographically to be able to access to machinery and greenhouse facilities shared by different producers (Tsai 2001). The knowledge required for the production is very specific and operational and most producers do not have any marketing skills.

Regional autonomy in the Taiwanese floral industry

As a province of China formally speaking, and taking into account their limited territory Taiwan can be considered to be in itself a region with complete *de facto* political autonomy from mainland China. The producers are dispersed around the island. The Taiwanese government has settled the priorities for the economic development of the island, being one of them the biotech sector and its connections with other local industries including the floral industry.

The government of Taiwan is playing a major role in the development of the flower industry in Taiwan, specially the orchid production. As an example, the national government in cooperation with the local government of Tainan County decided to create an Orchid biotechnology park that is currently under development. The purpose is to turn a former sugar cane production area into a world class orchid production area.

Strategies behind SMEs upgrading in the cluster

The technological upgrading of the flower industry in Taiwan, especially the orchid production is clearly linked to the investments in biotechnology and the linkages with the knowledge providers of the regional innovation system (universities and research centers). Until very recently the Taiwanese producers relied only on 'natural' species which could be produced on most Asian countries, hence not a source of long term competitiveness. Now they are experimenting with non-natural varieties which display particular aesthetic features and longer durability. These are the outcome of an emerging collaboration between producers and the bio institutes. This collaboration has provided and provides opportunities for developing new species. (E.g. like the blue orchid). Realizing the full potential of this collaboration is however s contingent to establishing the right links between the producers, the researchers and the final markets (through the marketing channels). Currently collective action is frequent but limited to one activity of the value chain (production or marketing) and hence appears fragmented. Orchids are rather easily copied (imitated) but since Taiwan has and is developing specialized knowledge and related support institutions within these fields Taiwan can engage in a constant upgrading and protect themselves against imitators and hence sustain their long term competitiveness. SMEs are responsible for the production and, to some extent for the marketing of the product. Most of the activities are based on indigenous Taiwanese firms and TNCs have a limited role only.

Human Capital

In terms of human capital Taiwan government has made a considerable effort increasing the number of students in secondary and tertiary education (Veselka 2005). In 2000 the percentage of the population with higher education was 88, 5 %. General competences are crucial for the upgrading process which places high demands for general skills on the producers.

In the Taiwanese flower cluster there is a great component of formal training and, although it has not been documented, we expect that there is also a great flow of information between the farmers about production techniques and intense learning by doing. The Taiwanese Council of Agriculture supports different training program in agricultural product marketing targeted specially to young farmers (Taiwan Council of Agriculture, 2003).

However, the upgrading strategy chosen in the cluster (via biotech developments) requires a great absorptive capacity by the indigenous SMEs. Not only they need to know their product and how to optimize the production, but need to have some minimal technical knowledge to be able to interact with the researchers in the biotechnology firms.

Social capital and networks

Taiwan economy has been traditionally dominated by SMEs. Small businesses form tight networks encompassing personal and business relationships. These networks guanxi are based on traditional Chinese social values where human relationships are closely linked to families, relatives, friends, classmates, and previous colleagues (Liu, 1998) but segmented along 'ethnical' lines (e.g.Hakka, Mainlander and Taiwanese).

The distribution of flowers to the domestic and international markets is in the hands of cooperatives and cooperative marketing teams who also set the quality standards that the farmers should follow (Hsieh 2001). The marketing channel is dominated by four wholesale companies that use the auction system providing on real time the information on the market on line. Most SMEs produce for the local market and only 10-20 percent of the production goes to external markets. This focus on the local market can partly been explained by the appreciation of the NT dollar that destroyed the price advantage that Taiwanese firms had (Taiwan Ministry of Economic Affairs, 2004)

The majority of producers do not have any interaction with the final customer. Most innovations are technology driven (and not customer driven) and relate to better seeds and new varieties of plants (product innovation) or more efficient forms of cultivating (and transporting) the flowers to the final market (process innovation).

Financial capital

The government has played an important role in the provision of financial support for indigenous SMEs as they could not finance research activities nor did the Taiwanese producers initially considering investing in these areas as they did not realize the potential. Additionally to financing the research and development the financial support has been mainly in the form of loans at preferential rates for the construction of greenhouse facilities explicitly targeting groups of SMEs. However, the regional innovation system seems to be weak in the provision of funds for other purposes (such as upgrading of skills, participation in international trade fairs, etc). That is, the amount of financial capital committed by the government for the upgrading of the cluster is high but limited somehow to the provision of hard infrastructure.

Policy

The technological upgrading of the flower industry in Taiwan, especially the orchid production is clearly linked to the investments in biotechnology. The government support has been decisive in the technological upgrading of the sector, being the main instrument of the innovation policy the creation of Science and Industry parks (Tsai and Wang 2002). One of the most recent initiatives has been the creation of an Orchid Biotechnology Park in Tainan County (Taiwan Council of Agriculture 2003). The government is financing the construction of an exposition hall, a genetic laboratory, quarantine site, shipping and packing areas and the improvement of the existing road and water infrastructure (Bradsher 2004). As mentioned before, the government is also providing the farmers with access to subsidized loans to build approximately 200 greenhouse facilities. The objective of the program is to turn the Taiwanese orchid industry into a world leader and to gradually substitute low added value agricultural activities in the area, such as sugar cane production.

However, the government has focus largely on the provision of hard infrastructure for the sector and not much on the soft infrastructure. Although most producers seem to have the required technical skills, they lack managerial and marketing skills. Their information on the market is very limited, and their access to new techniques contingent to the formal linkages with biotechnology firms.

In the past, the linkages between producers and researchers have been one of the Achilles heel of similar initiatives. The Taiwanese government has a great role to play facilitating the interaction between these two collectives of firms, as well as linking them to the firms commercializing the final product. That is, there is a need to invest as well in soft infrastructure in the cluster, developing both the networks and the absorptive capacity of local SMEs. The provision of business services such as technical and managerial training, information, etc. could be a good instrument to support this process.

Thailand's Automobile clusters – suggestions for RIS policies

The Thai automobile industry – occasionally referred to as the Detroit of Asia – is considered to be the most important hub for automotive production in Asian (Techakanont and Takahashi 2004, Lecler 2002) and has until recently – at least – been considered a success case; why will be come clear below.

The automobile industry is the paradigmatic case of complex production systems (Pietrobelli and Rabelotti 2002). The Thai automobile industry is constituted by several clusters. Initially the production was located in a cluster located close to Bangkok. Diseconomies of agglomeration (ranging from increased wages, scarcity of workers to traffic congestion) have resulted in the emergence of new clusters scattered around Thailand where Chonburi, Bangkok, Rayong, Samutprakarn and Pathumthani are among the most important ones (for details on the differences in their internal specialization, see Samat 2004). The Thai clusters are centred on TNCs. Most major assemblers are present in Thailand (from Japan: Toyota, Honda, Isuzu, Nissan,

Mitsubishi, Hino; US: GM, Chrysler, Ford; Europe: BMW, Volvo, Daimler, Volkswagen, Citron, and Peugeot).

Around 113,512 are employed in the Industry where SME accounts for approximately 50% percent of the employees (Samat 2004). The indigenous Thai firms are mainly SMEs and mainly second and third tier subcontractors. The first tier consists of more than 700 companies where 40% of these are owned by TNCs and where fully Thai-owned companies constitute a 50% but where the value of the Thai tiers constitutes only 10 percent. Second tier suppliers are around 1000 (Samat 2004).

Regional Autonomy in Thailand's automobile cluster

The Thai innovation system is highly centralized when it comes to automotive industry. Policy-making, budget allocation is centralized in Thailand. Regions do not hold any important decision making powers. Nor do the regions yet hold noteworthy competences or capacities for public intervention although the last years the central government has allocated more money for the regional government bodies;

Strategies behind SMEs upgrading in the clusters – Building on the TNCs

The clusters are clearly dominated by TNC who control and define the scope of the innovation in the sector. The role of the SMEs in the clusters has been significantly affected by the national policy which changed significantly after the WTO/GATT agreement. Until recently the Thai SMEs played a significant role as first or second tier subcontractors for the TNCs. Formal policies from the Thai central government stipulated that TNCs locating in Thailand had to guarantee a certain local content in the production. TNC were obliged to link up with local manufacturers. However, in the last years have the Thai SMEs have either been reduced to third or forth tier subcontractors, been bought up or gone bankrupt.[9] This can be attributed to the general 'deregulation' enforced by WTO/GATT. The Thai government interpreted the WTO/GATT agreement as entailing the dismantlement of the "local content requirement" and a general opening of the economy to FDI. As a result TNC subsidiaries established production in the Thai clusters and out competed the Thai SMEs. Moreover, new strategies among the major assemblers on product innovations place a new demand on the local subcontractors. The assemblers have started to develop local models. To attain this goal the SMEs have to become involved in the design process to.

In this context, it is possible to distinguish between two types of SMEs and upgrading opportunities: Foreign and joint-venture firms seem to have preferential access to the required technology and resources through their parent companies. Unfortunately, this is only a minority in the cluster. For the vast majority of SMEs in the sector, technological improvement is only the result of in-house efforts and the improved experience of employees (Techakanonta and T. Terdudomtham, 2004). Human and organizational capitals are the main determinants of the upgrading of these SMEs. Most SMEs do not comply with the international quality standards required by the TNC assemblers to be first-tiers.

[9] While the bankruptcy sure was accelerated by the late nineties financial crisis in Asia; this cannot hide the fundamental structural problems the Thai automotive industry faced.

Thai firms cannot always be price competitive. If they want to compete Thai firms need to enhance their engineering capabilities, develop design competencies and move up in the value chain. The Thai SMEs have not managed this transformation. Why?

Human capital

Thai firms did not use the advantage that they enjoy during the "local content requirement" period to develop their competencies or implement organizational forms supporting product or process innovations. Thai SMEs simply produced parts according to already established production methods, blueprints and – often – based on technology acquired from the TNC (Techakanont and Takahashi, 2004). Due to the lack of competition (and lack of opportunities because of the global strategies on which the assemblers relied) the Thai SMEs were not stimulated to invest in their human capital and technological upgrading, nor did their profit margins allow for huge investments in human capital building. The central Thai government did not develop or implement competitiveness oriented policies (the link to decentralization will be elaborated upon below). As a result, most Thai SMEs lack the human capital and organisational ability required to engage in innovation (and upgrading in the global value chain), that is, they lack the required absorptive capacity to acquire technology and knowledge generated elsewhere. In the short run the Thai SMEs need to engage in 'continuous' improvements within three areas: quality improvements, cost reductions and more secure delivery times' (Techakanont and Takahashi, 2004). In the long run there is a need for a developing the technological (engineering) capabilities based on external technology transfer from TNCs as indigenous technologies are almost none existing[10]; additionally there is a need for building competencies within design and testing (Techakanont and Takahashi, 2004).

Social capital in Thai automobile clusters

Compared to other types of clusters where horizontal knowledge spillovers are considered crucial this is not the case for the Thai automobile clusters. Networks are limited to first tier suppliers[11]. Second third-tier suppliers do not connect to the network as they do not meet the quality standards (Sevilla and Soonthornthada, 2000). As an example, only 10 % of the Thai suppliers have ISO 9000, 14000 or 18000. That is, collaboration based on social capital between Thai SMEs is not yet of much relevancy as most Thai SMEs simply do not have the competencies, knowledge and information that can create synergetic relationships.

As the situation is now the Thai have to rely on technology transfer from TNCs. This however is a challenging strategy with few successes (Asheim and Vang, forthcoming, Narula and Marin 2005, Lall and Narula 2004). Only few SMEs receive advice about quality control, maintenance, design drawings for the making of dies or tooling and advice about project management from the assemblers (Techakanonta and Terdudomtham, 2004)

[10] Unless the Thai government uses RIS policies to develop indigenous capabilities, see below.
[11] For example one of the consequences of the Japanese leadership was to create several Automobile Industry Cooperative clubs for assemblers and first-tier suppliers.

Financial capital

Introducing the quality standards is a costly process. Only SMEs in the first tier might benefit from some support from the TNC. As demonstrated by Ramachandran (1993) and Technakanont (2003) the TNCs spend ' … more resources for technology transfer to wholly owned subsidiaries that to joint ventures, while they expended the smallest quantity of resources on the independent local firms (Technakanont 2003). In other words the Thai SMEs cannot expect much support from TNCs; and certainly not before a minimum human and organisational capital level is reached.

But most of the SMEs need to rely on the regional and sectoral infrastructure for the provision of sources of funding. In this sense, The Thai Automotive Institute (Ministry of Industry) has a scheme for supporting supplier development directed primarily toward SMEs. The scheme provides funding for group consulting, although some individual support is also available (Turpin et al. 2002).

Policies – from cluster to sector specific SME RIS policies

The current situation of Thai indigenous SMEs in the automotive clusters is precarious and there is room for improvement in the local soft and hard RIS infrastructure. In terms of the human capital there is a need to investment in sector specific training. Given the current competencies of regional government bodies the central government should maintain control over general training and competency building; the need for localized knowledge is of minor importance in these cases within a global industry like the automobile industry.

There is a need for establishing links between the best technical colleges and universities and the Thai SMEs in order to develop the indigenous technologies which the Thai firms cannot access from the assemblers (and other TNCs). Unless these are developed it is difficult to imagine the Thai SMEs moving up the value chain (again). But is seems logical to link this government initiatives with existing ones sponsored by some assemblers (avoiding reinventing the wheel). For example, Toyota has a special vocational education school in Thailand and Chulalongkorn University's Faculty of Engineering has a Bachelor degree program on Automotive engineering with collaboration of Toyota. Alliances with this type of educational institutions to provide training to a wider array of Thai SMEs would be desirable. Of more mundane tasks there is a need for zooming in on training focusing on ' … mold and dies, casting, tooling and design technology such as CAD/CAM/CAE (Techakanont and Takahashi 2004, p. 23). Supplementary to this firms need to transform their organization so the can accommodate innovations; this includes allowing time for participation in training, minor development projects, and so forth.

The centralized government bodies including the technical colleges and universities need to build organizations physically present in the clusters as this is where the SMEs are located. This will allow the central government bodies to develop the needed local knowledge (local knowledge is needed despite the global standards due to different degrees of specialization, institutional structure, and so forth). Moreover,

these government bodies need to be equipped with a sufficient high degree of autonomy that allows them to act on the basis of local knowledge. The combination of centralization and decentralization will allow for harvesting some economies of scale in the development of indigenous technologies. In a slightly longer time perspective the decentralized structure might provide a foundation that will allow for more social capital based horizontal collaboration which might become relevant when the investments in human and organisational capital is 'in place' and a indigenous technologies developed. Increasing the absorptive capacity of the firms will set the foundations for the introduction of quality standards in the SMEs which, in turn, will improve the possibilities for recuperating their position in the first tier.

Bangalore IT cluster

Situated 1000 km from Bombay, in the Karnataka State, Bangalore has become one of the most important IT clusters outside the US to the extent that it is known as "India's Silicon Valley" (Nadvi, 1995). Bangalore city, with around 1 million inhabitants, is the center of the city-region spread out around Bangalore.

Bangalore houses several high-tech clusters (defense, aeronautics and IT) and is considered to be the scientific and engineering centre of India in terms of research, training and manufacturing. India's best research university- Indian Institute of Science is based in Bangalore. The easy access to qualified and relatively cheap technical human capital attracted a number of transnational corporations during the nineties. Large firms such as IBM, Motorola, Hewlett-Packard, Siemens, 3M, Texas, etc. located in the area.

Despite the weight of the TNC in the Bangalore IT sector, the large majority of firms are small and medium sized enterprises. Only 10-15 percent of the revenues of the sector are from SMEs (NASSCOM, 2005).

Regional autonomy in Bangalore IT cluster

The development of this particular city-region is more shaped by the industrial development in the US than local cluster-effects and regional government bodies' policies. Though it should be stressed that Bangalore's growth until the late 1980s (when the software export boom began) relied on local (largely public sector) investments; it should also be noted that Bangalore had a privileged position in comparison with other Indian regions. Bangalore already had a dense organizational setting; Bangalore was/is the center for advanced science and military research – this was mainly for physical geographical reasons such as air without dust which was needed for military testing - and had a number of good educational institutions already, mainly paid for by the central authorities. Even the government did locate in Bangalore the public telephone company as well as other large state enterprises in high-tech sectors.

The state apart from providing basic sound macro-economical policies and similar did not do much to enhance the development of an IT industry in India, subsequently Bangalore (Parthasarathy 2004). Nor did they have noticeable regional policies concerning the development of the IT industry. The crucial difference between India and other developing countries was a rather highly developed human capital infrastructure. The Indian state has developed IT colleges of a high quality and many Indians considered them attractive.

Strategy for SME upgrading in the cluster

As in the Thai Automotive cluster, the dynamics of the IT cluster in Bangalore are dominated by the large transnational corporations located there. It is possible to find two types of SMEs: those tied to a TNC through a subcontracting agreement and a limited number of independent SMEs.

Frequently, SMEs undertake task specific job-work for the large client firm who settles the parameters of the production and the final outcome and tightly controls the performance of the SME. For these SMEs, which are the majority, innovation is defined by the large firms and SMEs are only responsible for maintaining quality standards at minimum costs. Innovation is mostly determined by the large firms (Nadvi, 1995, Vang and Overby, forthcoming)). Occasionally the SMEs suggest marginal modifications to the large firm, based on their expertise.

Beside this large group of SMEs and networks, it is possible to find some independent SMEs, usually driven by highly qualified people that decided to run their own firm. These firms retain their own design and production capacity and try to position their products in the local market and to a lesser extent, abroad. Innovation is the result of the interaction with the final clients.

Human capital

The technical side of the knowledge base of the IT industry draws on a combination of technical – engineering -skills. The routine activities basically draw on codified programming skills while the sophisticated tasks draw on a combination of codified programming competencies, firm specific – tacit and quasi-codified - competencies developed through creating customized programs.

Accessing qualified workers is not a problem for the SMEs of this cluster and, in this sense, their capacity to absorb knowledge and technology generated outside the SME (absorptive capacity) is very high. There are several universities, business schools and high schools located in the region that provide the cluster with the required supply of skill labor.

Several studies have documented that during the first phase US-firms mainly outsourced routine IT-services such as maintenance of existing code or reengineering code from one programming language to another to India. The human capital base in Bangalore was characterized by many well-educated engineers that were perfectly capable of undertaking these activities. The skills needed for this were simple IT skills and the Indians undertaking these activities were most often over-qualified.

In recent years Indian firms have to some extent been capable of moving up the global value chain. On the one hand, TNCs adopted a deliberate strategy to modularize and standardize some of their IT processes. This provides the background for the distance work which in turn allowed the Indian firms to maintain a broader knowledge base at home ((Parthasarathy, 2004), hence secure better absorptive capacity.

Social capital and networks

Collaboration between SMEs based on social networks is limited in the IT cluster, but it exists. Interpersonal networks are based on common schooling and alumni links built around the many technical schools located in the region (Nadvi 1995) as well as on previous working relationships (people that have been working together in the same firm one time or another).

Consortia of SMEs have often been prone to failure due to the competitive tendencies among group members. Evidence suggests that they have been more effective when member firms are complementing each other and not competing. Joint action has often involved marketing of products and seldom the development of a product (Nadvi 1995).

Social capital transcends the regional boundaries in this cluster. The social capital of the Indian transnational community played a crucial role in establishing the IT industry. To get access to orders, capital and more sophisticated knowledge the Indian firms were forced to target transnational corporations. This uncertainty allowed the Indian transnational community, who held important positions in the US firms, to play a significant role in shaping the outsourcing decisions in the US firms

Recently one has witnessed a significant growth in interaction between Bangalore firms and US and European firms as well as a diversification of the profiles of firms investing in Bangalore. The Bangalore firms have developed a certain degree of autonomy from the lead firms in US and Europe. The autonomy is a function of investments in human capital and new managerial strategies; hence they can now provide all types of services from the highest end of the value chain to the bottom end. This has allowed them to move up the global value chain. Part of this process has been facilitated by increased cluster-effect and spin offs from the different universities located in Bangalore. However, the Indian firms did only to a limited extent engage in interactive learning compared to more bustling IT cluster such as Silicon Valley. While the social capital was efficiently in creating the initial development phase it has proven less efficient in stimulating collaboration between different Indian firms; especially Indian firms outside the boundaries of the networks (i.e. not an inclusive social capital structure)

Financial capital and other hard infrastructure

Although the national government has made significant efforts in establishing a venture-capital community in India, the results have been puzzling. The development of venture capital in India can be divided into two periods: 1986-95 and 1995-currently (Avnimelech and Teubal 2002). During the first period, the first Guidelines for the emergence of venture capital firms were approved. The Indian government with the support of the World Bank financed the creation of four venture capital companies (VC), subsidiaries of state-controlled banks. One of the, the TDCI was located in Bangalore. The results of this first phase were weak. Some of the reasons adduced to the failure were the high bureaucracy and the state control of the VC. During the second period, the market was open to private VC. The first foreign owned CV firm established in the nineties as well as the first 100% privately owned CV. During this second phase, non-resident Indians (members of the transnational

community) have become significant investors. Nevertheless the VC infrastructure remains weak, highly bureaucratized and overruled.

Particularly in the cluster, TNC are an important source of financial capital for some SMEs as well as non-resident Indians. Social capital might facilitate the access to this later source of funding, exploiting family or kinship ties with Indians residing abroad.

Policies – from cluster to sector specific SME RIS policies

The high human capital profile combined with lack of inclusive social capital calls for intervention by the regional authorities with the aim of stimulating collaborative projects for SMEs. The regional state however has not done enough to spur a new development model based on local interaction and public procurements.

Government support is actively needed as salaries in this period have grown up to 40 percent eroding the cost advantage for the Bangalore SME. Thus the competitive advantage of Bangalore (or the Bangalore model) is diminishing and there is a need for RIS based policies such as strategic procurement from the state or regional authorities; these polices should stress the regional collaboration dimension with the aim of bringing the Indian firms closer together. The policies should also be focusing on innovations and hence help to overcome the obstacles the lack of a sophisticated national demand places on the Indian firms. This collective approach could be use to market the IT SMEs in international markets.

The individual firms do have the technical skills (human capital) to take advantage of a more local cooperation and apart from some limitations in the general level of management the absorptive capacity is highly developed.

Additionally, in this fast growing sector, there is a clear need to improve the financial infrastructure. As discussed previously, although there is a VC market, SMEs in the sector might find serious constraints accessing the funds due to the excessive bureaucracy. Accessing funds timely is as important as accessing funds at all in this fast growing sector.

5. Innovation Policy for SMEs – learning from the cases

This section aims at drawing lessons for the design and implementation of innovation policies to support Asian SMEs in a regional innovation systems perspective. The lessons are based on the cases; hence we do not suggest they can be automatically applied to other clusters and regional innovation systems. Instead the serve purpose of illustrating the need for diversity of innovation policies supporting SMEs. We critically use the RIS framework to discuss how the hard and soft infrastructure of the RIS and their systemic propensities might influence the innovative performance of the Asian SMEs located in the region; and how can the government selectively invest in the weak and critical nodes of the infrastructure to support SMEs innovative capabilities and upgrading in general.

Innovation policies usually follow best practice models based on high-tech clusters located in high performing regions and only a small number of SMEs benefit from these policy measures. In this paper we argue that when designing innovation policy for SMEs, policy makers need to take into account the different dynamics of regions and clusters of SMEs. In the current paper, we have discussed innovation patterns in four clusters of SMEs in Asia in relation to the hard and soft infrastructure of the regional system of innovation in which each cluster is operating. The four clusters represent the four most common industries in the region: traditional industry, resource-based industry, complex product systems industry and specialized software. The cases illustrate how traditional industries or resource-based industries that tend to be ignored by innovation (technology) policies in Asia, have significant potential in terms of innovation. Hence, these cases illustrate that traditional industries remain potential platforms for upgrading in developing countries (Mylteka and Farinelli 2000) but also that policy makers need to adopt a broader perspective on the innovation processes in these industries. Hence, one of the first conclusions to draw from the cases is that there is a need for innovation policies targeting the particular needs of SMEs operating in different industries. Unless such measures are taken SMEs are not likely to engage in noteworthy innovations or upgrading in general. Subsequently, the SMEs will at best maintain their role as low cost subcontractors to TNC and not exploit their economic potential. In the worst scenario they could even lose their position as subcontractors by being out competed by world players.

The cases also suggest that designing and implementing innovative policies for Asian SMEs requires an approach that pays attention to a) the territorial decision structure and b). The specific combination of hard and soft infrastructure that constitutes the appropriate support for Asian innovative SMEs.

Decentralized decision-making structure

Applying the regional innovation system approach has proven useful as the point of departure for the design of innovation policies to support SMEs in Asian countries. In contrast to other more atomistic approaches working with the same variables but in isolation, the systemic approach considers the links and dependencies of the different institutions and organizations that constitute the innovation system. Thinking “systemic” allows selective interventions in the weakest nodes in the system and/or on the most critical nodes. And selectivity is crucial for developing countries where financial resources are extremely scarce. The systemic approach facilitates the identification of dependencies and complementarities between variables. This in turn can help policy makers to avoid policy interventions focusing on just one variable of the system which might lead to decreasing returns unless supported by complementary investments. As an example, additional investment in human capital in the Bangalore region will not pay off of unless combined by demand side investments.

The cases tend to hold the general claim in the RIS and cluster-literature arguing in favor of decentralized decision-making structures. This is supported by the behavioral pattern of the Asian SMEs whose interactions tend to be embedded locally. Highly centralized government bodies tend to lack the local knowledge and base their interventions on aggregated data that often fails to capture both local and industry specificities. Thus the particular needs of the local SMEs, morphology of local

networks and so forth are ignored. For these reasons, centralized governments might even intervene in counterproductive ways. As mentioned earlier, this calls for a decentralized decision-making structure. However, there is a need to a) highlight the still relevant role of the centralized government agencies and b) a need to argue against a 'one-fits all' territorial decision-making structure.

Across industries the centralized government bodies continue to play a crucial role in generating general polices of relevancy for the SMEs innovative performance. The importance of replacing the ISI-strategy with an EOS-strategy in the Indian case is almost paradigmatic for illustrating this. Equally, important is that the centralized governmental bodies need to define the general formal rules of the game (e.g. formal law, working standards) to avoid that regions use national policies to engage in a cost-based competition against each other. Decentralization of such policies is likely to hamper the innovation performance of SMEs.

The morphology of the decentralized decision-making structure is also contingent on the industry and institutional setting as the cases illustrate. It can take two forms: a) all major decision rights can (or should be) be allocated to the regional governments or b) central government bodies have (or should have) located local government branches with a high degree of autonomy in the relevant regions and clusters. In the latter case there is an additional need to pay attention to which part of the policy process needs to be decentralized (e.g. design and/or implementation)

While it is still too early to come up with a rule of thumb on when the first or second type of decentralized decision-making structure should be applied the cases seems to suggest the following. First, that industries relying on highly localized idiosyncratic knowledge tend to benefit most from a decision-making structure based on regional government bodies. The Jepara furniture cluster can illustrate this. The case points to how the regional government has been effective in identifying some the weakest and most crucial nodes in the regional innovation system with respect to the internationalization of the clustered SMEs. Secondly, industries relying on global standards and/or high capital entry-barriers tend to be best facilitated by the central government premises located in the region. This comes out most clearly in the Bangalore IT software case where the central government's ISS policies have been important in the development of the cluster and the educational institutions function well despite being under central rule. The Thai automobile case also suggests the need for a strategy based on decentralization of central government bodies as scale economies benefit from a centrally coordinated strategy.

Soft and hard infrastructure

The appropriate territorial decision-making structure assures the provision of information on weak nodes and complementarities in the RIS/cluster and thus on where and how to intervene with respect to the soft and hard infrastructure. The industry specific RIS policies can draw on a palette of different supply and/or demand side policies. Among these the can focus on providing timely and qualified human resources, supporting the creation of social capital and effective networks between SMEs and TNCs, supplying physical infrastructure, business support services and financial capital and supporting access to markets

Industry and institutional contingencies dictate what are the areas (hard and soft infrastructure) in which a governmental intervention is most needed in the RIS e.g. investments in human capital, or scientific infrastructure, etc).

Before presenting the case specificities it should be noted that across all the cases the Asian SMEs innovative performance tend to constrained by lack of managerial skills in the broadest sense, especially of the manager or owner of the firm. Intervention in this area seems to be critical for all Asian industries considered in the study.

In traditional industries as illustrated by the Jepara furniture cluster in Indonesia the major weakness in for the SMEs in the cluster is upgrading the local craftsmanship to meet international demands. This can be solved partly if local manufacturers can link up to international buyers and international markets directly. This is possible when they are price competitive, provide the right design, comply with required international standards (environmental mainly) and are known actors on the international market. For SMEs not possessing the skills needed for harvesting the benefits from collaborating directly or indirectly with international buyers the government needs to provide information on international demands, standards and international markets and facilitate the access to international markets (for example, supporting the presence of local SMEs in international trade fairs). However, providing information is only one variable in the equation. SMEs also need to change their productive competences according to the demands of the global markets. Regional governments can facilitate the acquisition of new competences through training tailored to the specificities of the local industry and the global markets. This will lead to an improvement in the absorptive capacity of the SME.

In resource-based industries the weakest node constraining SMEs innovative performance is the lack of competencies allowing SMEs to move up in the global value chain. Success stories like the wine and salmon production in Chile or the Taiwan case in our paper show that this can be attained by linking the industry to biotechnology research. Central in the policy interventions is the collaboration between the knowledge providers (universities and research institutions) and the producers as well as the provision of hard scientific infrastructure and qualified human capital. This type of collaboration can facilitate, for example, the invention of new species, more resistant ones, or similar. Local producers can then enter international market with a knowledge intensive new product, creating a new niche market. This is clearly the strategy of Taiwan, which attempts to become a world leader in orchid production. The government has a crucial role to play as this strategy requires significant investments in research facilities that exceed SMEs capacity. But hard infrastructure is only one part of the system. The linkages between the knowledge infrastructure (biotech labs for example), the producers and the markets need to be in place and SMEs need to have the knowledge to understand the possibilities of the new products (absorptive capacity).

The policies in CoPS, like the Thai automotive clusters illustrate, are highly dependent on the TNCs willingness to provide assistance on technological upgrading and building of design competencies as this is beyond the scope of the indigenous SMEs. When TNCs provide this type of information/assistance it is mainly to first tier suppliers. SMEs do not play a significant role as first tier suppliers as most indigenous SMEs do not comply with the international quality standards required by the TNC.

The cases illustrate that at least two strategies are possible. One is to regulate the relationship between the TNC and the SME, for example, forcing the TNC to subcontract with indigenous SMEs. While this might seem a viable solution in the short term, it does not provide the right incentives for the SMEs to acquire new competences, as the Thai case shows. The second strategy is for the Government to focus directly on improving the competences of the indigenous SMEs. This calls for government intervention focusing on providing the needed industry specific technical and managerial training and the development of indigenous technologies.

Finally the policies targeting specialized supplier as illustrated by the Bangalore case initially consists in building the required human capital level engage in cost-based collaboration with TNCs. One that this level is attained the largest problem that the SMEs in these types of industries in Asia are currently facing is getting the high-value assignments that would allow them position in higher parts of the value chain. While the SMEs might have the formally needed competencies for undertaking these activities, TNCs do know or do not trust yet the ability of the indigenous SMEs to undertake these activities. This prevents them from transforming their formal competencies into 'real' competencies; this transformation requires user-producer interaction. This problem is central as the SMEs cannot rely on localized lead users. In parallel knowledge tend not to be distributed within the clusters of co-located firms. Thus after initial phases with investments in human capital public interventions should focus on public procurements allowing where the public government bodies functions as lead users (lead users demanding local interaction).

Summing up

Contrary to the tendency of one size fits all, we have argued that the needs of the SMEs and the regional system of innovation respond to industry specificities. For policy makers the selection of the areas of intervention as well as the instruments has to be the result of a throughout analysis of the regional system of innovation, particularly, of the hard and soft infrastructure and the complementarities between the different elements. The governments need accurate and timely information on the specific needs of the clusters of SMEs located in a given region. For this reason, generally we plea in favor of regionalized innovation policy infrastructures, both for the design and the implementation of the innovation policy. The cases also illustrate that a) all hard and soft infrastructure elements are needed for the development of the clustered SMEs but that b) the relative importance of each of them will vary significantly by industry and throughout time.

Concluding remarks

We started the paper with the general claim that innovation policies in Asia have tended to support high-tech sectors dominated by large firms. It is estimated that only 3% of the SMEs benefit from this policies (as they are high-tech SMEs). The cases have illustrated that SMEs across industries do have an unrealized potential. They can compete in international markets, even in mature or traditional industries, if there is the right support locally.

Unfolding this potential is a matter of understanding the specific needs of the local SMEs and identifying the weakest nodes in the regional system of innovation. In order to reach the largest amount of SMEs policy makers need to focus on clusters of SMEs, that is, the policy target should be groups of SMEs and not isolated SMEs.

This paper has contributed to the current discussion of innovation policies in Asia in many ways. First, by providing an analytical framework (RIS) to unfold the system propensities in which the activity of the SMEs is embedded (hard and soft infrastructure and how they relate to the SMEs needs and the use of the innovation system approach in practice). Second, by particularizing the analysis to the four most common clusters of SMEs in Asia, identifying some general patterns within the cluster and the main differences across clusters. And finally, by providing some guidance to policy makers on how to intervene support these clusters with the provision of hard and soft infrastructure.

---- Insert table 3 around here ----

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Table 1. The Economic importance of SMEs in a selection of Asian countries in the nineties

Country	Economic relevance
Bangladesh	- 80-95 % of the manufacturing establishments are SMEs - SMEs are responsible for 80% of the labour force - They account for 50% of the output of the sector and 5% of the GDP. - Most prominent sectors: garments, footwear and agro-processing
India	- 95% of the industrial establishments - 80% of employment - 40% of industrial output, 35% of the manufacturing sector, 40% of exports and 7% of NDP
Pakistan	- 80% of industrial employment - 60% of industrial output - 15% of GDP
Nepal (1)	- 89 % of establishments - 87% of employment - 63% of the total manufacturing added value
Indonesia	- 70-90% of establishments - 20% of the GDP
Thailand	- 98% of the establishments - 70 % of industrial employment - 4,7 % of added value in manufacturing - Main industries: metal and steel, plastic products, rubber and garments
Malaysia	- 93% of the establishments - 80% of the manufacturing firms - Only 17,5 of employment in the manufacturing sector - 30 % of the total output
Philippines	- 99 % of enterprises - 45% of employment - 28% of the value added in the manufacturing sector
Singapore	- Estimated 40% of the manufacturing production - 25% of the value added in manufacturing
Korea	- 70 % of employment - 46% of gross output - 47 % of value added
Taiwan (2)	- 98% of the firms are classified as SMEs - 31,5 % of the total sales - 77,5 % of the workforce - 28,11 of the production of the manufacturing sector

(1) Data is not including Cottage industries that is, traditional industries that utilize specific (indigenous) skills or local raw materials and resources, labour intensive and are based on national tradition, art and culture (United Nation Economic and Social Commission for Asia and the Pacific (2003).
(2) Data of 2001

Source: based on (Dhungana 2003), Nepal Central Bureau of Statistics and SMEA (2004).

Table 2. Distribution of employment and value added among manufacturing sectors in a selection of asian countries (1)

Country	ISIC sector	% employment	% manufacturing added value
India	Food and beverages	16,1	12,2
	Textiles	17,1	12,4
	Chemical and chemical products	9,6	15,7
Indonesia	Food and beverages	13,9	13,6
	Textiles	15,7	12,6
	Tobacco products	6,0	8,9
Philippines	Food and beverages	16,8	29,8
	Chemical and chemical products	5,0	12,0
	Coke, refined petroleum products	0,2	9,7
Korea	Radio, TV and communication equipment	9,7	16,2
	Chemical and chemical products	5,4	9,5
	Motor vehicles, trailers	8,0	8,7
Singapore	Office and computing machinery	12,6	22,5
	Radio, TV and communication equipment	17,4	19,4
	Chemical and chemical products	6,4	18,5
China	Chemical and chemical products	11,1	12,0
	Food and beverages	8,2	10,2
	Basic metals	8,3	9,0
Sri Lanka	Food and beverages	14,1	26,4
	Wearing apparel, fur products	33,3	18,4
	Tobacco products	5,6	12,2
Thailand	Food and beverages	19,0	25,4
	Motor vehicles, trailers	3,9	10,8
	Non-metallic mineral products	6,4	8,6

(1) Total added value of manufacturing= 100. Three most important sectors according to added value.

Source: UNIDO, International Yearbook of Industrial Statistics, 2002 taken from (Das 2003)

Table 3. Comparison of the Asian cases

	Traditional **Jepara cluster**	**Resource-based** **Taiwan flower industry**	**CoPS** **Automotive Thailand**	**Specialized suppliers** **Software Bangalore**
Main cluster features	About 2000 SMEs Production goes to international markets	Production dominated by small farms (1 ha per family)	Strongly dominated by TNC assemblers. Local SMEs are usually 2nd and 3rd tier, with very limited access to knowledge and technology.	Cluster with strong presence of multinational firms but dominated by SMEs.
Regional autonomy	High	High	Low	Medium
Strategies for upgrading (role of TNC-SME)	Innovation is customer driven. But most firms do not have direct access to the large international buyer. Joint actions to attend international trade fairs (supported by the government) have been very successful	Innovation is science-driven High coordination between researchers – maket-producers is needed. Boundary spanners. Government can play a role in supporting the interaction between these institutions	Innovation is TNC driven. The TNC defines the scope of change and only SMEs that are 1st ties have access to knowledge and information on the market. SMEs that want to be part of the TNC network need to comply with international quality standards. Only 10% of the SMEs have an ISO certification. Government has a great role encouraging and supporting SMEs to obtain such quality standard.	Innovation is customer driven. But for many firms the customer is the TNC. They work on job-work basis, as subcontractors, and their scope for upgrading and innovating is limited. Another group of SMEs have opted to be independent. They have better chances to enter international markets, if they are able to gain recognition. Support from the government to attend international trade fairs could have a positive impact.
Human Capital	Craft industry. Knowledge acquisition is by learning by doing. There are a limited number of very qualified human resources that are shared by several SMEs and large firms. Policy makers can support the transfer of this knowledge?. Managerial and marketing skills are needed.	Knowledge is very fragmented in three groups. Producers only know about production techniques, but nothing about the market. Marketing of the flowers is dominated by "marketing" firms. And innovation in the cluster is driven by advances in biotechnology, with researchers in labs relatively isolated from producers and markets.	Production is dominated by blue collar workers. Competition is based on costs, quality standards and to a lesser extent on *just in time*. Learning is limited as production is according to blueprints. Upgrading requires formal training in engineering and design.	Firms have easy access to qualified human resources. The region houses an important number of education and training institutions. So the technical skills are ensured. However, managerial and marketing skills could be strengthen.

	Traditional **Jepara cluster**	**Resource-based** **Taiwan flower industry**	**CoPS** **Automotive Thailand**	**Specialized suppliers** **Software Bangalore**
Social capital & networks	Social capital is strong, based on kinship and family ties. Collective action is common, both to access machinery and to attain economies of scale.	Social capital is strong, based on Chinese values and collective action common. However, networks seem to be confined to one activity (production, research or commercialization).	Social capital is weak. Some initiatives like the Toyota's sponsored Automobile Industry Club only reaches first tiers. Collaboration between the SMEs and collective action is almost inexistent, not even to achieve efficiency based on specialization. Government could support the introduction of quality standards to groups of complementary SMEs.	Social capital is based on the alumni network and the mobility of workers. Collective action exits, specially for marketing purposes and to a lesser extent to share technological knowledge or gain economies of scale. However, collective action has been hampered by fierce competition between the firms. Cooperation is successful when based on specialization. Government could play a role supporting collective initiatives of complementary firms and providing information of the SMEs core business.
Financial Capital	Weak support by financial institutions. Cluster works on micro credits among the producers (based on social capital)	The upgrading of the cluster via investment in research and technology requires vast amounts of financial capital provided by the government and some international large firms.	Introducing quality standards is a costly process. Most of the SMEs in the cluster do not have any access to financial capital. Only SMEs in the first tier might benefit from some support from the TNC.	VC market in India suffers from excessive regulations and bureaucracy. Funding is provided by some TNC and members of the transnational community returning from the US (or just setting up some business in India). Public procurement is non-existent.
Policy	The presence of the government in the cluster has been limited. However, some of the initiatives (like promoting the attendance to international trade fairs) have been very successful. More support for the development of human capital, specially managerial and marketing skills, provision of information on international trends and facilitating direct access to the customer is needed.	Success in this cluster is based on coordination of the different actors (producers, researchers and customers) as well, access to information on international opportunities and trends and the provision of infrastructure (scientific mainly). The government has a great role to play in setting the RIS infrastructure and connecting the relevant actors.	Latest Thai policy towards the sector has been quite detrimental for the SMEs as it eliminated the obligations of TNC to local manufacturers. Government has a role to play in the provision of soft and hard infrastructure for the cluster: qualification of human resources, introduction of quality standards, support of collective action and specialization (upgrading in the value change), encouraging a change of strategy from cost reduction to quality and specialization (knowledge based), and put back the obligations of TNC towards indigenous SMEs.	Government has an important role fomenting collective actions among SMEs in the cluster, focusing on specialization and not competition. Assistance for international trade fairs could facilitate the insertion of these SMEs in international market. Public procurement could also be a powerful incentive for the local SMEs. Finally, upgrading managerial skills to complement the high technical skills is needed.

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