

Institutional Settings in a Rice Cluster: Assessing the Effects of Social Capital on Learning in Malaysia

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Abstract

Based on a case study of the Sekinchan rice cluster in Malaysia, this paper provides empirical evidence demonstrating that geographic proximity goes hand-in-hand with social capital. The paper argues that the study of social capital within a geographic dimension (such as Regional Innovation Systems and clusters) needs to take place in its institutional context. Thus, agricultural cluster development policies must address the 'soft' elements of the cluster in fostering cooperative relationships and "social contracts" among the cluster actors. Findings also indicate that the cluster's learning processes take place mainly in the form of informal learning and learning by doing, in which the effects of social cohesiveness, trust and connectedness are particularly important. The sustainability issues encountered by the rice cluster and key policy implications conclude the paper.

Keywords: agricultural innovation systems, social cohesion, trust, traditional sector

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1.0 Introduction

As a supplier-dominated sector, the technological trajectory of the agricultural sector is supplier-driven regarding technology sources, non-technical and price sensitive (Pavitt, 1984). In this context, the dynamics of agricultural innovation are highly correlated with the determinants of socio-economic processes, technology and institutions. In other words, the effects of social cohesiveness and the willingness to work together to achieve goals and develop norms and connections for joint action are crucial for successful uptake, diffusion and innovation (Parthasarathy and Chopde, 2001). Thus, the patterns of innovation in the agricultural sector need to be explored from both the internal (e.g. productivity and production) and external (e.g. competition, inter-industry dynamics and market changes) domains (Possas et al., 1996). Discourses concerning the interactive roles and functions of these internal and external elements in the dynamics of innovation at the macro and meso level have appeared in the innovation systems literature since the 1990s (e.g. Cooke et al., 1997; Lundvall, 1992; Nelson, 1993).

One of the central propositions in innovation systems literature is that institution¹ (such as culture, norms, routines, laws and regulations) is acknowledged as one of the main building blocks in systemic studies of innovation (Johnson, 1992)². Indeed, the Regional Innovation Systems emphasised that capacity for associational, high-trust and networking practices, which is social capital³, plays significant roles in building up productivity and competencies within a geographical space (Cooke et al., 1997). For instance, regional measures of social capital

¹ Refer to North (1990) for a detailed explanation of institutions.

² We are aware of the concept of heterogeneity concerning use of the term 'institutions'. In addition to the use that we adopt here, some scholars refer to institutions as organisational settings, such as universities and research institutions.

³ Social capital comprises the relations of trust, norms and sanctions, associational activity, common rules and connectedness in institutions (Dakhli and Clerq, 2004).

correlate positively with various indices of economic performance (Fukuyama, 1995). For agricultural activities, the central issue lies in understanding the farming community networks and the ways they adopt, adapt and benefit from improved agricultural technologies (Parthasarathy and Chopde, 2001). Social capital is a communal property involving civic engagement, associational membership, high trust, reliability and reciprocity in social networks (Cooke and Wills, 1999). Social capital is identifiable in social, political and economic contexts, often associated with strong communities. The role of social capital in norms and networks that facilitate collective action for mutual benefit among firms is further ascertained from the standpoint that:

“I contend that development outcomes are shaped by the extent to which basic social dilemmas at the micro and macro level are resolved. Positive outcomes are attained to the extent that both embedded and autonomous social relations prevail at both levels. This happens when people are willing and able to draw on nurturing social ties (i) within their local communities; (ii) between local communities and groups with external and more extensive social connections to civil society; (iii) between civil society and macro-level institutions; and (iv) within corporate sector institutions. All four dimensions must be present for optimal developmental outcomes.” (Woolcock, 1998:86)

In this aspect, studying the social capital that enables development of the ability to use different kinds of social networks is crucial. Both institutions and social capital are imperative given that they complement each other. Social capital can be viewed as a subset of institutions and institutions can never operate effectively if they do not operate in a socially embedded system that requires strong social capital.

Based on the theoretical foundation of the idiosyncratic nature and actual mix of rationality in the systemic view of innovation (see Lundvall et al., 2002; Lundvall, 1992), particularly in the context of geographical innovation (see Asheim, 2002; Asheim and Isaksen, 2002), this qualitative paper investigates the effects of institutions and social capital, especially the element

of trust-building, on the dynamics of agricultural innovation by taking Malaysia's Sekinchan rice cluster as the case study. This paper answers the following research questions: (a) How do the elements of social capital contribute to localised learning processes in the cluster? (b) What significant roles do public policies play in developing the technological capabilities in the cluster? (c) How do industry practitioners react to such public policies? In pursuing answers to these questions, the paper enriches the innovation studies literature in the realm of institutional capabilities for agricultural cluster dynamics. It provides insights into the importance of social capital, particularly the essence of trust-building and social cohesion, to the success of a cluster. In addition, existing studies about social capital often focus on the positive consequences of social capital for cluster development whereas less emphasis has been given to addressing the 'dark side' of social capital, especially in regards to the issues of civiness, equality and democracy (van Deth and Zmerli, 2010). Therefore, issues highlighted in establishing the cross-cluster collaboration at the end of this paper provide anecdotal evidence towards this end. Finally, addressing the three research questions stated above allows policymakers to understand the critical predicaments of agricultural cluster development that are sectoral, locational and country specific.

This paper is structured as follows. Following this introductory section, Section 2 presents the conceptual background of agricultural cluster innovation by emphasising the effects of social capital in fostering learning processes. The importance of trust as a key element in social capital is also discussed. Section 3 provides details on the research methods. Section 4 presents the main findings and is followed by a discussion in Section 5. The paper ends with concluding statements and key policy implications.

2. Theoretical Justification: Institutions, Social Capital, Learning and Innovation in the Agricultural Cluster

The theoretical concept of territorial (or geographic) region and agglomeration (or the study of human settlements and clusters) has been widely used in the study of geographical innovation

due to its embedded localised learning processes and tacit (and disembodied) knowledge rooted in social interaction (see Asheim, 2002; Asheim and Isaksen, 2002; Gertler, 2004). Indeed, the important roles of social cohesiveness in shaping knowledge creation, sharing and utilisation are highly emphasised. With respect to studying the characteristics of innovation activities in the agriculture sector, the framework of Agricultural Innovation Systems (AIS), which is grounded in the family of innovation systems, has received great attention amongst researchers in analysing the actors and institutional changes in agriculture and economics (such as Hall et al., 2003; Klerkx et al., 2010; Morriss et al., 2006). The innovation systems concept is attractive not only because it offers a holistic explanation of how knowledge is produced, diffused and used but also because it emphasises the actors and processes that have been increasingly important in agricultural development (World Bank, 2007). In this context, institutions are important for innovation and learning processes, and trust-building is of the essence (Johnson, 1992). The following subsections provide critical reviews on social capital, the importance of localised learning and the effects of social capital in the geographic proximity context of AIS.

2.1 Institutions and social capital

Institutions play a major role in determining how people relate to each other and how they learn and use their knowledge (Johnson, 1992). To build competence and innovate, it is important to establish institutions that enhance order, trust and predictability in the life of individuals and in the workings of firms and other organisations (Johnson et al., 2003). Thus, the institution is widely considered a key building block in innovation systems (Lundvall, 1992) whereas social capital is a vital element in creating a vibrant system (Dakhli and De Clercq, 2004; Pretty and Ward, 2001). Although numerous studies have dealt with the importance of social capital as a vital element in understanding knowledge creation (e.g. Nahapiet and Ghoshal, 1998; Westlund, 2004), no specific definition of social capital exists because of its broad context. Despite this drawback, social capital is understood as the centre of a social structure that facilitates the actions of actors within the structure (Coleman, 1988). Social capital not only facilitates cooperation, but it also lowers the cost of working collaboratively due to its embedded trust, connectedness and networks (Pretty and Ward, 2001). Social capital and knowledge creation are

positively connected because social capital provides good access and network resources (Nahapiet and Ghoshal, 1998).

Connectedness is an important aspect of social capital, and it consists of many different types of connectedness. Examples include knowledge transfer, trading of goods, agriculture and farming, financial agreements, loans and subsidies and mutual help (Pretty and Ward, 2001). However, rules, norms and sanctions are also an important part of social capital; they strengthen the individual's confidence to invest in favourable groups or individuals and are called the "rules of the game" (Taylor, 1982) or "internal morality of the social system" (Coleman, 1990). These are important factors of social capital in fostering knowledge as social capital strengthens the bonds of productivity among the organisation, institutions and innovation. In the same respect, trust is a multidimensional and complex concept which refers to expectations about consistency in behaviour, full revelation of what agents regard as relevant information for the other party and restraint in exploiting any temporary weaknesses of partners. The institutions that constitute trust are crucial for interactive learning and innovation capabilities. In addition, the strength and kind of trust embedding markets will determine the degree to which interactive learning can take place in organised markets (see Johnson, 1992; Lundvall, 1992). In a geographic context, a collective order based on micro-constitutional regulation conditioned by trust, reliability, exchange and cooperative interaction is crucial in forming a systemic cooperative, trust-dependent and associational character in Regional Innovation Systems (Cooke et al., 1997).

For policymakers, efforts to examine the link between social capital and cluster performance should not concentrate solely on the positive value gained by the cluster. For instance, the over-emphasis on the role of social capital in cluster formation with the exclusion of outsiders, limited mobility, poor socio-economic advancement and lack of adaptability to change can hinder cluster development. Some clusters in transition economies can have negative social capital due to strong ties as sometimes their closed networks lack transparency, are locked up in kinship obligations and apply illegal methods (see Arzeni and Ionescu, 2007; Falco and Bulte, 2011; van Deth and Zmerli, 2010; Woolcock, 1998). In addition, as regional policies to foster innovation have evolved towards a 'soft' focus on facilitating relationships of cooperation, the 'soft'

qualities of innovation policies, such as the atmosphere of the cluster, have become important intangible assets that facilitate socially embedded learning and trust among cluster members (Aragón et al., 2012).

2.2 Localised learning and regional supporting infrastructures

The literature in spatial innovation and geographic economics has long recognised that the innovation process of firms goes parallel with geographic proximity and is strongly fashioned by firms' specific knowledge-based and localised learning process. The concept of the idiosyncratic nature of innovation and knowledge is spatially bound in that their development path evolves through time and space (Lundvall, 1992). Within the same thought, the different types of regional systems must exist within a context of actual knowledge in the form of analytical (i.e. use analysis or logical reasoning) and synthetic (i.e. obtain knowledge through observation or facts) knowledge (Asheim and Coenen, 2005). These forms of knowledge exhibit different mixes of tacit (or implicit) and formal (or codified) knowledge, prospects and limits of codification, qualifications and skills and institutional setting involved, among other things. They define the learning innovation economy (rather than the knowledge-based economy) as an interactive process that is socially and locally embedded, as well as culturally and institutionally contextualised.

Meanwhile, the rise of problematic aspects of learning has pushed into focus 'catching up' learning (such as 'learning by doing' and 'learning by using') based on incremental innovation and not on radical innovations which require the creation of new knowledge. Incremental innovation and learning by doing, using and interacting have been continuously cited as important elements in the process of technical change and diffusion of innovations (Freeman, 1993). In addition, importantly, in this context, geographic proximity plays an important role when it comes to the regional embedding of knowledge and learning processes. Drawing on this standpoint, knowledge is nationally and regionally embedded as a result of a historically produced territorial division of labour (Asheim and Coenen, 2005). In fact, development of the

endogenous capacity of regions to innovate so as to create competitive advantage is often referred to as a 'regional constructed advantage' (Cooke and Leydesdorff, 2006).

Regional supporting infrastructure or knowledge-generation subsystems comprise formal institutions such as public and private research institutions, universities, colleges and agencies for technology transfer (Cooke et al., 1998), informal institutional settings that are commonly in the form of rules of the game (Pretty and Ward, 2001; Taylor, 1982), values of the social system (Coleman, 1990) and the foundation that shapes beliefs and trust (Collins and Chippendale, 1991). Informal institutions are used to shape individuals' everyday behaviour and habits, which are also called norms. This indicates how individuals reflect and act when rules stipulate positive or negative behaviour. In this regard, the elements of 'region culture' (such as a set of values, norms, attitudes, routines and expectations) reflect and shape how firms interact with each other in the regional economy, which is an important part of the basis for sustainable livelihood (Asheim and Coenen, 2005).

2.3 Social capital-embedded framework of AIS

In the realm of agricultural innovation, the framework of innovation systems has been extensively used to monitor and develop capability in new solutions with the goal of addressing issues in the socio-technical regime (Hall et al., 2003; Klerkx et al., 2010). This has resulted in interest among academicians and policymakers in investigating the behaviour and capability of heterogeneous sets of actors (such as farmers, input industries, traders, researchers, government officials and civil society organisations) in developing and employing various kinds of social capital (Parthasarathy and Chopde, 2001). Indeed, AIS not only is concerned with the study of technology itself, but it also emphasises social-technical institutional change, which requires alternative ways of coordination (Leeuwis, 2004; Spielman et al., 2008). That capacity to innovate is the combined function of the actors involved, the skills they bring to partnerships and the institutional contexts that shape the relationships (Hall et al., 2003). Consequently, within the context of institutional learning, appropriately designed and executed evaluations of agricultural research should go beyond traditional economic impact assessments, such as active stakeholder

participation and recognising innovation system frameworks that are realistic (Horton and Mackay, 2003). Table 1 summarises studies on AIS that have highlighted the critical roles of geographic proximity and social capital.

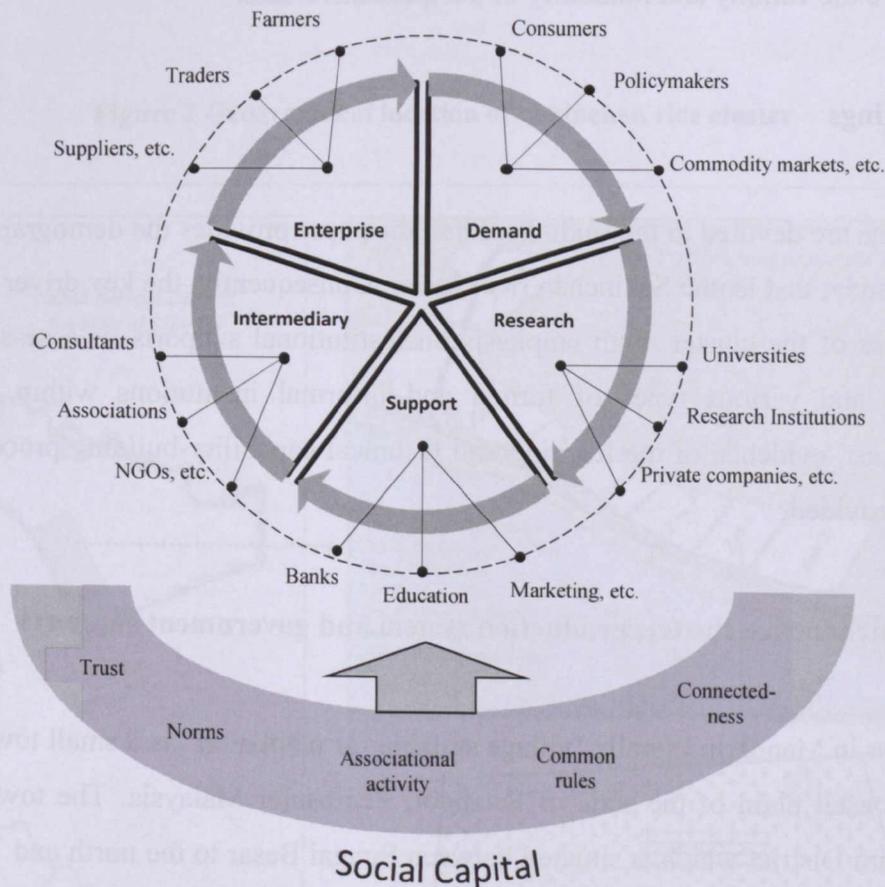
A wide set of attitudes and practices that emphasise collaboration, potential inefficiencies, patterns of trust and the existence of a culture must be cultivated to foster a culture of innovation in AIS. Partnerships and linkages are amongst the elements in AIS that must be analysed in their historical and contemporary context. Actors can be generally categorised into five domains, namely, demand, enterprise, research and intermediary and support structure (World Bank, 2007). Figure 1 illustrates the interaction between these domains together with the effects of the elements of social capital in the context of geographic proximity in AIS. This framework serves as the analytical framework for this study.

Table 1 Summary of the literature on the importance of social capital and geographic proximity in agricultural activities

Literature	Approach	Descriptions
Possas et al. (1996)	Evolutionary economics	Heterogeneous features of technology production and markets should be incorporated in the analysis of the dynamics of agriculture-based innovation. Different technological trajectories can be envisaged based on different historical purposes and industry initiatives. Technological regime can be identified in agriculture.
Parthasarathy and Chopde (2001)	Development studies	Social capital plays a key role in enabling households to take advantage of human capital resources that become available in the form of new cultivation practices and knowledge regarding technologies. Poor people, in their social networks, can cooperate, share resources and risks and act collectively. The formal and informal organisations' contribution to the construction of social capital.
Knight et al. (2003)	Agricultural education	Schooling encourages farmers to adopt innovations, whereas risk aversion reduces the probability of adoption. Educated farmers are early innovators and are copied by those with less schooling.
Spielman et al. (2008)	Agricultural education	Agricultural education and research left behind by the colonial regimes (in sub-Saharan Africa) are undergoing reforms (in both formal and informal systems) in response to changing socio-political, economic, scientific and agro-ecological conditions in the region.
Morriss et al. (2006)	Innovation intermediaries	Communication-based process can effectively augment the more conventional rational approach to policy development. It provides a degree of 'mediating neutrality' independent of the role of those facilitating the process.
Klerkx and Leeuwis (2008, 2009)	Innovation intermediaries	Besides directly contracting services that fulfil a public good role (i.e. becoming a client) and acting as a market supervisor, government becomes a market facilitator. The public interest involved in acting as a market facilitator is that it catalyses innovation, which in current policy and scientific literature is seen as key to economic viability. Also, the government role as an innovation system coordinator and mediator through the continued funding of innovation brokers is needed. This is due to innovation brokers having difficulty in becoming embedded as their clients and/or financiers find it difficult to grasp the nature and value of their activities.

Source: Authors' compilation

Figure 1 Domains of AIS with the elements of social capital



Source: Adapted from World Bank (2007)

3. Research Methodology

The study employed a qualitative research approach with a series of in-depth interviews with the main actors in the Sekinchan rice cluster based on five domains determined in the AIS framework. These include the main players in the paddy production system (such as farmers, millers, wholesalers, retailers, supporting contractors and material suppliers) and also the relevant public research institutions, local authorities and communities. All the interview sessions were conducted from January 2013 through March 2014. Qualitative data were obtained

through secondary sources and observations during site visits. The case study procedures were followed closely (see Yin, 2003). The triangulation methodology was adopted, using a variety of data to ensure the validity and reliability of the qualitative data.

4. Findings

Three sections are devoted to the findings. First, the paper provides the demographic background of the case study, that is, the Sekinchan rice cluster. Consequently, the key driver that contributes to the success of the cluster, with emphasis on institutional supports, is assessed. Second, the main actors and various types of formal and informal institutions within the cluster are examined. Last, evidence of the learning and technical capability-building processes within the cluster are provided.

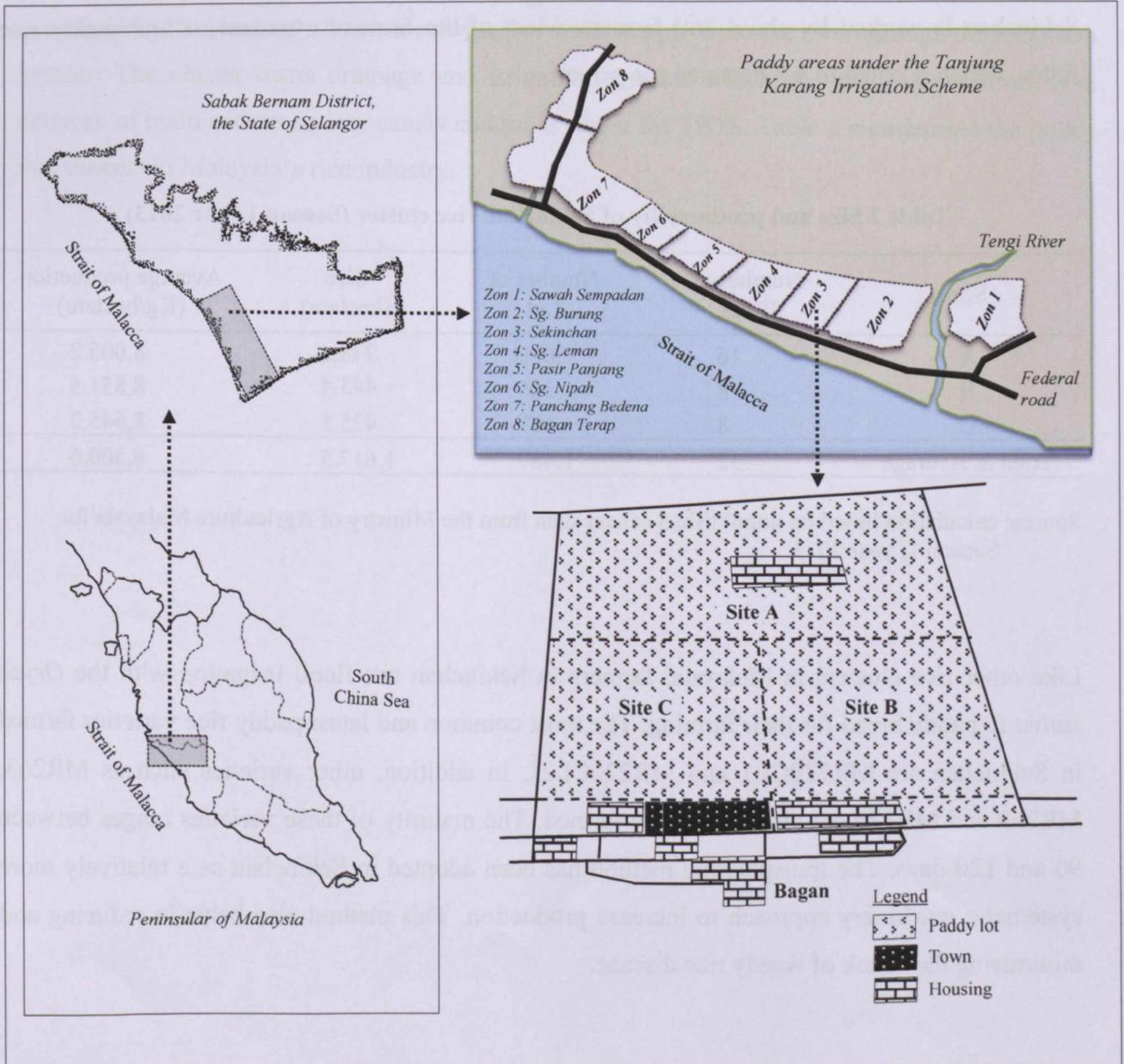
4.1 Sekinchan rice cluster, production system and government supports

Sekinchan, or in Mandarin literally 'village suitable for plantation', is a small town located in the northwest coastal plain of the state of Selangor, Peninsular Malaysia. The town is part of the Sabak Bernam District which is situated between Sungai Besar to the north and Tanjung Karang to the South. Sekinchan is a coastal rice-planting area with a population of 20,000 people, of whom about 60% are Chinese descendants. Most of the farmers in Sekinchan are the third - and fourth - generation. The paddy field land has passed from ancestors to grandchildren.

Sekinchan consists of a town centre and four new villages, namely Site A, Site B, Site C and Bagan. The four new villages in Sekinchan were established during the early 1950s as a result of the British colonial government's efforts to segregate in outskirts areas the Chinese community from the early Malayan Communist Party insurgents. The main rice-planting areas are Site A, Site B and Site C; whereas Bagan is a fishing village. The area was developed by the British administrative before the war together with the neighbouring Malay granary areas under the Tanjung Karang Irrigation Scheme (TKIS) with was aimed to increase rice production in

Peninsular Malaysia⁴. Figure 2 show the geographic location and schematic drawing of Sekinchan rice cluster.

Figure 2 Geographical location of Sekinchan rice cluster



⁴ According to Wu (1995), the British had view agriculture as a constructive economic activity which could attract settled population and lead to permanent colonisation. In the case of TKIS, the British administrators were keen to attract immigrant settlers, particularly the Chinese, to participate in paddy cultivation to supplement the efforts of the native Malay farmers.

As shown in Table 2, block system is used in managing rice-plantation areas in Sekinchan. Each block is then divided into numerous lots which are owned by the farmers. The total rice-plantation land for the three sites is about 1,617.5 hectares. Average rice production from these three sites is about 8.5 tonnes per hectare. This surpasses twice the national average yield of Malaysian paddy production, which is 5 tonnes per hectare. Besides, the plantation land in Sekinchan is worked by about 360 farmers. Most of the farmers own one to four paddy rice fields, which is equal to 4.8 hectares per person.

Table 2 Size and productivity of Sekinchan rice cluster (Season 1 year 2013)

Site	Number of Block	Number of Lot	Size (hectare)	Average production (Kg/hectare)
A	16	696	748.6	8,005.2
B	8	386	443.4	8,851.5
C	8	407	425.5	8,645.2
Total & Average	32	1,489	1,617.5	8,500.6

Source: calculation based on unpublished census data from the Ministry of Agriculture Malaysia for Season 1, year 2013

Like other rice clusters in Malaysia, farmers in Sekinchan use flood irrigation with the *Oryza sativa L.* paddy breed for their farming. The most common and latest paddy rice varieties farmed in Sekinchan are MR220CL1 and MR220CL2⁵. In addition, other varieties such as MR263, MR269 and MR220 are also commonly farmed. The maturity of these varieties ranges between 90 and 120 days. The transplanting method has been adopted in Sekinchan as a relatively more systematic machinery approach to increase production. This method also helps in reducing and minimising the attack of weedy rice disease.

⁵ MR220CL1 and MR220CL2 are progeny of a hybrid cross between IMI-TR1770 and MR 220. MR220 is a popular rice variety introduced by the Malaysian Agricultural R&D Institute (MARDI). IMI-TR1770 is paddy rice variety from the United States, licensed to MARDI for use as a parent cross.

Similar to other rice farmers in Malaysia, Sekinchan's farmers receive strong support from the government in the form of subsidies, incentives and price controls. These government supports and interventions, among other things, include input subsidies (such as seeds, fertilisers, pesticides and machinery), low irrigation rates, price subsidies, rice production incentives, yield increase incentives, price controls (ranging from farm to retail) and control over imported rice. These supports are in line with the government's policies to ensure a sufficient supply and price sustainability. Sekinchan's farmers enjoy a free water supply from the river through the irrigation system. The cluster owns drainage and irrigation systems which are efficiently served by a network of main and secondary canals and roads under the TKIS. Table 3 summarises the policy instruments in Malaysia's rice industry.

Table 3 Key policy instruments in Malaysia's rice industry

Policy Instrument	Description
Input subsidies	<ul style="list-style-type: none"> The federal government provides subsidies in the amount of RM2,700 per hectare per season to farmers in every harvest season. These subsidies include fertiliser, pesticides, paddy seeds and free supports for irrigation, infrastructure and water supply. Subsidies given include: 240kg/hectare mixed fertiliser (12 bags at 20kg/bag) and 80kg/hectare for organic fertiliser (4 bags at 20kg/bag) and a pesticide incentive at RM200 per hectare.
Price subsidies	<ul style="list-style-type: none"> The government provides a selling price of RM248.10 per metric tonne of paddy sold.
Rice production incentive	<ul style="list-style-type: none"> Land preparation/ploughing incentive – RM100 per hectare, and organic fertiliser 100kg per hectare – worth RM140 per hectare.
Yield increase incentive	<ul style="list-style-type: none"> This incentive is provided to productive farmers if they produce 10 tonnes or more per hectare – RM650 per tonne. Token rewards are also given to farmers who manage to increase their paddy rice yield in each season, with a minimum payment of RM200 to eligible farmers who work less than 2 hectares of cultivated rice.
Price control	<ul style="list-style-type: none"> Retailers must follow the controlled price for rice set by the government, as the rice sector is highly protected, with the protection justified largely by arguments for food security. Controlled prices: <ul style="list-style-type: none"> – ST15% = RM1.60/kg – ST10% = RM2.40 /kg – ST5% = RM 2.60/ kg
Rice miller subsidies	<ul style="list-style-type: none"> Peninsular Malaysia: Financial assistance of RM600 per metric tonne paid to rice millers who produce ST15%. Payment is made through BERNAS. Sabah & Sarawak: Financial assistance of RM600 per metric tonne paid to BERNAS to ensure local supply of white rice ST15% Sabah and Sarawak sold on the market.
Imported rice control	<ul style="list-style-type: none"> Government enforces high import duties on rice; about 20%-30% of imported rice sold is from Thailand, Vietnam, India and Pakistan. The enforcement of high import duties is intended to protect the domestic industry and for food security purposes. PadiBeras National Berhad (BERNAS) is the sole importer; BERNAS⁶ owns the privilege to import rice at duty-free rates.

Source: Authors' compilation based on Department of Agriculture Malaysia (2010)

⁶ BERNAS has regulated the paddy and rice sector in Malaysia since its privatisation in January 1996 and is involved in paddy procurement and rice processing, importation and exportation, distribution and marketing activities.

4.2 Actors and institutions

The innovation systems literature emphasises that a cluster is composed of heterogeneous actors consisting of organisations or individuals. These organisations may be firms (such as users, producers and input suppliers) or non-firms (such as universities, financial institutions, government agencies, trade unions and technical associations). Consumers, entrepreneurs and technologists are examples of individual actors in a sector. A similar composition of actors is reflected in the Sekinchan rice cluster. As shown in Table 4, the Sekinchan cluster operates in the presence of various actors which can be generally categorised into five main domains, namely, enterprises, intermediaries, researches, demands and support infrastructures, as indicated by the World Bank (2007).

Table 4 Main actors in the Sekinchan rice cluster

Type of actor / domain	Description
Enterprises	<p>About 360 famers (majority is Chinese) who are mainly third and fourth generation residents in Sekinchan. Locally owned multi-function millers or traders provide services such as renting of machinery and selling paddy seeds as well as pesticides and fertilisers. PLS Marketing (M) Sdn. Bhd. plays its role as anchor firm in strengthening the farming techniques and marketing capabilities of the farmers and promoting the cluster through tourism.</p>
Intermediaries	<p>The Ministry of Agriculture through the National Farmers Association (PPK) coordinates farming activities in terms of the distribution of government subsidies. The Federal Agricultural Marketing Authority (FAMA) provides mechanisms to help farmers ensure that their product is getting a fair return. Also, people's representatives uphold the economic benefit and social well-being of the farmers.</p>
Research	<p>Malaysian Agricultural R&D Institute (MARDI), a government-funded agency, provides research and development (R&D) to produce paddy seeds (i.e. MR220CL1 and MR220CL2), which are the main variety used by the farmers, techniques to sustain soil nutrition and the use of appropriate pesticides and fertilisers. Collaboration between MARDI and Universti Putra Malaysia (UPM) to enhance the quality of farming tools and machinery as well as new varieties of paddy. Also, there are significant individual efforts from the anchor firm (i.e. PLS Marketing Sdn. Bhd.) in knowledge sharing and demonstrating good farming techniques and machinery.</p>
Demands	<p>The main customers are local communities (including the districts of Sabak Bernam and Kuala Selangor) as well as local and foreign tourists who can purchase rice directly from the factories and small retail shops. The BERNAS Group, a corporation entrusted by the government, distributes rice nationwide, including Sekinchan rice, through registered rice brands such as JASMINE Super 5%, Cap Rambutan and Sekinchan Best. BERNAS currently controls about 24% of the paddy market and 45% of the rice demand. In addition, PLS Marketing Sdn. Bhd. also owns its network in marketing rice through its showroom and <i>99 Speedmart</i> – a local mini-market franchise.</p>
Support infrastructures	<p>Agrobank provides holistic financial services and banking facilities to farmers. Also, locally owned millers and factories provide machinery renting services and management of paddy land for farmers. Meanwhile, the government provides free irrigation services to the farmers through the Department of Irrigation and Drainage Malaysia (IADA).</p>

The overall performance of the rice cluster depends on the close linkages between farmers and various innovation actors such as customers, suppliers, competitors, government machinery, research agencies and financial institutions. In the case of the Sekinchan rice cluster, the linkages played a crucial role in establishing co-operation and partnership with alliance parties, sourcing external knowledge and information as well as funding for technological innovation. Strong connectedness among the main actors in each domain in Sekinchan has contributed to the success of the cluster. This can be observed in the existence of both formal and informal institutional settings within the cluster. The presence of locally owned anchor firms in knowledge sharing, marketing and promoting the cluster has contributed greatly. PLS Marketing Sdn. Bhd, a locally owned anchor firm (established by one of the farmers), has openly shared its experiences and knowledge about new technologies and skills in farming with the farmers. New farming knowledge and techniques were acquired from the Taiwanese and disseminated to the local people. PLS Marketing has established a paddy-processing showroom and opens its factory production line to all local and foreign visitors. In addition, PLS Marketing conducted research on its own on high-quality rice (e.g. fragrant and pearl rice) in its own paddy fields a decade ago. These hand-on experiments have improved the tacit knowledge of farming, which spills over to other farmers within the vicinity. In contrast to the government-linked companies (GLCC) and their affiliations, such as BERNAS, farmers felt that PLS Marketing was more trustworthy because it was initiated and owned by local people in the cluster.

In addition to relying on the fertiliser subsidies from the government, farmers were motivated to invest and use different types of fertilisers and pesticides, such as organic, urea and fruit fertilisers. The initiatives and determination to invest and use varieties of inputs provided farmers with knowledge of the best combination of inputs to use, especially in terms of fertilisers and pesticides and their effectiveness in increasing yield. Indeed, what distinguishes the Sekinchan cluster from the rest is that the farmers are highly disciplined in their daily work. They are meticulous and attentive in taking care of their paddy production system from its seeding process through rice yielding. In addition, the whispering system, which is fully based on trust, was introduced within the cluster. Millers, traders and machinery providers offer their services in advance, without the need for farmers to pay in advance. The spirit of loyalty is also emphasised in this context in which there is continuous engagement among the farmers, millers and other

service providers from seeding until the harvesting season. The bond of trust among farmers has made these types of arrangements possible. Knowing that the success of farming activities depends on collectiveness, the actors have developed a socially bonded system to realise its potential. The assistance and supports given by different actors in Sekinchan are not observed in other rice clusters. The strong social cohesiveness in Sekinchan is linked to the “pioneering spirit” (or “emigrant spirit”) which provides strong motivation for achievement. This spirit has underpinned the work ethic that is highly based on the achievement-oriented ability to adapt swiftly to changing circumstances and farming operations calculated to optimised output⁷.

Another feature of the Sekinchan cluster is the informality in technology transfer and knowledge spillover. The rice cultivation methods practiced by the Chinese farmers are shared with other farmers from various socio-cultural backgrounds, such as the Malays and Indian farmers. Knowledge sharing and the transfer of skills and techniques (particularly in terms of the selection of appropriate pesticides, fertilisers and machinery) through informal channels such as observation of good practices from neighbouring farmers, as well as kinship and non-kinship’s knowledge and tools sharing, are common. This can be seen in a number of cases in which newcomers who join the cluster, regardless of their socio-cultural background, are able to perform like other farmers. The key driver to make this happen is the strongly disciplined and determined work culture that has long been embedded in the cluster. This also showcases the importance of geographic proximity in determining knowledge flows among heterogeneous actors (e.g. farmers, millers, suppliers, supporting services) operating in a cluster. They hold the belief that they must be independent in increasing the yield as a whole, rather than solely dependent on assistance from the government.

Government agencies, especially the Ministry of Agriculture (MOA), Ministry of Rural and Regional Development, Department of Irrigation and Drainage Malaysia (IADA) and the Malaysian Agricultural R&D Institute (MARDI), to a certain extent, have played significant

⁷ Wu (1995) provides an excellent elaboration on the links among culture, social organisations and economic activities of a Chinese farming community in Sekinchan from the perspective of anthropology. The harsh and hostile conditions during the resettlement process (and the establishment of the new villages in which tight control were implied on their movement and food) after the Second World War helped in fostering the spirit of cohesion amongst the community.

roles in the development of the Sekinchan cluster. Brainstorming sessions between MOA's officers and farmers are held to improve the quality of the crops. Weaknesses and challenges the farmers face are discussed and solutions sought. On the other hand, MARDI has continuously conducted research to introduce a better paddy rice variety that can increase the quality and productivity of the yield. In short, both formal and informal institutions are crucial to the success and survival of a cluster. One key driver for the success of the Sekinchan cluster is the presence of a strong internal connectedness amongst the farmers. The interactive learning processes which are socially and locally embedded will be explored in the following sub-section.

4.3 Learning and technical capabilities building

Information gleaned through the interview sessions and observations in the field provides ample evidence to show that the success of the Sekinchan cluster is mainly due to decades of hard work, discipline and determination – particularly with respect to cluster members' values, attitudes and beliefs – to enhance productivity and overcome the social constraints farmers face. Meanwhile, farmers are receptive to change and alert to government incentives and assistance. Indeed, over the years, learning and technical capabilities have evolved due to the experimental nature of the farmers. In this respect, the experimental mind of one farmer motivates the others to collectively try new methods and techniques. Indeed, the sharing of practices speeds up the learning process and development of the technical competence of the farmers. Such hard work and determination are clearly shown in the yield gap concept, which includes, amongst other things, the following:

- Consolidation of the standard lots of 1.2 hectares into bigger farms of 30-40 hectares either through acquisition or lease – a concept of *mini-estate* for economy of size and efficient farm operation.
- Phasing out of the direct seeding practice and adopting mechanised planting by using the latest six-rowed transplanters to counter the weedy rice problem. It is precision agriculture giving 7 seedlings per point (14 plants eventually) with a planting distance of 25cm x 30cm (between plants and between rows). About 80% of the area in Sekinchan has adopted the practice of mechanised planting.

- Contract planting is commonly practised at a cost of RM1,100 per hectare inclusive of all inputs, and the transplanting rate is 2.5 hours per hectare.
- 200 kg per hectare (or 4 bags) of additional fertiliser 12-12-17-2+TE is being used. This type of fertiliser is much better than other fertilisers, including those provided by the government.
- Mechanisation is adequately supported with the current fleet of about 100 four-wheeled tractors and 5 combine harvesters in Sekinchan. The duration to complete the planting cycle of Sekinchan is 30 days. Farmers strictly adhere to the planting schedule.

Due to self-effort and robust commitment to improve productivity and high-quality yield, farmers in Sekinchan have triumphed in bringing in new technology and machinery as well new breeds of rice from Taiwan. A good example is the effort of PLS Marketing (M) Sdn. Bhd. to foster the adaptation of new and current technologies in both paddy farming in the paddy field and the rice production process at the factory. In this respect, PLS Marketing has initiated visits and collaborations with its Taiwanese counterparts without support from the government. As a result, modern paddy transplanters have been brought into the cluster and these facilities are made available to the farmers. At the rice factory, PLS Marketing has successfully introduced new technology and established automated production lines.

5. Discussion

The main findings provide lessons related to the current patterns of innovation in Sekinchan and the importance of social capital elements within the agricultural cluster. The findings are summarised below.

5.1 Patterns of innovation

In terms of innovation patterns, the findings from the Sekinchan rice cluster provide ample evidence to demonstrate that innovation activity in the rice cluster is characterised as supplier dominated, in which innovation is mainly non-technical and occurs through the assistance of suppliers (see Pavitt, 1984). In the case of Sekinchan, there are limited incremental innovations

in the form of technology acquisition from abroad by some of the machinery suppliers, wage labourers, field contractors and anchor firms (i.e. PLS Marketing). These incremental innovations are mainly in terms of machine and farming techniques that do not require high levels of technical knowledge and skill. In this respect, farmers are seen as 'passive' recipients of these innovations. Nonetheless, farmers are fast learners and can adapt quickly to the employment of new machines and techniques. The effects of geographic proximity in establishing a strong social capital community (such as relations of trust, norms and connectedness) that is conducive to the 'learning-by-doing' and 'learning-by-using' processes are the key drivers of this success (see Asheim and Gertler, 2005; Klerkx et al., 2010; Lundvall, 1992). On the other hand, R&D activities are only conducted by government institutions (such as MARDI and universities) and the anchor firm in the cluster. Table 5 provides a summary of the patterns of innovation in the Sekinchan rice cluster.

Table 5 Summary of the pattern of innovation in the Sekinchan rice cluster

Activity	Component	Source of empirical evidence	Activities implemented
Technological capabilities development	<ul style="list-style-type: none"> • Learning process • Main developer of innovation • Methods to protect innovation 	<ul style="list-style-type: none"> - Geographic proximity provides a platform for localised learning to take place and the availability of 'sticky' knowledge grounded in social interaction. - Mainly developed by the Taiwanese and acquired by the local factories, contractors and service providers at the cluster. R&D only at government institutions such as MARDI and universities, and a small number of local rice factories such as PLS Marketing. - Knowledge of farming and techniques is not unique and can be considered as public knowledge. Thus, no specific method is required for the protection of such knowledge and techniques. 	
Linkages and networks	<ul style="list-style-type: none"> • Source for transfer of knowledge and technology 	<ul style="list-style-type: none"> - Both internal (such as farmers' know-how) and external (such as R&D outputs from MARDI and universities, and Taiwanese firms) sources are made available to the farmers. 	
Institutions	<ul style="list-style-type: none"> • Sources of funds • Formal • Informal 	<ul style="list-style-type: none"> - Own fund, subsidies from government and bank loans from banks (such as Agrobank). - Mainly run by government machinery for various farming activities such R&D (e.g. MARDI, universities), marketing (e.g. FAMA, BERNAS), farmers' associations (e.g. PPK), banks (e.g. Agrobank) and infrastructure (e.g. IADA, municipal council). In addition, some private enterprises (e.g. suppliers, factories, contractors) are also playing their roles. - Cultural activities such as annual festivals, wage-labour and free-lance service providers, non-collateral small loan/debt on trust basis, ad-hoc committees established amongst the farmers' representatives to address problems faced by the farmers, and similar activities. 	

5.2 Elements of social capital

As for social capital, firms' acquisition of knowledge depends not only on the market or the hierarchy, but also on the social capital accumulated within regions through networks of interaction and learning (Landry et al., 2002). In this context, cultural space is important in that it allows the establishment of an institutional framework, that is, "sets of habits, routines, rules, norms and laws which regulate the relations between people and shape human interaction" in innovation and learning. Since learning and innovation are interactive processes, success closely depends on trust and other elements of social cohesion (Lundvall, 1992).

The study confirmed the importance of social capital in providing a greater and sustainable source of competitive advantage for the industry. As a small town, the cooperative spirit, trust and loyalty are strong among the Sekinchan people, who share a similar culture, traditions and beliefs due to geographic proximity. Most of the farmers know each other and their close relationship has been inherited from earlier generations. Indeed, the achievements of the Sekinchan rice cluster are built on the collective efforts of the entire Sekinchan community. Such collective efforts are clearly exhibited in the learning process and the sharing of both formal (i.e. know-what and know-why) and informal (i.e. know-how and know-who) knowledge. The strong utilisation and sharing of informal knowledge, in fact, enables the Sekinchan cluster to progress ahead of other clusters in the country. This observation is consistent with the viewpoint of Lundvall (1992) and Asheim and Coenen (2005) that tacit knowledge (or experience-based informal knowledge) is important because knowledge often results from experience gained in the workplace by doing, using and interacting. This eventually contributes to more concrete know-how, craft and practical skills required in the knowledge production and circulation processes. Also, this finding provides a clear case in which geographic proximity provides the context for innovation because of localised learning processes and 'sticky' knowledge grounded in social interaction, which has been debated in previous studies (e.g. Asheim, 2002; Gertler, 2004).

In addition, the social cohesiveness in the Sekinchan cluster showcases the importance of both internal (e.g. spirit and philosophy, cooperation climate and utilisation of tacit knowledge) and external (e.g. relations with suppliers, perception of government interventions and customer

relationships) components of social capital, as postulated by Westlund (2004). In regards to the roles of government intervention, various subsidies in terms of input subsidies, price subsidies and production incentives, among others, have managed to reduce the burdens of farmers. This is very much in line with suggestions that the government role as an innovation coordinator and mediator through continued funding is necessary (see Klerkx and Leeuwis, 2008, 2009). MARDI's production of quality paddy varieties is also gaining positive perceptions amongst the farmers. However, agencies such as BERNAS are seen as not able to play their mediating role's 'neutrality'; their role should be performed by an intermediary (see Morriss et al., 2006). In some cases, there is this same lack of trust and understanding between the cluster and the government in technological development. This might be due to the two parties' differing work culture and interests. As Parthasarathy and Chopde (2001) pointed out, the understanding of formal and informal organisations and their contribution to the construction of social capital is crucial in AIS.

5.3 Issues and challenges

Nevertheless, the cluster does face challenges. Key issues and challenges the Sekinchan rice cluster faced in its quest to upgrade the quantity and quality of crops, as well as the sustainability of the cluster in the face of intense competition from imported rice, are summarised as follows:

- An obvious disparity in perspective exists between cluster practitioners (especially the farmers) and policymakers with respect to the highly regulated rice industry in Malaysia, especially in regards to the fixed price of rice, rice varieties allowed for farming and rice importer permits. For policymakers, rice must be a controlled good, that is, the price of raw paddy rice and rice's selling price must be fixed to protect consumers. For rice varieties, farmers are only allowed to use paddy seed varieties that are approved by the government. Farmers are prohibited from farming, at their own choice and capacity, varieties that are not on the government's list even though there are better quality varieties available. The main reason given by the government is that intakes of rice variety without strict controls might lead to the spread of paddy diseases, which could affect the whole of paddy farming in the country. In regards to the rice import permit,

BERNAS has an exclusive permit to import fragrant and pearl rice, both of which are better quality (and have a higher selling price) than the rice produced in the country. Again, this arrangement is a government attempt to control the price of rice in the country.

In the views of farmers, government policy in fixing the rice price has made the industry unattractive, especially to the younger generation. Despite all the hard work, determination and discipline in producing better quality rice, government policy in regulating a fixed price for raw paddy rice and processed rice demotivates farmers from moving forward. Farmers are not convinced by claims that farming other rice varieties might result in transmission of rice diseases. Their main question is that if neighbouring nations such as Thailand and Vietnam can produce better quality fragrant and pearl rice, why can't Malaysia? By just allowing farmers to farm the MR263, MR269, MR220, MR220CL1 and MR220CL2 varieties, which are considered lower grade rice than fragrant and pearl rice, the cluster cannot compete with its competitors from abroad. Moreover, granting BERAS an exclusive permit as sole importer of fragrant and pearl rice from abroad raises the issue of monopoly and 'rent seeking' activities in Malaysia's rice industry.

- Despite the government providing heavy subsidies to the farmers with the aim of increasing productivity, the rice industry in Malaysia has yet to make progress. One clear piece of evidence supporting this assertion is that Malaysia is always a net importer of rice. As one of the world's most productive rice clusters, the success of Sekinchan should be seen as the result of best practices and a model that can teach other rice clusters, which will eventually contribute to the country's overall rice production. However, the government has not made a serious effort to foster the transmission of Sekinchan's best practices and model across the country, which eventually would stimulate the spillover of knowledge and skills across the various rice clusters.

The government's commitment in this context is crucial given that each rice cluster in the country is rooted in its predominant institutional settings. It is particularly important to

note that the community in the Sekinchan cluster is mainly Chinese, whereas other rice cluster communities are mainly Malay. Cross-cluster knowledge sharing and collaboration is rare in Malaysia because of (a) the existence of endogeneity concerns over several elements of the 'dark side' of clusters, such as exclusion of non-members, limited mobility, informal networks (or cliques) and monopoly of resources, and (b) the absence of a strong commitment from the government in driving cross-cluster development agendas. In a nutshell, these shortfalls showcase the current lack of 'soft' policies that foster cooperative relationships and "social contracts" among the members (see Aragón et al., 2012).

6 Conclusions and Policy Implications

As a supplier-dominated cluster, innovation activities in the Sekinchan rice cluster demonstrate the important roles of various suppliers, particularly machinery and service contractors, in introducing new farming techniques and skills to the farmers. The sustainability of the cluster is also built on endogenous drivers. Social capital, in this context, is considered a main endogenous driver that established a knowledge-sharing platform conducive to skills and technical capability development in the cluster. As one of the main elements of social capital, trust amongst the cluster communities that builds mainly through informal institution settings is the key determinant in social cohesion and cluster development. In the case of the Sekinchan cluster, the spirit of trust not only revolves around kinship but also is displayed in non-kin relationships. Thus, issues locked up in kinship obligations are not found in the Sekinchan cluster. The successful case of PLS Marketing establishing itself as the anchor firm in this cluster is one piece of evidence supporting this. Therefore, cluster development policies intended to stimulate innovation and skills development must address the 'soft' ingredient of facilitating relationships of cooperation. Room needs to be provided for the nurturing of local enterprises from the cluster since these firms will gain more trust from their communities than external firms (such as GLCs) that are 'mechanically' placed into the cluster.

As a cluster stems from particular historic, cultural and social roots (clusters as 'social technologies'), government intervention in cluster development should mainly focus on the role

of catalyst and thereby support existing and emerging clusters (see Arzeni and Ionescu, 2007; Steiner and Hartmann, 2006). The main message of the findings of this study supports the literature in cluster research suggesting that top-down policies aiming to construct clusters from scratch are often unsuccessful and government should refrain from trying to create clusters. On the other hand, good practices from a successful cluster should be shared amongst similar clusters regardless of the clusters' socio-cultural background. To realise this effort, the role of government as an intermediary in bridging the various clusters in the sense of collective capacity building should be enhanced. Thus, cluster policies must address the 'soft' substance of cluster activities which are socially embedded.

Government efforts to control the rice market are undoubtedly important with regards to national food security. However, an over-regulated market will cause the industry to lose its dynamic capability. This is clearly exhibited in the case of Malaysia's rice industry; the industry cannot survive without heavy subsidies from the government. In the view of Sekinchan's farmers, to sustain the cluster, it is more important for the government to initiate efforts that enable the farmers to increase their income (e.g. allowing the farming of higher quality rice, credits given to better quality crops). In this regard, public subsidies are only short-term solutions for the industry; they demonstrate that the industry is not competitive. Also, the presence of GLCs that crowd out competition among other industry players shows that the government plays conflicting roles as supervisory body, policymaker and trader.

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