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Fokkema, Jan Eise; Pennink, Bartjan J. W.; Simatupang, Togar M.

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Coordinating technology introduction and entrepreneurial activities in rural areas

Jan Eise Fokkema* and Bartjan J.W. Pennink

Faculty of Economics and Business,
University of Groningen,
9700AV Groningen, the Netherlands
Email: j.e.fokkema@rug.nl
Email: b.j.w.pennink@rug.nl
*Corresponding author

Togar M. Simatupang

School of Business and Management,
Bandung Institute of Technology,
Bandung, Indonesia
Fax: +62-22-2504249
Email: togar@sbm-itb.ac.id

Abstract: The main purpose of this research is to investigate how technology introduction projects in rural areas should be coordinated in order to achieve local economic development and the role of social capital and entrepreneurial activities. Characteristics of three approaches were considered including top-down conventional coordination, communities of practice (CoP) and social entrepreneurship. Previous literature suggests the last two methods can lead to increased bridging social capital, which generates a relationship between social and commercial entrepreneurship. By qualitatively researching two successful case studies in Indonesia, it was found that for a top-down approach using CoP elements, bridging social capital was developed leading to both profit and non-profit entrepreneurial activities. However, the reverse was also found, even though it was less obvious. For a top down approach with a local leader functioning as a social entrepreneur, bridging social capital was also developed leading to both profit and non-profit entrepreneurial activities.

Keywords: social capital; entrepreneurial activities; technology push; cultural capital; coordination; communities of practice; CoP; social entrepreneurship; rural.

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Biographical notes: Jan Eise Fokkema holds a Master in Technology and Operations Management and is currently a PhD candidate (University of Groningen, the Netherlands). He has experience in conducting research on technology introduction and operations management. His research interests include local economic development, technology introduction, entrepreneurship, logistics and operations.

Bartjan J.W. Pennink is an Assistant Professor at the Faculty of Economics and Business in the University of Groningen, the Netherlands. The focus of his research activities is on modelling the process of local economic development. For this work, he was able to collect data in Indonesia and in Africa, Tanzania. Besides his research, he teaches at the Master level on research methodology (see Jonker and Pennink, 2010, Springer Verlag) and teaches on organisational theory in a Bachelor programme. He has also coordinated several development projects in Indonesia and contributed to developments projects in Burkina Faso and Tanzania.

Togar M. Simatupang is a Professor of Operations and Supply Chain Management at the School of Business and Management in Bandung Institute of Technology, Indonesia. He has extensively published in logistics and supply chain management journals. He has been attributed the Highly Commended Award by Emerald Literati Network for his research in supply chain management. His current research and teaching interests focus primarily on supply chain management, logistics systems, value chain management, creative economy, design thinking, and entrepreneurship.

1 Introduction

Despite increasing globalisation, urbanisation and economic development at the global and national level, rural poverty levels are still higher than urban levels in most countries. Economic growth has in many cases not been accompanied by a similar decrease in inequality or poverty (Rodríguez-Pose and Tijmstra, 2009). The same applies to Indonesia, where rapid growth and reduction of poverty over the last three decades has been accompanied by rising inequality offsetting positive effects of consumption growth on poverty (Miranti et al., 2013). Therefore, recent research confirms the relevance of increased emphasis on economic development at the local level (Pennink, 2014; Reece and Sumberg, 2003). In attempting to achieve local economic development, technology transfer holds great potential in promoting innovation and competitiveness (Ramadani et al., 2016; Bennet and Vaidya, 2005). Coordinating this transfer is challenging as technology benefits are not always immediately evident to recipients, knowledge by institutions on technology diffusion methods can be incomplete and there is a tendency for communication difficulties between technology recipients and providers (Theodorakopoulos et al., 2012; Torres et al., 2004). Furthermore, cultural differences, lack of entrepreneurship and technical support have found to be common obstacles (Decter et al., 2007).

In explaining economic development endogenously, theories have included variables such as leadership, institutions and entrepreneurship at the regional level (Stimson et al., 2005) and empowerment, local leadership and entrepreneurial activities at the local level (Pennink, 2014). Furthermore, studies have found relationships between both entrepreneurial activities and the development of social capital with local economic development (Mandarano, 2009; Westlund and Adam, 2010). However, the role of social capital and entrepreneurial activities in coordinating technology transfer in rural areas has not been fully covered. Furthermore, the question as to how coordinating a technology push or introduction can aid in developing entrepreneurial activities and social capital towards local economic development remains not fully answered.

The main objective of this research is to examine what coordination approaches are most suitable in achieving local economic development in what context and the role of social capital and entrepreneurial activities. Accordingly, a conceptual model has been developed and tested with the help of the following research question: How should technology introduction in rural areas in Indonesia be coordinated, in order to successfully stimulate local economic development and what is the role of the combination of social capital and entrepreneurial activities? This question has been answered by considering the following sub-questions:

- 1 What does the literature say about local economic development in relation to introductions of new technologies?
- 2 What is the link between social capital and entrepreneurial activities in rural areas and what is its role in technology introduction and LED?
- 3 What coordination of technology introduction is there and who does it?
- 4 How can technology introduction be coordinated in what context and what can be the role of social capital and entrepreneurial activities?

This paper continues by reviewing relevant literature and developing a conceptual model. The next section presents research method and main findings. The last section provides concluding notes of this research.

2 Theoretical background

2.1 Local economic development

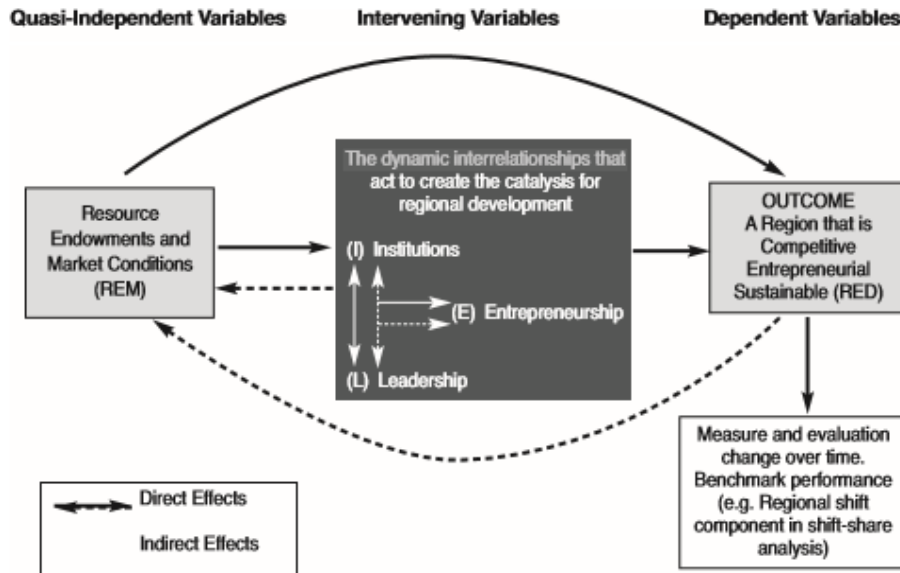
This section will aim to answer the first sub question: What does the literature say about local economic development? Important scholars in the field of local economic development, Stimson et al. (2002), provide the following definition of regional economic development: “Regional economic development is the application of economic processes and resources available to a region that result in the sustainable development of, and desired economic outcomes for a region and meet the values and expectations of business, of residents and of visitors.” Over the long term, local economic development aims to internalise a process which will ensure a competitive and entrepreneurial region or city that achieves economic development (Stimson and Stough, 2008; Stimson et al., 2009; Fredriks et al., 2014). The same definition will be applied to local economic development (LED) in this paper.

Approaches to regional economic development and planning strategies have evolved towards a concern for sustainability and quality of life, in which a shift occurred from exogenous to endogenous growth theories and regional self-help (Stimson and Stough, 2008). This paper takes a similar perspective towards local economic development and will use the model of Stimson et al. (2005) on regional economic growth as a starting point in developing this theory further.

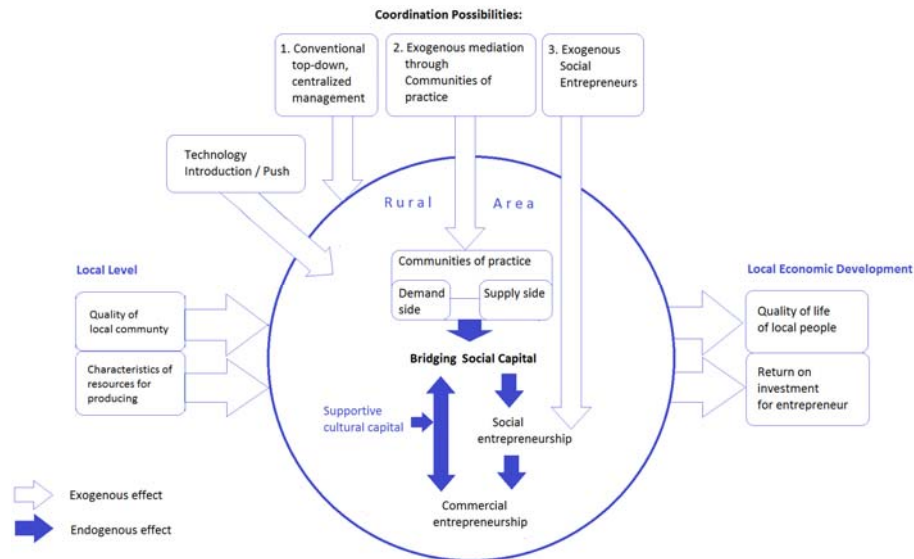
2.2 Regional economic development model by Stimson et al. (2005)

The endogenous economic growth model of Stimson et al. (2005) on regional economic development provides a useful starting point in developing the theory in this paper. In their model, a virtuous circle is proposed in which institutions and proactive and strong leadership enable a region to better use its internal resource endowments and achieve improved market fit. Consequently, this should make the region more competitive and entrepreneurial and lead to sustainable economic development. The portrayed relationships can be both direct and indirect. Stimson et al. (2005) suggest these to be dynamic and evolve over time and shape a city or region accordingly. The interaction between the intervening variables can create more effective and efficient resource utilisation of a region’s resource endowments and allow capturing increased market opportunities.

Figure 1 The Stimson et al. model on regional economic development



Since this model focuses on the regional level, some elements are not included because of the regional level of analysis. Applying it to remote areas entails including local actors (Pennink, 2014). The model of Stimson et al. (2005) has been advanced to the local level by Pennink (2014) portraying the same relationships. However, they now include local actors and associated new intervening variables namely empowerment, local leaders, entrepreneurial activities and its human coordination, which are interrelated. The importance of the role of the local actors is also found to be significant with regards to technology adoption by farmers in undeveloped rural areas (Reece and Sumberg, 2003). Both models are advanced by this paper in Figure 2 to include other variables and providing a framework for coordinating technology introduction. In order to do this, the concept of social capital will first be elaborated and its role in technology introduction and LED explained with existing literature.

Figure 2 Coordinating technology push towards LED (see online version for colours)

Source: Adapted from Stimson et al. (2005) and Pennink (2014).

2.3 Social capital

This section on social capital will aim to answer the second sub question: What is the link between social capital and entrepreneurial activities in rural areas and what is its role in technology introduction and LED? Social capital is an important variable which is neglected in the Stimson et al. (2005) model on regional economic development. However, recent literature on social capital suggests its importance to economic development and growth (Mandarano, 2009; Westlund and Adam, 2010) and is therefore used in the conceptual model proposed in this study (Figure 2).

Social capital can be described as resources or value embedded within the relationships between actors which are available through, and derived from the network (Gedajlovic et al., 2013). These can create mutual benefit by identifying with norms and networks of cooperation, reciprocity and trust (Christoforou, 2013). At the individual or local level, it is described as the ability to access resources through relationships (Estrin et al., 2013). From a conventional view, trust and reciprocity play a prominent role in social capital and networks.

In developing the theory in this paper, it is important to distinguish between two aspects of social capital, namely bridging and bonding social capital. With bonding and strong-tie social capital, there is high cohesion within small groups (Gedajlovic et al., 2013). Connections are strong and the actor emphasises developing existing ties further, resulting in trust and cooperation. Social capital is here a collective good from which all the actors benefit. Positively, it is associated with increased opportunity identification, in which market prospects potentially lead to increased performance outcomes. However, there are also negative effects associated with strong-ties. Increased cooperation can lead

to the exclusion and hostility of outsiders, possibly reducing performance outcomes and economic development.

Bridging social capital on the contrary, refers to weak ties based on impersonal relationships between strangers who share a common interest (Baker et al., 2011). It enables contact and collaboration among members of diverse and previously unconnected groups and can be seen as ‘persons who generate profit by being in between others’ (Estrin et al., 2013; Gedajlovic et al., 2013). In the literature, bridging social capital is associated with positive performance outcomes. With the emergence of a growing radius of trust, more external effects can be internalised, strangers are no longer seen as outsiders and societal norms of cooperation emerge (Estrin et al., 2013; Westlund and Adam, 2010; Putnam, 2000). Since much of the literature on social capital has regarded problems associated with bonding capital an important issue in obtaining positive outcomes, bridging social capital is argued to be an important variable in the process of achieving local economic development. Therefore, it is incorporated in the conceptual model proposed in Figure 2.

2.3.1 Social capital, entrepreneurial activities and the role of social entrepreneurship and cultural capital

This section reviews relevant literature on the link between social capital and entrepreneurial activities and considers the role of social entrepreneurship.

Entrepreneurship

Entrepreneurship in the context of rural development can be described as the propensity to engage in start-up enterprises and its execution with the aim of generating profits. Entrepreneurial activities refer to the activities associated with engaging in start-up enterprises. In order to achieve LED, it is important for local villagers to engage in entrepreneurial activities, because it organises economic activity and provides the basis for economic development. It is therefore included in the conceptual model proposed in Figure 2.

The link between social capital and entrepreneurial activities

Links between social capital and entrepreneurship have already been established by scholars. Firstly, Baker et al. (2011) found a reciprocal relationship between network-based social capital and social entrepreneurial activities, in which ‘self-organising’ emergence and development of dynamic community networks stimulate and sustain entrepreneurial activities. Furthermore, positive reinforcing feedback loops are created as entrepreneurial activities may generate more internetwork activity (Baker et al., 2011). Consequently, a virtuous cycle emanates where entrepreneurship in turn builds upon the social infrastructure within a community. Bauernschuster et al. (2010) also found that access to social capital stimulates entrepreneurship in small communities by helping entrepreneurs to overcome resource constraints and that this effect is stronger in small communities. Due to lower transaction costs and access to information, entrepreneurship is supported. These relationships are illustrated in Figure 2.

The 'dark side' of social capital

As mentioned earlier, it is important to note that social capital can also have negative influences on entrepreneurship and performance outcomes and is specifically associated with bonding-social capital. This so called 'dark-side' entails increased costs of developing and managing network relationships (Gedajlovic et al., 2009). Furthermore, it might also lead to corruption and/or the prevalence of monopolies. Therefore, it is important to observe whether or not such social problems arise when coordinating technology introduction in rural areas.

The role of social entrepreneurship

Social entrepreneurship has been recognised by the literature as a coordination approach that can facilitate community development by building both social capital and commercial entrepreneurship (Basu, 2012). Furthermore, it can also be seen as a form of entrepreneurship initiated by the local community. Moreover, it has not yet been explicitly considered in coordinating technology introduction. Because of its relevance with the aim of this study, it has been included in the theory proposed in this paper (Figure 2).

The theorised reciprocal relationship between social capital and entrepreneurial activities is supported by considering the role of social entrepreneurship. Social entrepreneurship can be described as a socially motivated form of entrepreneurship that aims to alleviate social problems, including poverty, discrimination and exclusion (Estrin et al., 2013). Firstly, Basu (2012) found that social entrepreneurship in a rural developing context stimulates the development of new social capital as outside social entrepreneurs can 'motivate and organise villagers as a group to participate in developmental activities' by following an enabling leadership style which is both assisting and facilitative. This will also create enhanced sustainability of the developed social capital, especially since associating with outside leaders is common in Asian contexts (Basu, 2012). Local people that are poor and disadvantaged that set up 'self-help' social enterprises are constrained by internal high bonding social capital that is overshadowed by low levels of bridging capital with other outside groups and networks (Bhrádaigh, 2009). Therefore outside intervention of highly educated social entrepreneurs can enable local people to bridge with outside groups and networks more easily (Bhrádaigh, 2009).

Secondly, social entrepreneurship tends to precede commercial entrepreneurship and proved important in developing entrepreneurship capital. By marshalling resources and gaining legitimacy during social entrepreneurship, private entrepreneurs face less challenges to exploit opportunities (Bhrádaigh, 2009). This is confirmed at the national level by Estrin et al. (2013) in which a higher national rate of social entrepreneurship increases the likelihood of commercial entrepreneurship.

Cultural capital

In the context of coordinating exogenous technology push, local culture is something that may not be overlooked, especially in a rural context. Therefore it has also been included in the conceptual model of this study (Figure 2). Light and Dana (2013) found that entrepreneurship is only promoted when supportive cultural capital is in place. This is relevant for this study, because traditional forms of culture tend to be prevalent in rural

areas in Indonesia. Not every culture values entrepreneurship, in which case the relationship between social capital and entrepreneurship is not positive.

2.3.2 The role of social capital and entrepreneurship in LED and technology push

After having explained the concepts social capital, entrepreneurial activities and social entrepreneurship and cultural capital, this section will consider their role in LED technology push using relevant literature.

The role of social capital in LED and technology push

Much of the recent literature on the relationship between social capital and economic development found contradictory results on the national level (Ramadani et al., 2016; Westlund and Adam, 2010). However, on the individual firm-level a strong relationship between social capital and entrepreneurship and economic performance is found for different measures of social capital such as ‘trust’ and ‘associations’. In general, the reasons for this positive relationship are attributed to reduced transaction costs and amount of resources needed for detailed contracts, controls, and surveillance. Developing social capital may therefore contribute to achieving LED.

The role of entrepreneurship in LED and technology push

With regards to the relationship between entrepreneurship and economic development, the literature overall suggests a positive relationship at the regional level as well. Similar as social capital, Audretsch and Keilbach (2005) found that entrepreneurship capital positively affects regional economic performance, measured by labour productivity. Entrepreneurship capital refers to capacity of a society to generate new firms (Audretsch and Keilbach, 2005). Therefore, policy measures stimulating the establishment of entrepreneurial capital should be considered. Furthermore, Acs et al. (2012) found that entrepreneurship has a positive and systematic impact on economic growth by providing knowledge spillovers. Decter et al. (2007) found ‘lack of entrepreneurship’ an important barrier in transferring technology, suggesting that entrepreneurship may facilitate the adoption of new innovations. From the above literature, it can be argued that stimulating entrepreneurship can both improve local economic development and increase technology adoption rates.

Technology push and local economic development

Regarding the concept of technology push, this study will follow the definition of Herstatt and Lettl (2004) describing a situation in which an emerging technology or a new combination of existing technologies provides the driving force for an innovative product and problem solution in the market place. Literature that links technology push with local economic development is only scarcely available (Gërguri-Rashiti et al., 2016; Fredriks et al., 2014). Especially, at the local level and in the specific case of local economic development in rural and lower developed regions. Furthermore, specific research on how social capital resources can be mobilised and how entrepreneurial activities can be motivated in a technology push situation in a rural undeveloped area is limited. It is clear however, that new technology plays an important role in regional

economic development. Recent work by Audretsch et al. (2013) established a link between university-based knowledge and technology and regional economic development also through knowledge spillovers. These relationships are also illustrated in Figure 2.

However, simply introducing new technology does not automatically ensure local economic development. In the specific context of technology push into undeveloped rural areas, coordination and planning are essential as many associated challenges have to be overcome. 'Lack of entrepreneurship', cultural differences between the technology provider, and recipients and moderate technical support are generally found to be important obstacles in technology transfer (Dexter et al., 2007). Moreover, recent research (Torres et al., 2004; Theodorakopoulos et al., 2012) on university to industry technology transfer in rural areas of Colombia found:

- potential recipients of new technology have difficulties in expressing their knowledge about the methods they use in appropriate language to those concerned with technology diffusion
- the benefits of new technologies are not immediately evident to these recipients
- the institutions have incomplete knowledge about the new methods and how to connect them with existing practices
- there is no systematic process in place to obtain information about how the technology transfer happens and to document the gains achieved.

2.4 Coordination possibilities in technology push in a rural context

In order to obtain a better understanding on how technology introduction can be coordinated, it is important to define coordination. This study will define coordination as a strategy or plan aimed at facilitating the process of technology introduction successfully, such that it will be adopted and will lead to local economic development.

With regards to coordinating technology introduction in a developing rural context, this paper considers several options, which are portrayed in Figure 2. These options are chosen, because they are best in line with the relationships described in this paper. That is, they may possess the ability to develop (bridging) social capital and entrepreneurial activities and thereby contribute to LED. The first option involves conventional diffusion approaches that assume a top-down centralised approach to coordination. The second option pertains to exogenous mediation and the use of communities of practice (CoP). Thirdly, coordination can be done by bringing in outside social entrepreneurs.

Traditional approaches to technology adoption

Firstly, traditional coordination approaches to technology adoption are considered (Figure 2). Recent studies that have focused on introducing technology in an agricultural rural setting are grounded on diffusion theory. This theory addresses issues relating to the steps, stages or episodes in the process of adopting innovations (Reece and Sumber, 2003). Important contributions come from Rogers (1983). Even though it is still being used today in the technology adoption process, such conventional approaches tend to assume technology driven, top-down and centralised methods according to critics. Furthermore, the theory implies that all innovations stem from a central source, in which

technology and research are of primary importance in technology diffusion and where the role of the recipient is passive (Reece and Sumber, 2003).

Communities of practice

The second coordination approach in the conceptual model of this paper (Figure 2) refers to CoP (Theodorakopoulos et al., 2012). In line with Pennink's (2014) proposition to include local actors, recently diffusion theory has also evolved to include the participative involvement of local actors. "Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" [Wenger et al., (2002), p.4]. They emphasise communities, practice, learning and meaning and thereby illuminating the learning process and facilitating the adoption of new technologies (Theodorakopoulos et al., 2012). The approach entails using exogenous brokers or mediators that 'bridge' the supply side (technology providers) with the demand side (technology recipients).

Firstly, the supply side in which brokers nurture a coalition CoP is concerned with diffusing technology to rural industry. This CoP should bring together all key stakeholders such as academic actors and regional government bodies concerned with technology diffusion. Balanced membership structures, agreed accountabilities, common agenda's and goals as well as action plans and assessment frameworks should be established. Such boundary objects should prevent harmful power relations and foster communal identification (Theodorakopoulos et al., 2012). Secondly, brokers should develop CoP relating to the demand side that comprise of the technology recipients. Brokers should administer workshops and assistance visits in order to interface with the recipients and identify demand side needs. Rationale, requirements, application modes and benefits of technology should be articulated (Theodorakopoulos et al., 2012). Furthermore, group and role divisions are common among the technology recipients, in which the mediators also constitute a CoP. Finally, NGO research and advisory centres should aim to optimise both components.

Scholars in this field suggest the success of CoP depends on the strength of the community, the quality of its boundaries and the health of the communal identity 'enabling the creation of new meaning and learning' (Theodorakopoulos et al., 2012). Furthermore, social participation is imperative in coordinating perspectives, interpretations and actions in realising higher goals. Success depends on the having common 'boundary objects' (e.g., agenda's, action plans and assessment frameworks) and the potency of boundary encounters (the extent to which these events allow meaningful interaction between CoP).

Outside social entrepreneurs

The final approach entails using outside social entrepreneurs motivating and training local people to become sustainable entrepreneurs themselves (see Figure 2). This approach entails bringing in outside highly educated social entrepreneurs that aim specifically at bringing social, economic and political change (Basu, 2012). According to Basu (2012), an enabling leadership style should be pursued, in which villagers are trained and educated in order to become self-reliant. This allows them to solve their own problems and not relying on government programs. Furthermore, the trust of villagers should be earned by the qualities of the social entrepreneur and hard work. This allows

them to 'motivate and organise villagers as a group to participate in developmental activities' and may even lead to the development and sustainability of enhanced social capital (Basu, 2012). As mentioned earlier, Bhrádaigh (2009) also advocates social entrepreneurship, because it facilitates the development of positive 'bridging' social capital. It is found that this will also lead to commercial entrepreneurship (Bradaigh, 2009). This in turn may lead to local or regional economic development (Audretsch and Keilbach, 2005; Acs et al., 2012).

2.5 Towards a framework of coordinating technology push in a rural context

After reviewing the above literature, this paper proposes a conceptual model (Figure 2) on coordinating technology transfer in a rural context. Stimson et al.'s model (2005) and Pennink's adaptation (2014) on regional and local economic development provide a useful endogenous economic growth theory. This theory can be extended by including neglected variables such as social capital and entrepreneurial activities and their interrelationships and including exogenous influences as well. The above literature allows theorising on how to effectively coordinate technology introduction in order to achieve local economic development (Stimson et al., 2009).

From the above literature, a conceptual model has been developed using the relationships found in the literature mentioned above (Figure 2). As found in the literature described in the earlier sections of this paper, the development of especially bridging social capital is found important in generating social and commercial entrepreneurial activity. Bonding social capital can be associated with negative social effects. If entrepreneurship is supported by supportive cultural capital, a vicious cycle can emanate resulting in the development of new social capital, increased entrepreneurship and local economic development. In its own right, social capital and entrepreneurial activity also positively affect local economic development. Furthermore, it is found that social entrepreneurship can lead to commercial entrepreneurship (Bhrádaigh, 2009). With the introduction and diffusion of new technology, it is important that these variables are managed in such a way that entrepreneurship and social capital are supported in order to achieve local economic development. Incorporating the work of Theodorakopoulos et al. (2012), CoP in which technology providers and recipients are bridged is suggested to be an appropriate mechanism in developing bridging social capital and entrepreneurial activities. This includes administering workshops and assistance visits. This interventionist approach involves the local community. These CoP are created and bridged by exogenous mediators who also constitute a community of practice. Furthermore, research on social entrepreneurship (Basu, 2012; Bradaigh, 2009) promotes using outside highly educated social entrepreneurs, in order to involve local recipients and to stimulate commercial entrepreneurship. In turn, this may lead to local economic development.

3 Research method

This research is executed by using a qualitative research design. First, relevant literature has been reviewed in an attempt to answer the research question with existing studies. Secondly, a conceptual model has been developed portraying these relationships. The

connections proposed in the conceptual model have been tested by employing two case studies that have both been successful in obtaining higher income and quality of life and that employ different coordination methods.

The first village is Margamulya; in the area of Pangalengan, West Java, in which a small communal corporation buys coffee from the coffee producing farmers. After applying for a grant to the Indonesian government, the corporation was given enough funds to build a processing plant and equipment that allows farmers to produce more highly processed coffee beans. The new technology consisted of a second pulp machine and related processing equipment in which the fruit covering the seeds/beans is removed before they are dried. This allows farmers to process coffee beans further and to obtain a higher place in the value chain of coffee production and leading to higher revenues. Coordination in this village is characterised as conventional and top-down, while employing CoP related elements.

The second village is named Lembang in West Java and north of Bandung, in which local vegetable and milk producers have been able to choose technological support from both the government program and a Dutch initiative named 'The Indonesia Domestic Biogas Program' or 'Biogas Rumah' (BIRU) by the NGO 'Hivos'. After having chosen BIRU, the local producers have been provided with digester technology to produce biogas and bio slurry from cow feces. This allows local farmers to reduce energy expenses by not having to buy LPG and increase revenue by selling abundant bio slurry, which can be used as fertiliser. Coordination can be described as conventional and top-down, with local leadership borrowing heavily from the social entrepreneurship approach. Villagers have been interviewed by means of a semi-structured interview, while observations have been made to support the data.

A typical case sampling strategy has been used in selecting cases. As suggested by Patton (1990), this sampling strategy is often appropriate in sampling villages for community development studies in Third World or developing countries. Since the community is the unit of analysis, it allows processes and effects to be described. The heads of the villages will be included in the sample as they possess important knowledge on the community as a whole. In Pangalengan, the corporation (local) leader, a machine operator, several farmers and the mother of a household have been interviewed. Moreover, in Lembang the local leader has been interviewed who is also a vegetable and milk producer. By interviewing typical cases and local leaders, the proposed relationships mentioned above are made clear. The results are compared and inferences are made to determine which coordination strategy is more effective in which situation and explain underlying mechanisms.

The data was collected using interviews and observations. Each question has been specifically constructed using concepts from the literature to investigate the relationships in the conceptual model. Questions and answers have been recorded and saved in text for further analysis and have been used to describe, categorise and compare the data. Firstly, fragments from the interview text have been 'coded' or labeled for both villages. Secondly, the codes have been portrayed and linked in a 'network view', in order to graphically display their interrelationships. Thirdly, a thick description was made to describe the issues and context. Fourthly, the codes have been categorised into families and compared. Finally, the findings are used to test and develop the proposed model in this paper.

4 Findings

This section will describe the data and findings from the interviews conducted in both villages. It will answer Sub-question 3: What coordination is there and who does it? Both projects provide valuable insights in the workings of the conceptual model in Figure 2. In both projects, the mechanisms illustrated in Figure 2 generally hold. Furthermore, the results have identified the important role of self-motivation and self-involvement of local farmers.

4.1 *Margamulya, Pangalengan*

The coffee producing project in Pangalengan represents a successful example in which a new, medium complex technology with appropriate coordination led to increased income levels, quality of life and economic development. After the self-establishment of the coffee corporation 'Margamulya', two government provided grants allowed the setup of a small factory and the purchase of land and advanced processing equipment. This enabled farmers to sell their products directly to one buyer (the corporation), which is then able to sell a more highly processed coffee bean on the international market and thereby increasing revenue and profits. Obtaining quality certificates allowed them to produce coffee with a high standard and increased their ability to compete internationally.

Coordination in this project can be classified as conventional and top-down, while borrowing certain elements from the CoP approach. One farmer confirmed the top-down part of the approach by quoting: "We get training from the trainers. With regard to coordination, this is it." It was stated that "People from the government were also present in the meetings", enabling bridging between government and farmers. After that, they were trained in separate groups, in which farmers were told "how to operate, produce and take care of the machine". Furthermore, the corporation leader stated that "the government's mission is to empower local people", indicating an emphasis on local involvement. Group divisions, uniting members and enabling participation and action confirm the complementing use of the CoP approach (Theodorakopoulos et al., 2012). Even though the corporation was not an external mediator, it does execute a similar function in bridging the government (constituting a CoP) with the farmers (which are a different CoP), as well as group divisions and role assignments.

It can be observed that bonding and bridging social capital was developed after the technology introduction. The central trainings allowed villagers to connect with others they had not known previously, also from other groups and villages. Interviewees reported: "trust between people has increased after the machine came". After the technology was in place, many farmers also explained an increased level of intergroup contacts, since trainings invited farmers from other groups. Farmers reported improved communication and improved and more consistent production and productivity as a result. Quotations include: "Our contacts became closer after the training, because we share more and talk about everything". Moreover, negative social effects generally associated with bonding social capital, such as corruption or exclusion of outsiders have not been reported.

Both profit and non-profit entrepreneurial activities increased as a result of positive bonding and bridging social capital. It was said that "inspiration and connections after the trainings have led to more people setting up businesses". Training provided motivations

and showed benefits which led to increased entrepreneurial interests. Even though it remains somewhat unclear whether or not connectedness has led to social entrepreneurship, in which development is the most important objective, it was reported that trainings were the most important motivator. Links between social entrepreneurship and commercial entrepreneurship have not been clearly established. However, the trainings itself have motivated both orientations. It was said that common goals also increased contacts and that both social and profit businesses led to more contacts. That is, bridging social capital has also increased as a result of entrepreneurship, even though support for this was not found to be very clear.

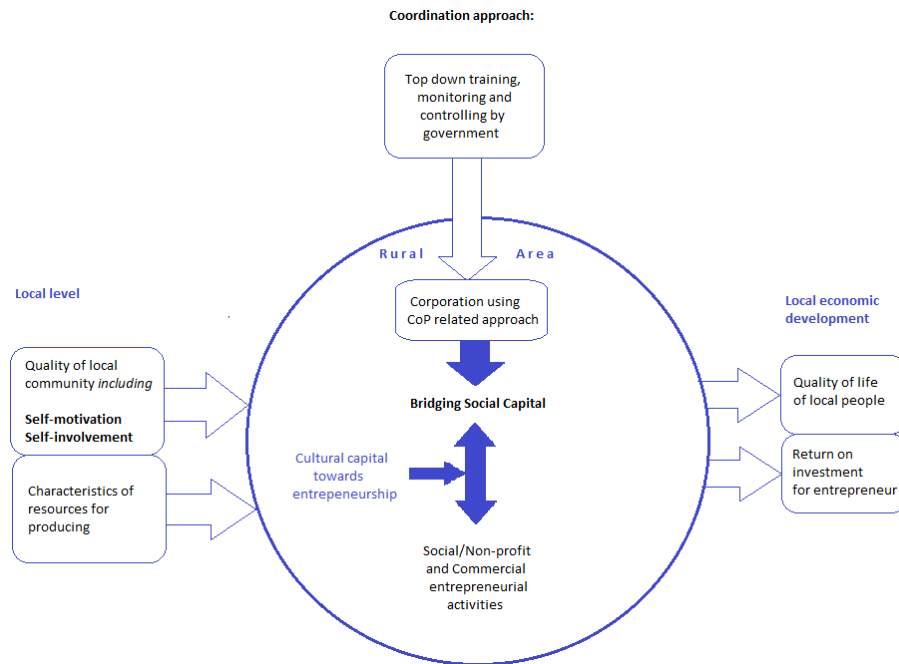
The presence of cultural capital for entrepreneurship has facilitated the relationship between bridging social capital and commercial entrepreneurship as higher income was highly valued and a cultural interest in setting up businesses allowed entrepreneurship to develop. It was stated that quality of life and income levels of the interviewees in the area has increased and as it was found that both trainings and the corporation have enabled the development of positive social capital and entrepreneurial activities. More patience, calmness, saved energy and increased happiness were reported as the corporation now provided a fixed and reliable selling point. One farmer stated: "I feel so calm and relaxed, because I know were to sell my product." Unequal incomes were only mentioned to occur for those not selling to the corporation. It is important to note however, that a real return on investment has not yet been obtained.

From the interviews and observations, self-involvement and self-motivation were two newly identified variables that were found to have an important role in the success of this project. Self-motivation refers to the extent to which someone is motivated by one-self to achieving goals, whereas self-involvement entails increased willingness to cooperate and learn and receptiveness to trainings. The community-initiated start-up of the corporation, the application for government support and the drive to learn more about increasing coffee quality are signs of high self-motivation and involvement. This was found to make the relatively top-down oriented approach more successful.

To sum up, the coordination approach in combination with the self-established corporation has proven to lead to positive bridging and bonding social capital, which positively influenced both profit and non-profit entrepreneurial activities. These relationships are illustrated in the updated model in Figure 3. The trainings were found to be the most important driving force. Villagers have showed high motivation to learn from trainings. Moreover, the initiative to receive new technology came from the corporation, which was set up by villagers. This high motivation to be active and participative together with supportive cultural capital has allowed a conventional coordination approach to be successful. The inclusion of CoP elements in which trainers used role divisions, goal setting, monitoring and controlling and motivating farmers to set up businesses has definitely played an important role in the success of the project. Social capital has developed without negative externalities, which has positively influenced both profit and non-profit entrepreneurial activities. An inverse relationship can also be observed, though it remains less clear. Quality of life has improved, with increased happiness and increased income without unfair income distributions. It was found that the motivation, participation and efforts of the villagers to produce a higher quality product, to develop the area and the presence cultural capital to set up businesses was of key importance in the success of a conventional top-down coordination approach. The inclusion of CoP methods facilitated the trainings. It can be argued that such a top-down

approach would not have been effective without these elements and active attitude of the villagers.

Figure 3 Top down training by the government with a locally established corporation using CoP related approach (see online version for colours)



Note: Coffee production in Margamulya, Pangalengan.

4.2 Biogas and bio slurry in Lembang

The project in Lembang represents a second example of successful technology introduction. It constitutes easy-to-use biogas technology that reduced LPG expenses. Furthermore, a self-appointed local leader discovered a second use. That is, using biogas residue named bio slurry as fertiliser and organic pesticides. It reduced waste and can be sold to others. Local leadership, increased income levels and reduced living expenses have led to better quality of life and are expected to produce significant signs of economic development.

In order to reduce LPG expenses for vegetable and milk farmers in many villages in Indonesia, the government and a Dutch NGO named BIRU provided a subsidy scheme in which farmers can obtain biogas technology. The government scheme is fully subsidised whereas the scheme BIRU requires monthly payments. However, the government does not provide training and its program is considered inferior to BIRU's program. Therefore, all farmers have chosen the last scheme.

Coordination in the project can be classified heavily as top down, borrowing from the social entrepreneurship approach, in which the social entrepreneur was not exogenous, but emerged out of self-motivation and self-involvement. Coordination from BIRU is

minimal, in which no rules are stipulated with only guidelines. The coordination itself does not borrow from the social entrepreneurship approach. However, one farmer took initiative to set up a corporation and act as a local leader. This was before BIRU offered its program. Her efforts are very similar to those of the outside social entrepreneur. When the trainings from BIRU were reduced, she began coordinating and overseeing the other farmers. The corporation she set up collected the bio slurry and resold it to other villagers. The revenues are then redistributed to the local farmers. Since she was already trusted by the others, she was able to motivate and organise them to participate in development activities. Based on observations, her leadership style can be described as enabling (Basu, 2012). Her efforts together with the training from BIRU has helped to make many villagers independent and self-organising.

In this project, positive bridging social capital was developed. However, it was not the direct result of BIRU's training, but from the efforts of the local leader. It can be argued that BIRU's central trainings may have helped to connect villagers that previously were unconnected. However, BIRU's influence on the development of social capital was found to be very limited, as most social connections were made as a result of the efforts of the local leader. It was stated: "She (the local leader) is the one who tried contacting other people from other villagers to promote bio slurry" and "There are more contacts with other villagers, because we are promoting and selling bio slurry to them".

The local leader had already set up the corporation, introduced bio slurry and promoted this to other villages. This allowed the farmers to sell bio slurry to other villages and increased bridging social capital. The success of the village has attracted interest from other villages and even other countries, which greatly expanded networks of the farmers and also increased bridging social capital. Furthermore, the establishment of the corporation has made locals more close by having a central point where they could ask questions and collect the bio slurry, contributing to bonding social capital. As more villagers decided to engage with BIRU and were helping each other, more intergroup contact ensued.

Both profit and non-profit entrepreneurial activities have increased as bio slurry was introduced and promoted by the local leader. As the interviewee reported, "she motivated everyone and created the bio slurry business model, both profit and non-profit oriented", it can be inferred that the efforts of the local leader in promoting and introducing bio slurry have led to this increase. That suggests that social entrepreneurship can lead to both profit and non-profit entrepreneurial activities. A positive relationship between commercial entrepreneurial activities and bridging social capital was also found. Success that arose from the bio slurry businesses generated interest by other villages and countries and enabled increased networking. Furthermore, sales to other areas increased networking as well, in which no negative social effects were reported.

Self-motivation and self-involvement was also found important in Lembang. BIRU's training schemes were top-down oriented and not highly involving local actors. However, self-motivation and self-involvement explained the establishment of a local leader with characteristics similar to the social entrepreneur. This leader inspired others to engage in entrepreneurial activities and highly involved the other farmers. As mentioned by the interviewee "BIRU is not able to manage it alone and is very attached and dependent on the local leader."

To sum up, the implementation of biogas and sale of bio slurry increased income levels with no unequal income distributions. These relationships are displayed in the updated model in Figure 5. The training by BIRU was considered to be of good quality.

However, it was not considered to be enough to be successful on its own. A self-involved and a highly motivated local leader emerged with social entrepreneurial characteristics that complemented the trainings by motivating the villagers. It can be noted that a social entrepreneur does not have to be exogenous. She suggested to sell bio slurry, promoting its use and sales to other villages and set up the corporation with a working business model. Accordingly, this form of social entrepreneurship positively affected bonding and bridging social capital as well as profit and non-profit entrepreneurial activities. In turn, a two-way relationship between increased bridging social capital and commercial entrepreneurial activities was found, in which cultural capital towards entrepreneurship facilitates this relationship. A positive relationship between bridging social capital and non-profit entrepreneurship was not found (see Figure 4).

5 Discussion

In the discussion section, the last sub question has been attempted to be answered: How should technology introduction be coordinated in what context and what is the role of social capital and entrepreneurial activities? Furthermore, the model proposed in Figure 2 will be advanced towards Figures 3 and 4.

With regards to the question on how technology introduction in rural villages should be coordinated, the findings suggest the following. The responses and opinions of interviewees outline that involvement of local actors in any case tends to create more successful outcomes than relying on only top-down, hands-off approaches, which is in line with developments in recent research (Pennink, 2014; Reece and Sumberg, 2003). Gërguri-Rashiti et al. (2016) also confirmed that the introduction of technology have increase the probability of firms to undertake innovation activities. Furthermore, the findings indicate that trainings and monitoring are a first step in making sure recipients become educated on using the new technology and adopt it. Furthermore, both cases indicate that monitoring is also important to success as trainers will be more involved in making sure everything is understood and corrections are made where necessary. Trainers in Pangalengan as well as the local leader in Lembang conducted monitoring. For any coordination approach, an emphasis on connecting previously unconnected villagers should foster networking benefits (social capital) and entrepreneurial activities. In turn, focusing on creating entrepreneurial activities may also increase bridging social capital, both resulting in local economic development.

Before choosing a coordination strategy, it is fruitful to evaluate self-involvement and self-motivation of local farmers as these were found to be highly important in the success of both technology introduction projects (see Figure 5). As in the case of Lembang, top-down oriented approaches may work when self-motivation and involvement is high. For example, a local leader emerged in Lembang as the result of at least one person being highly motivated and involved. However, such approaches are found to have limited contributions to the development of social capital or entrepreneurial activities. When self-motivation and involvement is limited, a top-down, hands-off coordination approach may not be successful. In this case, social entrepreneurs may be valuable in inspiring and activating local farmers, especially if in the form of local leaders who are able to motivate locals more easily. As in Lembang, this was found to develop social capital by teaching locals to be self-organising. This result corresponds with research in India on

self-reliance and social capital by Basu (2012). With higher levels of self-motivation and involvement, top-down approaches may be complemented with a CoP approach, in which technology recipients are bridged with the technology providers using trainers and mediators and where group divisions and uniting members making locals becoming highly involved.

Figure 4 Top down, centralised training with local leader acting as social entrepreneur with regard to biogas and bio slurry in Lembang (see online version for colours)

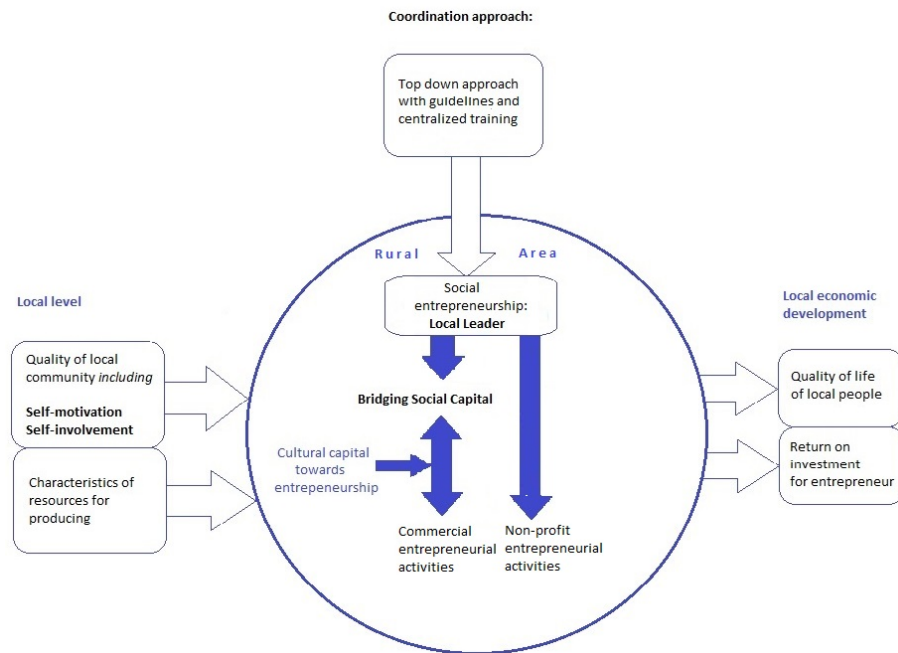
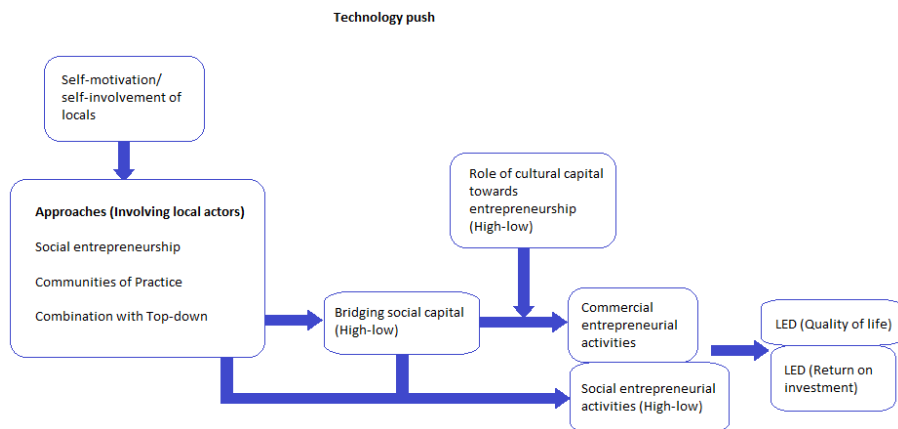


Figure 5 Causal model portraying general relationships found (see online version for colours)



Most of the relationships found in the literature and proposed in the conceptual model in Figure 2 have found to be existent after conducting research in the two villages. However, the results differ for both cases. For both cases, the model in Figure 2 has been updated into Figures 3 and 4 to reflect the new findings and interpretations from the field. Figure 3 refers to the situation in Pangalengan, whereas Figure 4 refers to the findings in Lembang.

In both villages, the presence of self-involvement and self-motivation have found to play important roles in the success of the coordination approach. Therefore, they are included in Figures 3 and 4 as one of other pre-existing characteristics of the local community. This variable along with ‘characteristics of resources for producing’ has already been introduced before in the model of Stimson et al. (2005) and Pennink (2014). From the findings in Section 4, the mostly top-down approach in Pangalengan by the government and the bridging role of the corporation has increased bridging social capital (see Figure 3). In turn, this fuels a two-way relationship between increased profit and non-profit oriented entrepreneurial activities and bridging social capital. This supports research by Baker et al. (2011) that found two-way positive feedback loops between social entrepreneurship and bridging social capital. Smith (2011) asserts that social networking and entrepreneurial identity is socially constructed to facilitate community-based entrepreneurial. Furthermore, the effect described by Bauernschuster et al. (2010) that access to social capital stimulates entrepreneurship in small communities by helping entrepreneurs to overcome resource constraints was also found in Pangalengan, in which farmers quoted: “After the machine was introduced, it was easier to get the necessary resources”, “the contact between people and trust became closer and bigger than before” and “people got inspired and people started setting up their own businesses more often”.

In Lembang (see Figure 4), top-down trainings with a local leader (social entrepreneurship) revealed a slightly different mechanism. The local leader caused an increase in bridging social capital and non-profit oriented entrepreneurial activities. For a non-profit orientation, a two-way relationship with bridging social capital was not found. However, the findings do reveal a two-way relationship between bridging social capital and profit oriented entrepreneurial activities. Cultural capital towards entrepreneurship was found to mediate this relationship in both Lembang and Pangalengan, which is in line with the study by Light and Dana (2010), who found that entrepreneurial activities are more likely to develop, if the local culture supports entrepreneurship. Arroyo-Lopez and Carcamo-Solis (2011) also found that social entrepreneur (SE) was characterised by individuals who strongly linked to a community and able to attract resources to create social value. In Lembang, quality of life has improved significantly and bio slurry and biogas are expected to provide returns on investment in the future.

With supportive cultural capital towards entrepreneurship, these interactions between entrepreneurial activities and social capital have contributed to LED in the form of increased quality of life and signs of potential return on investments in the future in both villages. This is reflected in both models (see Figures 3 and 4) under ‘local economic development’ and supports the findings of Westlund and Adam (2010) that found a positive relationship between social capital, entrepreneurship and economic performance on the firm level.

Based on our empirical results and reflections we can also improve our model into the direction of a more ‘causal model’ with variables (see Figure 5). This allows one to

get general insights in the way these variables interact. After evaluating local self-involvement and motivation, coordination strategies can be selected. These can positively influence bridging social capital and both social and commercial entrepreneurial activities. With the presence of cultural capital towards entrepreneurship, this may lead to local economic development. Other than selecting coordination approaches, making sure that villagers interact and will be making new connections as well as stimulating entrepreneurship can be considered important guidelines in the process of achieving LED.

Since this research was carried out in Indonesia, future research might undertake similar studies in other contexts and cultures, in order to find out the extent to which these findings can be generalised. Furthermore, future research may attempt to advance this theory by researching more specifically in what context, which coordination approach is more successful and by providing a more specific and actionable framework that can be used directly by technology providers in coordinating technology introduction in rural areas. Moreover, it is also recommended that future research investigates how culture affects adoption of new technology, the relationships found in this paper and local economic development and how coordination approaches might account for this. Finally, future studies may focus on the effect of different leadership styles on the relationship between social capital, entrepreneurial activities and economic development, when using the social entrepreneurship approach and extending research by Basu (2002) on this topic.

6 Conclusions

The relationships displayed in the proposed conceptual model of Figure 2 hold true with exceptions. It was found that coordinating technology push using a conventional top-down approach, can be successful under certain conditions. Firstly, self-motivation of local actors was found to be highly important as these existed for both projects. If coordinators do not involve local actors, these local actors should be motivated enough to become involved by their initiative. Secondly, borrowing elements from either the CoP or social entrepreneurship approach have also been found to increase chances of success. However, the results also suggest that only top-down trainings without local involvement may not be successful in the process of achieving LED, as motivation and self-involvement of local actors were found to be of key importance. The use of trainings and monitoring involving local actors provide a first step in coordinating technology introduction, as well as emphasising the development of (bridging) social capital and entrepreneurial activities.

The CoP approach provides a structured coordination method, in which farmers shared the passion of producing higher quality coffee and economic and environmental concerns. The project in Murgamulya, which combined CoP elements with a top down approach, led to increased income and a higher standard of living. These elements consisted of high local involvement in practice and learning and the establishment of group divisions where the technology recipients were interfaced with the trainers with workshops and assistance visits. The development of positive social capital has facilitated an increase in both profit and non-profit entrepreneurial activities. The reverse was found to be less clear. The presence of cultural capital towards entrepreneurship was existent

and has arguably enabled and mitigated the relationship between social capital and commercial entrepreneurship (see Figure 3).

As in Lembang, a top down coordination approach combining regular individual and group trainings with a highly motivated social entrepreneur was found to enhance both bonding and bridging social capital without negative externalities. Furthermore, it was also found to increase both profit and non-profit entrepreneurial activities. However, social capital was not found to lead to social entrepreneurship. This social entrepreneur does not have to be exogenous. In the form of a local leader, he/she will be able to gain trust and acceptance by other locals and has the ability to become highly involved, which can be seen as an advantage over using an exogenous entrepreneur. The presence of positive cultural capital towards entrepreneurial activities has also arguably facilitated the two-way positive relationship between social capital and commercial (profit oriented) entrepreneurship (see Figure 4).

This research confirms the notion by the development of economic growth theories that local involvement is of key importance in the process of achieving LED and its coordination. The role of social capital and entrepreneurial activities have found to be very significant as both projects displayed an important increase in their development as a result of self-involvement, CoP oriented trainings and/or local leadership, in which a higher quality of life was attained. It can be suggested that carrying out pre-research on local involvement, motivation and cultural capital towards entrepreneurship before introducing new technology can be fruitful in selecting coordination strategies (see Figure 5).

If local motivation, self-involvement and social capital is found to be high, conventional top-down methods are more likely to succeed than when these are low. Such top-down, guideline or rule imposing methods were found to have limited contributions to social capital. Therefore, it is suggested that such approaches are complemented in any case with other approaches involving local actors (such as CoP or social entrepreneurship). In case local leaders are present, a social entrepreneurship approach may seem more appropriate than a CoP approach, because CoP are more oriented towards bridging villagers directly with NGO's or government bodies using mediators. In this case, training and fully facilitating local leaders can help create successful outcomes.

When local involvement and motivation is lower or when locals possess less knowledge on the technology, social entrepreneurship approaches may also work well to enhance motivation and involving locals. On the other hand, when self-motivation and self-involvement is higher, CoP oriented approaches may be more appropriate. For any coordination method, emphasising the development of both entrepreneurial activities and social capital is found important in achieving LED. Furthermore, it might be important to investigate whether or not present social norms exclude negative social effects, in order to prevent the development of 'dark-side' social capital. Since this research is qualitative in nature, caution should be taken in generalising these findings to other technology introduction projects in different contexts. More research is necessary to confirm the validity of the relationships found and to provide more insights on the role of different contexts.

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