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Technological Capability Building in Informal Firms in the Agricultural Subsistence Sector In Tanzania: Assessing the Role of Gatsby Clubs

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Abstract

We use a case study approach to examine whether new knowledge and technological capabilities can be acquired by a set of informal firms operating in the agricultural subsistence sector in Tanzania as a result of interaction with the College of Engineering and Technology at the University of Dar es Salaam. We find that by becoming members of Gatsby Club, firms have been introduced to important new organisations which assisted in the process of new knowledge acquisition. Technological capabilities have mainly been improved but also been acquired; mainly at the basic level.

Keywords: Technological capabilities, knowledge acquisition, Informal firms, Agriculture sector, Tanzania,

JEL Classification: O30; O39; O55; D80; Q16.

1. Introduction

African countries lag behind when it comes to accumulating technological capabilities, upgrading and catching up (Muchie *et al.*, 2003; Lall and Pietrobelli, 2002). Technological competence is a set of dynamic resources, including skills, knowledge and routines needed to generate and manage technological change, including production activities, investment activities or the linkages with other firms (Bell and Pavitt, 1995). Related to this, Kim (1980) introduced the concept of "technological capability" which, he in a later work defined as "the ability to make effective use of technological

knowledge in efforts to assimilate, use, adapt and change existing technologies" (Kim, 1997: 4).

Following this definition, technological capabilities are the result of interactive learning processes and linkages between a number of actors such as firms (through collaborations both with complementary and competing ones), universities and research centres (Bell and Pavitt, 1993). The focus of the technological capability approach is on the ability to use available resources and competences.

Technological capabilities are essential "ingredients" for sustainable development Endogenous capabilities are necessary to build in order to be able to absorb, diffuse and use effectively technologies that have been developed elsewhere, as well as for adapting, improving and creating new technologies (e.g. Bell and Pavitt, 1993; Lall, 1993). While some indigenous capabilities always exist, in least developed countries (LDCs)[1] these capabilities are rather low or not well developed enough as compared to developed countries. This applies especially for those capabilities needed to develop new technologies and innovations and these countries therefore rely on various channels for technology transfer. Thus, "innovation" is not to be mixed with the term "technological capability".

Most definitions of innovation refer to the successful application of new knowledge in products and processes. One can differentiate between incremental and radical innovations where incremental innovations are consecutive changes and improvements in already existing processes and products. Contrary to this, a radical innovation refers to the introduction of a new process or product. Product and process differentiations constitute important distinctions of the definition of technological innovation. In addition to technological innovation, marketing innovations and organisational innovations are additional main types of innovations that the Oslo Manual specifies (OECD, 2005).[2] Technological innovations are to be distinguished from and not mixed with technological knowledge which is the focus of the case examined in this paper. Further, the OECD definition defines three different levels of "new": "new to the world", "new to the country" and "new to the firm" (OECD, 1996).

While 'new to the world' and 'radical innovation' tend to dominate in the developed world, in a developing country context, innovations are mainly of incremental nature. For example, the first South African innovation survey found that 86 per cent of innovations in the South African industry were incremental. These innovations often stem from adaptations of knowledge developed elsewhere; they may be new to the firm or the country rather than new to the world.

In LDCs, many of these incremental innovations result from interactions with foreign affiliates of MNEs (e.g. Dicken, 2003; Dunning, 1993; Reddy,

2000; Lall and Narula, 2004; Marin and Bell, 2006). Further characteristics of innovation in developing countries are the size and structure of the market, where most firms operate at suboptimal production scales with high costs.

Thus, in a developing country context we are mainly dealing with incremental innovations. Importantly, small scale industries are dominating and these mostly belong to the informal economy. It is therefore crucial to understand how technological capabilities can be built in the informal economy, and through which channel from the formal to the informal economic sphere this can happen.

As the agricultural sector is the leading sector of the economy of Tanzania, understanding the dynamics of knowledge and technology accumulation in this sector is particularly important. Over 80% of the poor live in rural areas and their livelihood depends on agriculture. Moreover about 80% of the population live and earn their living in rural areas with agriculture as the mainstay of their living and 20% live in extreme poverty. They depend on land for food production and livestock keeping, with many living in arid and semi-arid regions.

Moreover, in Tanzania these smallholder farmers are potentially the largest drivers of economic growth and they account for over 50 per cent of the country's Gross Domestic Product (GDP). However, there are several constraints facing the smallholder farmers in the agricultural sector. For example, they depend exclusively on rain-fed agriculture, their production is usually affected by bad weather, in addition to the fact that they live in areas with inadequate road infrastructure. There are low levels of technology and the use of modern agricultural technology is not a common practice. The outdated technologies hamper the growth of SMEs. Moreover, entrepreneurs are not aware where to obtain technologies and machinery suited to their needs and business. Furthermore, lack of cooperation between SMEs and other organisations that could provide technologies and machinery are limited. Further constraints are low labour productivity and little access to financial services such as inadequate research and extension services, dependence on rainfall, low utilisation of improved technologies, poor infrastructure especially roads, and weak network of input and output markets. These problems are further compounded by lack of financial services in rural areas, low and declining prices of most export commodities, protectionist tendencies in developed countries, limited processing capacity and technologies, and the HIV/AIDS pandemic which leads to loss of skilled labour. Issues of how to improve the situation, develop existing technologies and build technological capabilities is therefore crucial for a vital and dynamic development of this important sector (URT, 2002).

Current estimates show that Tanzania has more than 2.3 million SME businesses,[3] which have absorbed about 5 million workers, representing

close to 20 per cent of the country's total labour force. It is also estimated that at all levels, the sector absorbs more than 90 per cent of the 700,000 school leavers annually (URT, 2002).

Tanzania is the largest country in East Africa and among the poorest countries in Sub-Saharan Africa. Upon independence from Britain in 1961, Tanzania inherited a small and unvaried industrial structure, dominated by simple consumer goods and primary processing activities. However, since the late 1980s the country has embarked on a strategy to attract FDI in different sectors of the economy, particularly aimed at bridging the industrial, technological and knowledge gap (UNCTAD, 2001).

The agricultural sector is the foundation of the Tanzanian economy. Therefore, understanding innovation in this sector is of utmost importance. Agricultural products include tea, cotton, coffee, sisal, nuts, tobacco, corn, wheat, cassava, bananas and vegetables. The livestock production includes cattle, sheep and goats. Approximately 70 per cent of the crop area in Tanzania is cultivated by hand hoe, 20 per cent by ox plough and another 10 per cent by tractor. The main part of the agricultural work force is constituted of women. The agricultural output is mainly based on small holder production, i.e. small household farmers mostly operating in the informal economy. The majority of export earnings is gained through cash crops such as coffee, tea, cotton, cashews and sisal. The sector has linkages with the non-farm sector through forward linkages to agro-processing, consumption and export. It also provides raw materials to industries and a market for manufactured goods.

This research investigates what type of knowledge and technological capabilities can be acquired in the context of collaboration between the NGO - Tanzania Gatsby Trust (TGT), the College of Engineering and Technology (CoET) at the University of Dar es Salaam (UDSM) and a set of informal firms operating in the subsistence agricultural sector in Sengerema district in Tanzania.

The paper first presents the theoretical and analytical framework followed by a short discussion of the informal economy. Then, it presents the case study exploring the type of agricultural activities of the firms in the Sengerema Gatsby Club. And it continues with presentation and discussion of the case results. Finally, it concludes from the case and makes some policy suggestions.

2. Theoretical and Analytical Framework

The technological capability building framework has mainly enabled to study how technological capabilities can be built in developing countries (e.g. Lall, 1992, 1993; Bell and Pavitt, 1993, 1995; Dutrenit, 2004;

Padilla-Perez, 2006; Iammarino *et al*., 2008). It provides a useful taxonomy for assessing the process of building technological capabilities. The insights from these works comprise our analytical framework, and we have classified the type of capabilities accordingly into basic, intermediate and advances capabilities first followed by analyses at the functional levels: production, investment, and linkage capabilities (Lall, 1992).

The acquisition of capabilities (through universities or MNEs) into innovation systems has been emphasised as important for the formation of local capabilities (e.g., Göransson and Brundenius, forthcoming; Lundvall *et al*., 2009; Chen, 1996; Lall, 1986, 2001, 2002).[4] While international linkages can provide an initial catalyst for the development of domestic capabilities, local universities may also play a crucial role in this respect (e.g. Göransson *et al*., 2009; Mwamila and Diyamett, 2009).

The conceptual framework of innovation systems (Nelson and Rosenberg, 1993; Lundvall, 1992; Edquist, 1997) deals with the strategic use of interactive learning and economically useful knowledge. The underlying assumption of the innovation system approach is that innovations are far more than a series of isolated events and it is not just a linear process from basic research to product development. The process can be characterised as an interactive and dynamic framing over time (Kline and Rosenberg, 1986), and also demand matters. In this process, interactions between various components, such as institutions, public policies, science and technology occur. The patterns of these interactions are shaped by a country's institutional framework and knowledge infrastructure. Thus, the interconnections among various institutions and how they interact are crucial to the definition of innovation systems. Lundvall defines innovation systems as "elements and relationships that interact in the production, diffusion and use of new and economically useful knowledge" (Lundvall, 1992: 2).

Since innovation seems to play such a crucial role for development, it is important that regions, organisations and whole cultures not only are learning regions or organisations but that different organisations learn from each other, i.e. interact. Importantly, this concept stems from and has mainly been developed in developed countries (e.g. Edquist, 1997; Lundvall, 1992, Nelson and Rosenberg, 1993) and to a lesser extent in developing countries (e.g. Muchie *et al*., 2003; Mytelka, 2003; Mwamila and Diyamett, 2009; Lundvall *et al*., 2009) in which patterns of technological accumulation differ from those of the developed countries (e.g. Bell and Pavitt, 1997).

The research on innovation systems in developing countries points out that these are more open and dependent on external sources such as foreign aid and technology transfer through foreign direct investment. However, this literature addresses, maps and analyses mainly those actors interacting in the formal economy, i.e. in formal innovation systems.

A crucial issue that we only know very little about and that this literature does not deal with is that of the interactions and activities between actors in the formal and informal economy. Thus, studying capability building in the informal economy through a linkage with the formal economy has in innovation studies so far been very much neglected. Importantly though, most of the economic activities in developing countries take place in the informal sector. Therefore, it is important to study how technological capabilities can be acquired in the informal economy through interactions with the formal economy where relevant knowledge is available for instance at universities.

Based on and derived from the above, we address this gap in the literature and examine what type of knowledge was transferred through the university to the informal firms via the specific transfer mechanism of Gatsby Club, as well as what technological capabilities were acquired as a result of this collaboration.

3. The Informal Sector

In developing countries there exists a large local informal sector, which also generates substantial economic and employment activities. About 98 % of the human work force is in one or the other way engaged in the activities of this sector. Thus, there is a wide spectrum of economic activities that are "unmeasured, unrecorded and, in varying degrees, illegal (Brown, 1995: 217). In Tanzania this sector is referred to as informal or second economy and plays a crucial role in the livelihoods of individuals. All activities of the economy that are not registered in the statistics and beyond state controls and taxes are covered by this sector. The presence of this large second economy in Tanzania indicates that a different type of economic activity is present in these countries. It might therefore be difficult to "impose the norms of a system on persons who function according to the norms of another system" (Ndione, 1992). Thus, in an economy, where the mainstream activities are not registered, it might be difficult to get an adequate understanding of the dynamics of the innovation system if it only focuses on those parts of the innovation system that belongs to the formal economy.

Similarly, it has been apparent from structural adjustment programmes and various attempts to restructure the economic activities that various sectors of the economy are more or less immune to the economic rationality that is the basis of the industrialised political economy. Therefore, it is crucial to understand the dynamics of knowledge transfer and technological capability accumulation in the informal economy.

Individual entrepreneurs, family enterprises or small groups who organise themselves together with the overall aim of joint production are

dominating in the informal economy. These activities cover for instance vehicle repair, woodworking, hand crafts, paintings, clothing, shoe manufacture, construction, growing and selling vegetables and fruits. There are also many instances of local innovations. Thus, informality does not imply the lack of an entrepreneurial spirit. For example, Bertelsen and Müller (2003) have done a rich and interesting study on village blacksmiths and indigenous boat building in Tanzania and they demonstrated how exogenous technological inputs are feeding into innovative transformations.

Despite these characteristics and the fact that the enterprises are not formally registered, most of the activities that take place in the informal economy result in products and services that are produced and distributed in a legal way. This indicates the complex intertwining of the formal and informal economic spheres.

4. Research Methodology/Methods

This study used both a qualitative and quantitative descriptive survey design. A triangulation of both qualitative and quantitative methods was used in order to come up with balanced and credible explanations regarding the research question. The choice of the two methods has been guided by the need to collect available in depth information on technological capability building in the agricultural sector in Tanzania. A total of 26 SMEs from the informal agricultural sector were covered in this study. Primary data collection was undertaken employing interviews and questionnaires, which covered CoET and the SMEs. The survey was conducted between November 2008 – February 2009, and interviews were conducted in March 2009. Issues concerning innovation systems and technology and knowledge transfer and their mechanisms were discussed. In the survey, information about firms, and details and types of technological capabilities that were acquired were gathered. Secondary data were collected from published and unpublished documents such as books, articles, local and national government reports, policy documents, and newspaper clippings.

5. The case: Technological capability building through the Gatsby Club mechanism

Before presenting the findings of our case study, we briefly introduce the actors of the collaboration that is examined. Tanzania Gatsby Trust (TGT) was established in 1992 to contribute to poverty alleviation with one of the main targets being the support of small and micro entrepreneurs from different sectors, including food processing, garment and agriculture. TGT provides the financial support to those SMEs, including the ones in our

sample, which belong to the Gatsby Club. The responsible collaborator for the implementation of various projects, however, is CoET. The main objective of CoET is to become the leading institution within engineering and technology at national and regional levels. The structure of CoET is based on three specific pillars: teaching and research, consultancy and services, and technology development and transfer.

CoET in collaboration with TGT has established different mechanisms to assist SMEs in their efforts to build or advance technological capabilities. The main mechanisms are: student projects, the SME incubator programme and Gatsby Clubs.

Not all of these mechanisms are offered to the same type of SMEs, but depending on their specific needs and interests, they join one of these mechanisms. We have assessed knowledge transfer and the impact of the Gatsby Club on building of technological capabilities.

In total there are 6 Gatsby Clubs spread throughout Tanzania, with different numbers of members in each club. A member can be an individual or a group of several firms. We are here investigating only those firms that are active in the agricultural sector.

5. 1. Agriculture Activities in Sengerema

Most of the SMEs are growing crops in Sengerema for both food and income generation. The crops include rice, bananas, cotton, cassava, sunflowers, maize, beans (including soya beans and other beans) and sweet potatoes. All crops are grown in small scale and with very small external inputs usage.

The main livestock types are cattle, pigs and chickens. The livestock population differs between the villages. Most of the farmers use free intensive system for chickens, cattle and pig keeping.

5. 2. Overview of Sengerema Gatsby Club agricultural companies – background data

The number of employees in the agricultural companies in Sengerema Gatsby Club differs: 18 (69.2%) of the SMEs that were surveyed have between 1 and 9 employees while only 8 (30.8%) of the SMEs have 10-49 employees. Also, the level of education varies. The majority (38.5%) of the employees who are working in these sectors has never went to school About 32.5% has received elementary education, 14.3% vocational training education, 9.5% ordinary level, and only few (0.8%) have completed advanced secondary level. Among all the surveyed SMEs there was not a single employee with undergraduate or postgraduate degree. This implies that, most of the employees who are working in the sector are people with a lower

level of education. The level of education of the employees of the surveyed firms is as follows: 38.5 per cent have no schooling, 32.5 per cent have elementary school. 9.5 per cent have ordinary schooling, 14.3 per cent have vocational schooling and only 0.8 per cent have advanced schooling.

As regards the case of capital ownership, most of the SMEs have less than one million US$. They received loans from different financial institutions, research and other nongovernmental organisations. From the surveyed SMEs, about 85% of them have already received some financial support from Tanzania Gastby Trust (TGT).

5.3. Analysis of knowledge sources, knowledge transfer and technological capabilities

Our respondents indicated that through the collaboration with CoET they were introduced to important new knowledge sources. Thus, by becoming a member of Gatsby Club the firms were introduced to new organisations from which they acquired new knowledge. Figure 2 summarises the most essential new organisations that the SMEs started to interact with. For example, 46% interacted with Small Industries Development Organization (SIDO), 23.1% with Sengerema Organization Network (SENGONET), 19.2% with Tanzania Chamber of Commerce, Industries and Agriculture (TCCIA),[5] 9.1% with District Council Agriculture Department (DCAD), 6.3% interacted with Ukiliguru Agriculture Institute, 3.4% interacted with Tanzania Industrial Research and Development Organisation (TIRDO) and only 2.3% interacted with the Food and Agriculture Organisation (FAO).

The Small Industries Development Organisation (SIDO), and Tanzania Chamber of Commerce, Industries and Agriculture (TCCIA) are the most well known organisations for providing training on technological innovation among SMEs groups in both rural and urban areas. However, educational organisations are not common in interacting with SMEs in Tanzania. Obviously, since the SMEs are indirectly working with CoET through the mere fact of being a member of a Gatsby Club, this particular educational organisation does play a role, e.g. as it through the collaboration with TGT provides important funds and through this and the Gatsby Club arrangement provides the very infrastructure through which the above described interactions could arise Moreover, training is offered to the SMEs in the Clubs but not all members do always participate in the training.

Apart from that, local and international trade events and exhibitions such as Dar es Salaam International Trade Fair (DITF) provide opportunities for SMEs to learn new production technologies, gain innovative skills and knowledge by learning from the experience of others. They further

contribute to expanding business contacts and markets for the products from different parts of Tanzania.

Our results revealed that 28.1% of the SMEs have received technical assistance for technological processes from some of these new organisations that they were introduced to, while 71.9% have not. In connection with this, the respondent firms have specified how this has improved their performance. The results are shown in the Table 1 below: 20 (22.7%) said they have improved by introducing new methods in production processing and marketing strategies, 13 (14.8%) - enhanced job performance, 12 (13.6%) - improved quality and quantity of products, 11 (12.5) - increased customers, 9 (10.2%) - improved knowledge on technical know- how and only 6 (6.8%) said that they have gained innovative ideas and efficiency.

Table 1: Improvement of Firm Performance

Category	Frequency	Percentage
New methods in production processing	20	22.7
Improved technical know how	9	10.2
Improved quality and quantity of products	12	13.6
Enhanced job performance	13	14.8
Increased efficiency	6	6.8
New Innovation	6	6.8
Improved marketing strategies	20	22.7
Increased customers	11	12.5

Source: Compiled by the Authors from Field Data 2008/2009

An interesting example for new methods in production processing is the case of soya beans processing. For instance, the packaging was improved after the collaboration. They are now using aluminium material on which there is much more information about the ingredients of the soya beans on the label, as well as other information such as the date when it was produced and the expiry date. The same changes have also been made in the case of ground nuts.

In addition to this, firms have been asked to rank the importance of a specified set of actors as knowledge sources in their daily operations. The answers are presented in Table 2 below. The firms specified different types of knowledge that they have acquired as a result of collaboration with CoET/TGT, i.e. in this case joining Gatsby Club. Table 3 highlights different types of knowledge acquired through collaboration. This knowledge has then been used as illustrated in the Table 4 below.

Table 2: Importance of Knowledge Sources

Source	Importance												Source of knowledge						Use of Knowledge	
	5		4		3		2		1		No answer		Local		Foreign		L & F		Yes	No
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	%	%
Suppliers Equipment & Inputs	5	5.7	7	8	1	1.1	2	2.3	-	-	73	82.9	16	18.2	-	-	1	1.1	10.2	20.5
Public Research Centres	6	6.8	1	1.1	2	2.3	2	2.3	-	-	77	87.5	10	11.4	-	-	1	1.1	4.5	18.2
Universities	3	3.4	-	-	-	-	2	2.3	1	1.1	82	93.2	7	8	-	-	-	-	6.8	12.5
Recruitment of Highly Qualified personnel	-	-	-	-	-	-	-	-	1	1.1	87	98.9	3	3.4	-	-	-	-	-	15.9
Licensing	15	17	9	10.2	18	20.5	6	6.8	-	-	40	45.4	46	52.3	1	1.1	-	-	12.5	42
Clients	19	21.6	26	29.3	17	19.5	5	5.7	-	-	21	23.9	62	70.5	1	1.1	4	4.5	23.9	55.3
Competitors	21	23.9	17	19.3	23	26.1	2	2.3	1	1.1	24	27.2	60	68.2	-	-	3	3.4	30.7	43.2
Consultancies of NGO	21	23.9	17	19.3	9	10.2	4	4.5	1	1.1	36	40.9	49	55.7	-	-	2	2.3	17	53.4
Consultancies Public R&D	14	15.9	7	8	4	4.5	4	4.5	1	1.1	58	65.9	30	34.1	-	-	1	1.1	13.6	30.7
Fairs and Exhibitions	75	85.2	1	1.1	2	2.3	-	-	-	-	10	11.3	71	80.7	1	1.1	6	6.8	81.8	10.2
Chamber of Commerce	33	37.5	7	8	3	6.8	-	-	1	1.1	41	46.5	43	48.9	1	1.1	1	1.1	18.2	43.2

Source: Compiled by the Authors from Field Data 2008/2009

Table 3: Knowledge acquired from the collaboration

Category	Frequency	Percentage
Quality product processing	58	65.9
Marketing and price arrangement skills	22	25
Enhancing rules of production	8	9.1
Improved business plans	8	9.1
Improved job performance	11	12.5
Enhance customer care skills	2	2.3
New methods of production	45	51.1
Enhance new knowledge and skills in production	9	10.2
Stimulate innovations	18	20.5

Source: Compiled by the Authors from Field Data 2008/2009

Table 4: Use of Acquired Knowledge

Category	Frequency	Percentage
Making quality products	53	60.2
Making Innovations	10	11.4
Produce more products	23	26.1
Environment protection	10	11.4
Improve machines	15	17
Designing new business plan	12	13.6
Get new customers and markets	26	29.5
Make proper use of products	19	21.6
Impart knowledge and skills to others	29	33

Source: Compiled by the Authors from Field Data 2008/2009

Table 5: Improved and acquired process technological capabilities

Activities	Firm Performance		Result of Collaboration		
	YES %	NO %	Acquired %	Improved %	Acquired & Improved %
B: Assembly components and final goods	27.3	68.2	2.3	21.6	-
I: Manufacture components	15.9	80.7	2.3	12.5	-
A: Perform own design manufacturing	19.5	67	4.5	22.7	1.1
B: Introduce minor changes to process technology	69.3	27.3	6.8	62.5	1.1
I: Improvement of layout	23.9	72.7	2.3	21.6	-
A: Introduce major improvements to machinery	4.5	92	2.3	1.1	1.1
B: Maintain the machinery and equipments	35.2	61.4	2.3	30.7	1.1
I: Introduce automation of processes	1.1	95.5	-	1.1	-
A: Develop new equipment	5.7	90.9	1.1	4.5	1.1
B: Introduce planning and control production	60.2	36.4	5.7	54.5	-
I: Select technology	6.8	89.8	2.3	4.5	1.1
A: Develop new production process	19.3	77.3	5.7	12.5	2.3
B: Improve efficiency in existing work tasks	87.5	9.1	2.3	80.7	3.4
I: Obtain an international certification	1.1	95.5	1.1	2.3	-
A: Introduce radical innovations in organisation	3.4	93.2	2.3	3.4	-

Source: Compiled by the Authors from Field Data 2008/2009

Table 6: Improved and acquired product technological capabilities

Activities		Firm Perform-ance		Result of collaboration		
		YES %	NO %	Acquired %	Improved %	Acquired & Improved %
1	B: Replicate fixed specifications and designs	15.9	80.7	3.4	11.4	-
2	I: Introduce new design for manufacturing	13.6	83	2.3	11.4	1.1
3	A: Development of entirely new products	4.5	92	1.1	4.5	-
4	B: Introduce minor adaptations to product technology	79.5	17	5.7	70.5	1.1
5	I: Develop new proto-types	3.4	94.3	-	3.4	-
6	A: R&D into new product generations	14.8	81.8	3.4	8	-
7	B: Conduct routine quality control to maintain standards	56.8	39.8	6.8	50	-
8	I: Improve product quality	84.1	12.5	13.6	70.5	1.1
9	A: Conduct research into new materials & new specializations	11.4	85.2	-	9.1	1.1

Source: Compiled by the Authors from Field Data 2008/2009

As the results show quality product processing and new methods of production is the most frequently acquired type of knowledge, which is followed by the ability to stimulate innovations as well as new skills in marketing and price arrangements. This new knowledge has lead to the production of products with an increased quality and quantity. Moreover, machines were improved and new customers and markets identified. An important finding is furthermore that the new knowledge has been further transferred to others.

5.4. Process technological capabilities

The analysis of the survey results showed that both process and product technological capabilities have been improved and acquired. The results are presented in Tables 5 and 6. The specific activities are presented in the left hand column, starting always with a basic activity first (B), followed by an intermediate activity (I) and finally an advanced activity (A) and so on. The firms were asked to mark only that specific activity if it is something that they are performing. They were further asked to mark whether they improved that particular activity through the collaboration or acquired it entirely new as a result of the collaboration.

The results clearly reveal that most activities were improved rather than acquired new as a result of the collaboration through the Gatsby Club membership. The results further show that most technological capabilities of the basic level have been acquired.

5.5. Product technological capabilities

The findings for the performance, improvement or acquisition of product related technological capabilities show first of all that not all of the activities derived from the literature are performed by all firms that have been surveyed. For several of the activities a very high percentage of firms are not performing these specific activities. The development of entirely new products and new prototypes does not seem to be occurring at all. The most frequent activity is the intermediate level activity "improvement of product quality" with 84%, which is followed by the basic level activity of introducing minor adaptations to product technology with almost 80% of the firms, and conducting routine quality control to maintain standards with almost 60%.

The results further show that – as in the case of process technological capabilities – most product technological capabilities have been improved rather than acquired entirely new as a result of the collaboration.

6. Conclusion

We presented the findings of the acquisition of knowledge and technological capabilities of informal agricultural firms as a result of being a member of one of the Sengerema Gatsby Clubs. The results show that in the context of the TGT/CoET collaboration – in which the Gatsby Club is one out of several possible technology transfer mechanisms – both new knowledge and technological capabilities have been acquired. As regards new knowledge, an important finding was that the informal firms through their Gatsby Club membership have been introduced to a set of organisations that provided important technical assistance to their daily operations. Given the rather emerging nature of innovation systems in Africa (e.g. Muchie *et al.,* 2003; Lundvall *et al.,* 2009) it is interesting and important to see that these informal firms can be introduced to and linked up with organisations that can be of help for building technological capabilities. A mechanism such as the Gatsby Club initiative can thus be a crucial channel for linking formal and informal actors and may further serve as a kick-start for emerging local innovation systems. This finding has crucial implications both for theory development in the field of innovation system research in an African context, as well as for policy. By promoting such mechanisms an important bridge may be built to decrease some of the many weak linkages between the different actors in the emerging African innovation system in general and formal and informal economy in particular.

As regards technological capability building by the informal firms in the Sengerema Gatsby Club, we found that most of the technological capabilities were improved rather than acquired as a result of the collaboration. Thus, at present the Gatsby club mechanism appears highly successful when it comes to facilitating interactions between Gatsby Club firms and other additional actors in the "system of innovation" – which of course is a crucial prerequisite for further accumulation and building of technological capabilities. It is also effective in improving a large range of activities which belong to different levels of technological capabilities. It is, however, somewhat more limited when it comes to the acquisition of entirely new technological capabilities that the firms did not possess before they became part of the collaboration through the membership of the Senergema Gatsby Club.

Policy interventions could thus focus explicitly on addressing this weakness in the mechanisms, for instance by more comprehensive training that is offered to the SMEs. This way it may be more likely for the firms to acquire and build entirely new technological capabilities.

Notes

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1 Since 1971, the United Nations has termed a certain category of States as "least Developed Countries" (LDCs) that are highly disadvantageously "equipped" to manage the development process and are struggling and failing to escape from poverty as. Tanzania belongs to this list of countries.

2 The first and second edition of the Oslo Manual only used the technological product and process innovation definition with a focus on the technological development of new products and production techniques by firms as well as the diffusion to other firms. Organisational and non-technological innovation was only included in an annex. This has been changed in the third edition of the manual.

3 ' SME' refers in this paper, following Katalambula *et al*., (2006), to micro, small and medium enterprises. Usually the acronym 'MSMEs' is used to refer to micro, small and medium enterprises. Different measures of size depending on level of development can be found in different countries; commonly adopted yardsticks are total number of employees, total investment, and sales turnover. In the specific case of Tanzania firms engaging up to 4 people are micro enterprises. These are often family enterprises. Most of the micro enterprises belong to the informal sector. In the case of the TGT/CoET collaboration the term 'SMEs' is used to refer to the collaborating firms, that is, even those employing more than 4 persons.

4 This question has also been debated in innovation theory and the theory of the firm (e.g. Chandler *et al*, 1998).

5 The Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA) website: http://www.tccia.com was used as one of the resources for this paper.

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