Building systems of innovation in less developed countries:

The role of intermediate organizations.

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1. Introduction

While a rapidly increasing number of the world economies are catching up and witnessing rapid technological development, most African countries are far behind with regards to the accumulation of technological capabilities, catching up and upgrading (Muchie et al 2003; Lall and Pietrobelli, 2002)[4]. Although Central American economies are generally more advanced than their African counterparts, they are still very much behind the curve in relation to more advanced countries in Latin America, Asia and especially the industrialized North.

There is consensus among academics and policy makers that innovation, understood in a broad sense, as embracing upgrading and capability building (Lundvall et al, forthcoming) is a crucial "ingredient" for development, especially in the less developed countries (Lundvall et al. 2006; Lundvall, 1992; Muchie et al. 2003; Intarakumnerd and Chaminade, 2007; Cummings, 2007;Lall and Pietrobelli, 2005; Schmitz, 2006; Von Hippel, 1988). The interaction between development and learning has largely been recognized by innovation system research and innovation has become the centre of analysis and debate around upgrading in developing countries (Lundvall et al 2006; Giuliani and Bell, 2005; Lee and von Tunzelmann, 2004; van Dijk and Sandee, 2002). Scholars in the innovation system tradition highlight that innovation is the result of interactive learning taking place between organizations located in a specific national, regional or sectoral institutional system (Edquist and Hommen, 2008; Balaguer, 2008, Lim, 2008, Ernst, 2007, Lundvall et al, 2006, Orozco, 2005).

The learning capabilities of a system are linked to elements of its social capital (Woolcock, 1998). The learning capabilities are likely to be higher in systems in which citizens regularly cooperate and engage in interactions with each other, that is, where citizens and organizations are part of stable networks characterized by mutual trust. In systems where

[4] Many African countries are considered as Less Developed Countries characterized by low levels of per capita income, human resource development and high degree of economic vulnerability. Half of the population is under the threshold of poverty, 40% suffers from malnutrition and hunger and 1 out of 4 Africans suffer from HIV/AIDS (Hassan, 2003). A large proportion of the population is excluded from the formal economy and thus is not reflected in any official economic statistics.

this is absent, or under-developed, this poses a severe threat to competitiveness and participation in the global learning economy (Lundvall and Borras, 1998). Thus, building linkages between different types of public and private actors involved in economic activities and encouraging interactive learning between them in order to upgrade their technological and capabilities and innovate, is essential for the performance of national, sectoral and territorial innovation systems and ultimately for catching up and sustainable development.

The nature of innovation systems in developing countries differs substantially from those in developed countries (e.g. Arocena and Sutz, 2000; Cassiolato et al, 2003, Lundvall et al, forthcoming; Altenburg, forthcoming). Typically less developed countries are characterized by deficient socio-economic infrastructure, weaker institutional frameworks and low levels of interaction. Formal institutional, legal and regulatory, frameworks are generally weakly developed and usually have less reliable enforcement mechanisms. The composition of sectors tends to be different, less diversified, with simple consumer goods (in food and clothing) being central in local manufacturing (Tybout, 2000), with a high degree of dependence on imported manufactured goods. Low levels of interaction among firms, as well as among different type of organizations (e.g. firms, universities, technology service providers) are typical. The limited number of innovative enterprises are often isolated and suffer from few upstream and downstream linkages in the value chain, as well as specific technology institutions in their field of expertise (Arocena and Sutz, 2001). Informality in business networks, dominated by micro-enterprises and small scale agricultural production is another key distinctive feature of the innovation systems in less developed countries (e.g. Bertelsen and Müller 2003), which is often linked to higher degrees of poverty (Altenburg, forthcoming).

Overall, scholars in IS research agree on the importance of understanding systems of innovation in developing countries as systems in construction (Muchie et al 2003; Chaminade and Vang, 2008b, Cummings, 2007), where most of the organizations are there, but where the critical linkages (user-producer, university-industry, etc), and the institutional set-ups that are needed to facilitate innovation, are still weak and fragmented. However, the literature hitherto has been rather vague on how precisely these systems are being or can be built.

The aim of this paper is to discuss the role of intermediate organizations in supporting different forms of interactive learning and capability building in small scale business initiatives in emerging innovation systems in developing countries, using data from Tanzania and El Salvador. It is argued that different types of intermediate organizations have played key roles in linking marginalized economic actors, to sources of knowledge and other resources that are essential for capability upgrading and innovation in both traditional and more differentiated economic activities. They thus play an important role in linking innovative activity, to maintaining and upgrading the quality of existing jobs in crisis, generating new ones where opportunities arise, providing income crucial for family wellbeing in countries characterized by low levels of human development and high levels of inequality.

Tanzania is classified as a least developed country. The national economy is primarily based on the agricultural sector. The Tanzanian agriculture constitutes subsistence farming with mainly smallholders cultivating up to 85% of the arable land. The majority of Tanzanians are currently either without education or only with primary school education. Most of them work as peasants or apprentices in small family enterprises. In general, even the more advanced firms do not have their own R&D departments, and only weak linkages with government R&D organizations and universities (Diyamett, 2005; Wangwe et al 2003). Indigenous SMEs are struggling with a lack of awareness regarding relevant sources for new and appropriate technology and with limited internal capacities to implement innovations (Mahemba, C.M.M. and De Bruijn, E.J. 2003). The national innovation system is characterized by its fragmented structure and only sporadic links among the different organizations (Mwamila and Diyamett, 2006). Intermediate organizations play here an extremely crucial task in linking relevant actors in the national innovation system to each other, and with international sources of knowledge and resources, as well as facilitating learning processes that could lead to greater innovation.

El Salvador, is an interesting case of how non-governmental organizations have driven innovation in different types of economic activities. El Salvador is a country classified by the UNDP as medium income, but characterized by a historically unequal distribution of wealth. Municipalities are not active in local economic development, rather focused on small scale, basic infrastructure investments. The state withdraw from territorial development during structural adjustment in the 1990s was especially evident in agriculture and small enterprise development. In general, most territorial economic development initiatives are dependent on

external funding for their operations. It is in this context, that intermediate organizations, especially NGDOs have been a driving force for trying to upgrade technological capabilities and introduce innovations in economic activities, production processes and products for national and international markets. NGDOs work to promote different types of economic initiatives in urban and rural economic sectors, with resources from international development cooperation, mobilized directly or as service providers for territorial economic development programs.

The paper is structured as follows. After the introduction the concepts of systems of innovation, interactive learning and intermediaries in less developed countries are reviewed. This is followed by a presentation of the data and methodology, which is then analyzed in the following section. The paper ends with some conclusions on the role of intermediate organisations in linking actors, enabling technology and knowledge diffusion and building innovation systems in less developed countries.

2. Theoretical framework

2.1. Systems of innovation in developing countries

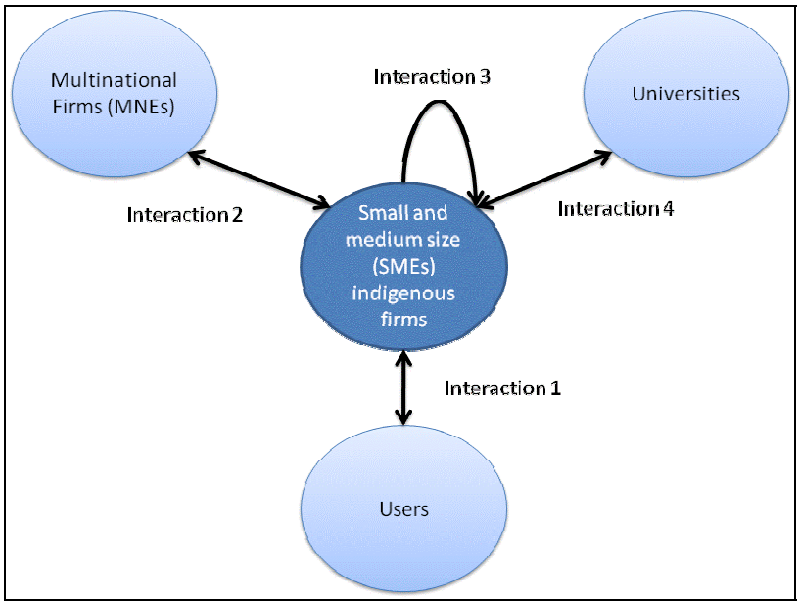
Knowledge is considered to be the most important resource and learning the most important process in contemporary societies (Lundvall, 1992). Without interactive learning between different actors, innovations could not come about, and thus, interactions between the different actors are of utmost importance for any system of innovation.

According to Lundvall (2007) and Jensen et al (2007) innovation can encompass two specific forms of learning. These are the STI (Science, Technology and Innovation) and the DUI (Doing, Using and Interacting) mode of learning. The STI mode refers mostly to codified knowledge, formal learning processes and learning through experimentation. STI modes of learning almost always results from formal training, interaction with science and research organizations (like universities) and R&D. On the other hand, DUI modes of learning refer to learning at the workplace and to the transfer of tacit knowledge resulting from the interaction with users. In both cases, establishing social capital in relationships and building networking capabilities to facilitate interactive learning among the different actors is crucial. However, in many developing country contexts, the nature and gaps between the respective

knowledge bases of different actors involved may be such as to require intermediary actors, to facilitate knowledge translation, distribution and assimilation.

In well functioning innovation systems both forms of interactive learning occur under a variety of agreements for mutual collaboration between firms and knowledge providers, leading to the acquisition of new knowledge and competences that can be applied to innovative practice. Broadly speaking the basic interactions in an innovation system are those taking place between a) user - producers, b) Multinationals (MNEs)- indigenous small and medium firms (SMEs), c) among SMEs and d) between universities and other public and private business and technical knowledge providers.[5].

Figure 1. Basic interactions in innovation systems (in developing countries)



Research on innovation systems has long called the attention on the importance of user-producer interactions stressing the role that they play in innovation and upgrading processes (e.g. Lundvall, 1998; Fagerberg, 2004; Castellacci, 2006 The user-producer mode presupposes that the interacting users and producers are both well equipped, in terms of in-house capabilities to absorb and benefit from the knowledge and information that is shared during the collaboration.

[5] Interactions in a system of innovation take place among all organizations in the system, not only the ones indicated in this paper. Firms learn through the interaction with financial institutions, with the Government, etc. For the purpose of this paper, we have opted to focus on those considered by the literature as most crucial for the acquisition of capabilities, particularly by indigenous firms in developing countries.

The interactions between multinationals (MNEs) and indigenous SMEs in systems of innovation in developing countries appear especially important taking the insufficient sources of local knowledge into account. MNEs are therefore potential providers of knowledge and technology (Dunning and Narula, 2004; Lall, 1996; Narula and Marin, 2005; Pietrobelli and Rabellotti; 2006) that may assist in upgrading (Chaminade and Vang 2007, 2008a, 2008b). The user in these interactions is usually the MNE and the relation between the indigenous SMEs (producers) and the users is here characterized by unevenness regarding how advanced the knowledge is, the amount of absorptive capacity that is available, what type of incentives exist and who is dominating even in terms of power (Pietrobelli and Rabellotti, forthcoming). The activities conducted by the indigenous SMEs are often in lower value-adding segments of their respective value chains, often dominated by hierarchical or quasi-hierarchical relationships between the MNEs and the dominant business governing the chains (Schmitz, 2006). Often, the MNEs have little incentives to interact with the domestic SMEs due to their lack of resources and their fear of losing sensitive knowledge (D` Costa 2006) and as indicated in the literature on spillovers from MNEs to domestic firms (Dunning, 1993; Dunning and Narula, 2004).

Interaction among SMEs is also an essential form of interactive learning in a system of innovation. The innovation system literature argues that interactions among SMEs (and with other types of organizations) occurs best if these are co-located in the same region as they are highly dependent on tacit knowledge, in which personal ways of interacting and transferring knowledge is important (Lundvall and Borras, 1999). This applies both for developed (e.g. Asheim et al, 2003;) as well as for developing countries (Giuliani, 2004; Giuliani and Bell, 2005; UNIDO, 2004; Pietrobelli and Rabellotti, 2006). However, in developing countries these interactions are often problematic as they are characterized by lack of trust, corruption in public services, regulatory enforcement and procurement procedures, and significant overlap in the production of non-differentiated products (e.g. D`Costa 2006)., Low levels of complementary specialization and limited knowledge of the potential benefits of associative, complementary, collaboration among SMEs, significantly restricts their collaborative potential, and results in opportunistic competitive behavior. .Although, many externally funded development programs promote associative business models, concrete examples of successful, innovative collaboration, that has resulted in significant gains in competitiveness are lacking, and small business owners frequently act on a must see to believe basis.

Finally, interactive learning processes also occur in university – industry linkages, i.e. between those who create and those who diffuse knowledge. There is extensive literature on interactions between university and industry (Mansfield, 1991, 1998; Salter and Martin, 2001), however its impact on innovation and firms innovative performance has been difficult to capture (Laursen and Salter, 2004; Fagerberg, 2004). Universities are crucial in interactions with industry both as providers of qualified human capital, on which industry is dependent not least for building up sufficient amounts of absorptive capacity, and as sources of knowledge inputs to innovative efforts. In the South, however, their efforts are frequently skewed towards teaching, frequently with significant rigidities in curriculum that are not necessarily in tune with business demands and entrepreneurial opportunities, and away from knowledge development and diffusion.

Given the weakness of the linkages between the different actors in systems of innovation in most developing countries, interactive learning dynamics are highly limited, putting further constraints on innovation and development (in addition to the lack of resources, the inadequate socio-economic infrastructure, poverty, corruption, etc.). Therefore, enabling different actors in the innovation system to interact with each other, and engaging in interactive learning processes oriented towards innovative efforts, developing networking capabilities and learning by doing, is a very important step in building innovation systems in developing countries.

While the literature on innovation systems has paid significant attention to the role paid by different forms of interaction in innovation and development, little has been said on how those interactions emerge and evolve. This is particularly true in development country contexts and between organizations with different knowledge bases and technological capabilities, and thus different levels of absorptive capacity, severe competition and lack of trust. We argue that intermediate organizations can play a significant role in reducing this gap and facilitating knowledge transfer, and the acquisition of capabilities between different organizations in systems of innovation in developing countries.

2.2. Intermediate organizations

As we have argued earlier (Szogs et al, 2008) intermediaries might play different roles in the innovation process as illustrated by the variety of terms associated with them, such as

intermediary firms (Stankiewicz, 1995), bridgers (Bessant and Rush, 1995; McEvily and Zaheer, 1999), third parties (Mantel and Rosegger, 1987), brokers (Hargadon and Sutton, 1997; Provan and Human, 1999), superstructure organizations (Lynn, et al. 1996) or bridging institutions (Sapsed et al 2007). Usually their main role is to compensate for weaknesses that exist in the innovation system of which they are part (Sapsed et al. 2007). Overall, an innovation intermediary can be defined as "an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties" (Howells, 2006: 720). Thus, innovation intermediaries are independent third parties engaged in collaboration between different actors and supporting different steps in the innovation process.

These intermediaries can act on a for profit basis, having identified an entrepreneurial opportunity filling a gap for some specialized knowledge service activity between paying customers. However, and especially in developing country contexts, these types of actors, tend to play a developmentary role, acting on behalf of the state or with resources from the international cooperation to support small scale business enterprises to gain access to knowledge and other resources necessary to initiative and sustain innovative efforts.

A framework to analyze the role that intermediate organizations can play in innovation is offered by Hoppe and Ozdenoren (2005). Overall, their key functions are to scan and gather information and to communicate this further to those in need of the information (Lynn et al, 1996 and Wolpert 2002). Intermediaries thus reduce search costs and other transactions costs for different actors operating in the system. Hence, their major task is the identification, location and absorption of relevant knowledge and to assist in its adaption to new applications, sectors or industries (Stankiewicz, 1995; Hargadon and Sutton, 1997; Hargadon, 1998).

By linking small scale businesses with other actors in the national systems of innovation, and even external actors, and facilitating their engagement in interactive learning processes, intermediate organisations are performing a fundamental overall task in building innovation systems in developing countries (Szogs, 2008; Szogs et al, 2008; Cummings 2007). Without this intermediation these different actors would have significant difficulties in collaborating, due to the distances between them. Thus, by facilitating contact between different actors, these intermediaries play a crucial role in initiating interactive learning processes. This differentiates the role they play in developing countries from those that they fulfil in developed countries, with well established systems, with strong linkages between most of the actors. In a developing country context, the role of intermediate organisations exceeds

that of compensating for weaknesses in system functioning, and could be more adequately characterized instead as building systems of innovation, creating new system linkages, constructing new networking and learning capabilities, fostering changes in the existing, formal and informal, institutional frameworks, frequently with explicit goals development goals related to employment and income generation, family wellbeing and human development.

Unquestionably, different intermediate organisations play different roles and tackle different tasks. In this paper, we analyze the specific role of different intermediaries in different forms of interactive learning between actors in innovation systems in lesser developed countries. The paper extends our previous research on Tanzania (Szogs, 2008; Szogs et al, 2008) to include another less developed country, El Salvador. The case study comparison provides greater insight into the extent to which intermediaries play similar roles in the process of innovation system construction, in very distant countries such as Tanzania and El Salvador. Additionally, it will allow us to better understand the extent to which the lessons learnt in each case can be generalized to other developing countries.

3. Method

The empirical material used in this paper was collected in connection with different cases in Tanzania and in El Salvador.

The Tanzanian material consists of interviews that have been conducted during a fieldwork in 2002 for the TIRDO case (Case 1) and an online survey and interviews conducted per telephone in 2007 for the interactions between the College of Engineering and Technology (CoET) of the University of Dar es Salaam (UDSM), the NGO Tanzanian Gatsby Trust (TGT) and a group of indigenous SMEs (Case 2). For the TIRDO case (Case 1) interviews were conducted with engineers at TIRDO, as well as intermediate managers and the director general. In addition to this both technicians, engineers and managing staff at two multinational enterprises were interviewed. For the TGT case (Case 2) the interviews were conducted with University researchers involved in the collaboration with the indigenous SMEs, representatives of the intermediate organization, and of firms participating in the collaboration with TGT in Tanzania.

The material of the El Salvador case (Case 3) has been collected between 1993 and 2005. This extended research process emerging from Cummings' work as a researcher for the FUNDE, an intermediate organization, no-profit foundation, supporting capacity building in El Salvador, and formed the empirical basis for his PhD thesis, defended at Aalborg University in 2005 (Cummings 2007) Theinformation was collected through several methods. First (period 1993-1997) a survey of family income and livelihood activities was carried out. Interviews were conducted with key persons and available documentary data was synthesized, to identify the needs of family livelihoods, community social and productive organisations, local development actors, their roles and specific activities. The second phase (period 1999-2001) involved specific qualitative research efforts to develop initial case studies of specific initiatives. Information was collected through semi-structured interviews with key people and available secondary sources such as internal economic data, project evaluations and other earlier studies (Cummings, 1992; 2000; 2001a). Finally, between 2002-2005 participant observation was conducted as part of work coordinated with the CORDES Bajo Lempa to elaborate a strategy to strengthen the economic initiatives and participation in different associational governance mechanisms promoting economic development in Tecoluca and its regional context; complementary interviews were carried out with key actors in the regional innovation system.

4. The role of intermediaries building innovation systems in developing countries

4.1. The role of intermediate organizations building user-producer interactions

An interesting example to examine the role of an intermediate organization in user- producer interactions is the case of The Grupo Bajo Lempa (GBL) consortium in El Salvador[6]. The GBL was formed in 2002 and is a consortium of social and economic organizations that emerged from the local development process in a group of what are now 50 communities (estimated 2, 500 families and 12, 500 people) in the municipalities of Tecoluca and Zacatecoluca[7]. The intermediate organization investigated in this case is a NGO: The CORDES Foundation (CORDES). CORDES has played a crucial role in the formation and maintenance of the initiatives that are integrated in the GBL. On a continuous basis this intermediate organization mediates between users and producers which are small producers and factory workers and other organisations who own processing and commercialization enterprises, many of them active in various fields of primary agricultural production and agro-processing.

Through processes of intermediation between the CORDES and the small-scale agro-industrial enterprises and associations of producer families and users interactive learning processes have been facilitated. These learning processes generated new knowledge and skills, improved networking capabilities, introduced new technological processes and in some instances products that are marketed nationally and internationally. For example, in the APRAINORES (Organic and fair trade certified cashew growing and processing initiative), the development of external networking capabilities has been a causal mechanism accounting for innovative practice. CORDES and the APRAINORES management have been working to leverage funds from state agencies and locally installed internationally financed development programs for complementary infrastructure, technical assistance and market

[6] For a detailed, comprehensive description of the case see Cummings (2001).
[7] The economic initiatives that are integrated in the GBL range from small- scale organic cashew producers, mall-scale milk producers that are the owners of a processing plant making gourmet European style chesses with European technology for national niche markets, small-scale sugar extractors to make granulated panela, a type of non-industrialized, unbleached, natural sugar, vegetable producers to El Salvador `s only biotech laboratory capable of producing (limited) commercial quantities of biological pesticide

studies, necessary to consolidate the technological transformations of the local producers to satisfy the demands of organic food by international markets. Additionally, CORDES has facilitated the relationship between APRAINORES, the national FRUTALES fruit development program, and the international experts from EMBRAPA Brazil, to provide expert technical assistance in both organic cashew cultivation and in the industrial processing operations. Recently APRAINORES acquired new machines for the delicate cashew shelling operation, which have dramatically increased productivity (percentage of whole nuts), which command a significantly higher price on the international market. CORDES, and the APRAINORES manager, have also played a key intermediation role between the associated producers and the international organic and fair trade certification agencies to negotiate the local application and compliance to these international certification regimes.

In sum, by linking users and producers, the intermediate organization in the GBL initiatives fulfills a decisive task as mediator. CORDES has actively worked for building and strengthening linkages between small-scale producers as suppliers but also owners of agro-processing and commercialization businesses. The majority of SMEs involved in similar agro-industrial and/or commercialization operations have vital linkages between the enterprise and the associated primary producers. These producers involve an important part of the raw inputs (cashews, milk, fruits and vegetables) that are processed and/or commercialized. A specific role of the intermediate organization in this specific form of interaction was to add value to local producers through small to medium scale agro-industrial processing and organized commercialization (and by this a more stable, better paying markets for local producers and the creation of local employment opportunities. Another important result of this interaction was the differentiation of products and production processes through a strategic emphasis on organic and fair trade certifiable products, as well as, production processes and associational forms of governance involving small-scale producers as owners.

4.2. Role of intermediate organization transferring knowledge between MNEs-local SMEs

In a different set of interactions, namely that between MNEs and SMEs we have investigated the role of a public R&D institute in Tanzania (TIRDO) that functioned as intermediate organization in mediating between these organizations (Szogs, 2008). TIRDO is a parastatal organization which operates since 1976 as an industrial research organization. Some of its tasks are the provision of consultancy services to industry and the support and use of local resources for the promotion of indigenous technology. Our case here illustrated the role of an intermediate organization (TIRDO) facilitating the transfer of knowledge between a multinational -Coca-Cola Kwanza Ltd.- and local manufacturers of stoves for households.

In the particular project that we have studied the Coca-Cola plant in Dar es Salaam approached TIRDO in connection with the need to meet the increasing demand of activity that they were planning. The MNE intended to improve the efficiency of the loading operations and for this they needed to assure that the added emissions from truck exhaust were not too high. The study started in October 2001 and was finalized in July 2002. The intermediate organization was therefore actively involved in studying the indoor air quality with the specific task to measure emission levels and to test whether workers health and security welfare was not threatened by the new plans. The knowledge directly acquired by TIRDO through the interaction with the MNE was further used for the measurement of emission levels from stoves used in households. The knowledge thus generated served as an input in the discussions with stove manufactures which eventually lead to a modification in their design (innovation).

4.3. The role of intermediate organizations facilitating interactive learning and upgrading of capabilities among indigenous SMEs

One of the traditional roles of NGOs in least developing countries is to stimulate the collaboration and transfer of knowledge among small firms, with the final goal of upgrading their capabilities, gaining access to markets (including international), facilitating the use of scarce resources, etc. In both our cases (Tanzania and El Salvador) we find good examples of such intermediation role. Often, in developing countries, small firms are collocated in the

same area or neighbourhood (as in the old guilds). They offer the same products (with almost no distinctive features) –so competition is fierce and unless there are strong family linkages (like Guanxi in China) trust is low and thus collaboration is almost inexistent.

The El Salvadoran Grupo Bajo Lemba consortium is a group in which many small SMEs are co-located and interact with each other. The co-location and in a sense formal membership to the consortium enables interactions and reduces problems associated with trust. Also, through the interactions with the intermediate organization (as already described in the first example above) the SMEs are diversifying their products. A good example of the impact on diversification is BIOTEC. BIOTEC has now diversified its offer from an initial organic fungicide – growth stimulant (Bio-Tric), to a new one that combats pests in sugar cane. Replacing chemical pesticides which are very environmentally damaging and costly, providing an alternative to a process similar to the pesticide treadmill that killed cotton as well as the environment in El Salvador.

The introduction of new technology can also support the upgrading of capabilities and the access to other markets, thus creating some differentiation with other producers. As a results of the cooperation with CORDES, a milk product processing plant has recently purchased some new equipment and began producing traditional Salvadoran dairy products, but with international technology and now hygienic and quality control standards, to compete for public procurement in hospitals and the like. Diversification to a higher demand although possibly less profitable market niche, to complement their initial focus on gourmet international style cheeses.

The intermediate organization CORDES Foundation in El Salvador has also played a key role in collectively upgrading local technical expertise. An important advance in this area has been the systematic formation of a reduced group of producers, trained to serve as "popular technicians," linked to the different production "lines" being promoted. For example, in the case of organic agriculture, a young local man has received specialized training and now carries a significant part of the work load for technical assistance. He has learned about organic production, visiting experiences in Central America and Cuba and also through trainings in El Salvador by experts that have put special emphasis on practical application. There is a similar case of a local man trained in the area of milk cattle production who is now part of CORDES technical staff and the BIOLACT cooperative's directive council. CORDES has also facilitated training for key people responsible for gourmet cheese production have also received international and national training in production and quality management

techniques, and also specialized training in Cuba for the biologists working at one of Central Americas only firms producing commercial quantities of biological pesticides.

Another effort to stimulate greater interactive learning among producer SMEs, was the promotion of on-farm participatory experimentation with producers concerning diverse techniques for vegetative grafting to renew unproductive trees, to select the genetic material to be used in renovating or replanting the cashew plantations, as well as, biological pest control and the production of organic fertilizer (Inverview with Tasso Hettershmidt, 2004). This process was promoted by an agricultural technician from a Dutch NGDO with a long term commitment to provide technical support to CORDES' agricultural program.

A similar intermediation role has been played by the Tanzania Gatsby Trust (TGT), facilitating interactions among SMEs. TGT contributed directly to the development of the SME Gatsby Clubs – an idea that is similar to the one of the GBL consortium regarding the co-location of SMEs in different regional areas. This co-location in the various regional areas in the different Gatsby Clubs is enabling easier interaction with mutual support, product development and reducing the lack of trust. At the end of 2006 six such clubs were formed. Another crucial action of the intermediate organization TGT was the implementation of training sessions to reduce the skill shortage of the indigenous firms participating in the Clubs. Two main categories of these training courses were: business management[8] and technology management.

4.4. Role of intermediate organization in university-industry - TGT, CoET and SMEs

The NGO TGT has introduced in the previous section, has also played an essential role in mediating between the University of Dar es Salaam and indigenous SMEs that became part of the Gatsby Clubs. An extremely important outcome of the mediating process of the intermediate organization in the university-industry interaction was to the task given to

[8] The main general management courses were: Networking with service providers, Problem identification and solving, TGTs financial service, Entrepreneurship, Entrepreneurs rights and advocacy, Marketing, Business planning, Management of small businesses, Resource mobilization, Record keeping and Quality assurance

students to develop their final projects at the university in areas that were crucial for the indigenous SMEs, i.e. specific problems that they are facing. Of these projects with important findings in particular two have had impressive results and therefore are mentioned specifically.

One of the results is the clarification of juice and wine using Pectrinace Enzymes which was adopted by M/s Solar Innovations. The other project dealt with the quality of Soymilk as influenced by the Blanching conditions and this was adopted by two companies –Abantu Food Products and M/s Soja Halisi Foods. Based on the outcomes of the student project the firms made a number of essential achievements and improvements such as the reduction of the loss of flour from a milling machine from 20% to only 2%, improvement of the qualities of wine, soya food, solar dried fruits, developing specialized technologies and machinery for some entrepreneurs, etc. A very important aspect of the students' consultancy to the specific agricultural units in the country was also that they contributed to creating a link between the university and its research and applications in the industry, a link that is generally not well developed in the Tanzanian innovation system. Additionally, the SMEs were also introduced to expertise from the University that could assist in the development of business plans for specific SMEs and to conduct research and development of new prototypes for the SMEs (TGT and CoET, 2006).

Another important initiative by the intermediate organization in order to link the University and industry was a series of local workshops for training and also for offering a crucial platform for networking with other SMEs located in the same area (thus at the same time also an important outcome of "intermediate organization-intervention" in SME interactions). The workshops have at a later stage developed into more advanced Technology Development and Transfer Workshops that both serve to raise awareness among the existence and capabilities of the stakeholders as well as the identification of technical gaps that SMEs were confronted with and for which the university could assist with solutions. A positive outcome of the workshops was also that they increased the interactions and the transfer of organizational and technological knowledge and experience.

Table 1 summarises the main findings of our research on the role that intermediate organizations have played supporting different forms of interactive learning and accumulation of capabilities in Tanzania and El Salvador.

Table 1. Role of intermediate organizations building innovation systems

Type of interaction	What the literature says	Common problems in developing countries	The role of intermediate organizations	Illustrative case
User-producer	Key for DUI modes of learning	The proximity with the user is lacking or users are not sophisticated	Translate the needs of sophisticated users to local needs	Ecological certification of farm products in El Salvador (Case 3)
Multinational-indigenous SMEs	Key in developing countries but not automatic transfer of knowledge. Different forms of governance lead to different learning possibilities	Different technological capabilities of MNEs and SMEs. SMEs lack the absorptive capacity to absorb knowledge from the MNE. SMEs in developing countries might be specialized in low added value activities in the value chain and linked to MNEs through hierarchical linkages.	Translate technological knowledge from MNEs to local needs	Transfer of knowledge from Coca-cola Kwanza Ltd. to local manufacturers of stoves for households in Tanzania. (Case 1)
University-Industry	Key for STI modes of learning	University research not linked to local industry needs. Lack of demand from firms or knowledge about what the university might offer.	Facilitate the mobility of students, with short stays in firms. Student projects based on needs of local firms. Facilitate technological training by university professors in firms.	Transfer of technological knowledge from the University of dar es Salaam to local SMEs in Tanzania. (Case 2)
SMEs	Social capital literature highlights that interactive learning among SMEs is crucial for innovation in clustered SMEs	No product differentiation. Exacerbated competition. Lack of trust.	Building trust. Setting platforms for collaboration among SMEs. Identification of common problems. Collective upgrading.	TGT Gastby Clubs in Tanzania (Case 2) Collective training to SMEs in organic production in El Salvador (case 3)

5. Conclusions

Current research on innovation systems in developing countries confirms the emerging, fragmented nature of the systems which can be viewed as still under construction, within fragile, dependent economies in transition. Often the system linkages that could exist between the various key public and private actors in these emerging national, and also sectoral and territorial innovation systems are weak, non-existent or in the worst case scenarios, characterized by exploitation, opportunistic competition, paternalistic and corrupting support with explicit political overtones, etc. Complementary specialization and synergy are rare qualities to be found.

This lack of continuous interactions, complementary specialization, and synergy emerging from interaction, reduces the possibilities for important interactive learning processes leading to capability upgrading and innovation. As analyzed in the key types of interactions existing in systems of innovation, intermediate organizations perform key tasks that have proven important in linking actors to each other, strengthening interactive learning and networking capabilities, and therefore contributing to establishing the well functioning system linkages between capable actors that are the building blocks of the innovation system as a whole. On a more micro level, important learning processes with outcomes in terms of increased knowledge, improved production processes; diversified products etc. were also revealed.

Linking the concluding discussion back to the theoretical synthesis on the different interactions in innovation systems, the literature on user-producer modes assumes that the interacting users and producers are engaging frequently and on the basis of equal preconditions in terms of resources as in-house human capital, equipment etc. The analysis of our case study material showed that the linkages with users in developing countries are not straightforward. Local users are not sophisticated, and thus do not provide the incentive to innovate, while most SMEs do not have direct contact to the most dynamic national and international users - consumers. The intermediate organization have played a crucial task in linking users and producers to each other. Their main role is to transfer information from the users to the producers (for example, the demand of organic products) and help them meeting that demand. Also, improved skills, networking capabilities and even product innovation are

the result of learning by interacting between small scale local business enterprises and other supporting and exogenous actors.

As the literature on MNEs-SMEs has demonstrated these interactions are potentially very important for the indigenous SMEs, as the MNEs represent crucial link to global flows of knowledge and generally more advanced technology. However, often the incentives of the MNE to support upgrading in the indigenous SMEs are limited, due to the low level of resources, absorptive capacity, networking capability etc of the local SMEs. As the experience of TIRDO (Case 1) has shown, intermediate organizations can play an extremely crucial role as mediators in these interactions, so as to materialize the real potential benefits that MNEs represent for the domestic industry. They form thus a particular mechanism for strengthening these interactions, so as to create win-win situations, enabling mutually reinforcing interactions and innovative synergy. In our cases the intermediate organization played a role facilitating knowledge transfer and assimilation, but they also supported the accumulation of capabilities, that could be applied to future innovative effort.

In the case of interaction among SMEs the main role of the intermediate organization was to enable and support linkages among SMEs. This demonstrated the crucial capabilities, enabling the exchange of critical knowledge necessary for technological innovations to come about. Also the intermediate organization initiated and offered platforms through which networking relationships could be established and developed, based on social capital accumulation. Finally, the case study analysis illustrates the role of the intermediate organizations facilitating the diversification of the local economic activities which, in turn, might enhance the collaboration of formerly competing firms, through complementary specialization.

In this paper, we have highlighted the potentiality of several different types of intermediary organziations to contribute to building systems of innovation in developing countries. This has important implications for public policy and development initiatives to support upgrading and innovation in SMEs in developing countries, explicitly recognizing their capabilities in establishing and developing system linkages, and the networking and learning capabilities that are key determinants of innovation system performance. However, the effective impact that such intermediation might have on learning, and especially innovation

towards business competitiveness, in local and internationalized value chains, and now in terms of resilience to crisis, is still to be further researched. Issues such as the sustainability of intermediate organization interventions with SMEs, or the capabilities of these organizations to capture and facilitate the dynamic local assimilation of exogenous knowledge and resources, in a way that builds off existing knowledge and capabilities, remain to be explored, in terms of their impact on learning and accumulation of technological capabilities. More research is needed on the determinants of the impact of such intermediation on learning and especially its translation into innovation and business competitiveness.

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