

Entrepreneur gatekeepers and adaptors of knowledge in emerging food processing clusters in Ghana

Anthony Ayakwah (Ph.D.)

Faculty of Business and Management Studies
Koforidua Technical University, Eastern Region - Ghana
ayakwah.anthony@ktu.edu.gh

Leandro Sepulveda

Associate Professor, CEEDR, Middlesex University
Business School, London, NW4 4BT, UK
l.sepulveda@mdx.ac.uk

Fergus Lyon

Professor, CEEDR, Middlesex University
Business School, London, NW4 4BT, UK
f.lyon@mdx.ac.uk

Abstract

Development, prosperity and sustainable livelihoods in Africa requires knowledge and technology adapted to local contexts. This paper argues that entrepreneur gatekeepers within developing economy clusters can become potent conduits for adapting technology but research overlooks their role, particularly when they are operating as part of the informal economy. This study therefore addresses this knowledge gap through a qualitative empirical study of two food processing clusters in Ghana. Gatekeepers are identified as those entrepreneurs who bring tacit and codified knowledge to be shared throughout a cluster, and also adapt technology to local contexts. The informal nature of the African economy shapes these processes with knowledge shared through personal trust based relationships, the movement of labour between businesses and work of artisan engineers who adapt technology. Innovation support in an African context therefore needs to work with these entrepreneur gatekeepers as well as larger companies and public institutions.

Key words: Entrepreneur gatekeepers; Cluster; Technology; Food processing; Informal sector; Cluster; Africa; Ghana; Multinational companies

1. Introduction

Emerging industrial clusters in developing countries need access to external knowledge that can be adapted to their local context. This is critical to African economies as they seek to reach their potential and develop sustainable industries. There is a need to understand the role that entrepreneur gatekeepers play in the process of acquisition, adaptation and diffusion of new knowledge and technologies. This paper shows that ‘local’ entrepreneur gatekeepers can be well equipped to capture, adapt and diffuse external knowledge within clusters, complementing and renovating the existing pool of knowledge which they generally master (Balland et al., 2016; Morrison, 2019). The importance of knowledge gatekeepers and their external networks within this process is recognised as a key element to boost clusters’ dynamics and the competitive advantage of co-located firms in the international market place (Harorimana, 2009; Giuliani, 2011; Morrison et al., 2013; Giuliani, et al., 2019). This research also addresses concerns over the constraints that restrict innovation within firms across Africa (McCormick, 1999; Sonobe et al., 2014; Danquah and Amankwah-Amoah, 2017).

However, much literature in this area suggests that new external knowledge is predominantly ‘codified knowledge’ and this is captured by ‘qualified decoding gatekeepers’ who then transfer it to firms within local clusters (Morrison et al., 2013; Todtling et al., 2013; Morrison, 2019). In developing economies, there has been much research on MNCs and large R&D government bodies as the conduits for capturing, decoding and transferring external knowledge (McDermott and Rocha, 2010; Clarke and Ramirez, 2014; Ascani et al., 2020). In this paper, we show how the process is not cast in stone (Asheim and Hansen, 2009; Balland et al., 2016; Giuliani, et al., 2019), and that individual gatekeepers can also play key roles in this sense, particularly in a context of prevalent informal economic relationships, and sometimes in collaboration with the public sector and/or MNCs.

The proposed research on entrepreneur gatekeepers in Ghana is therefore a timely contribution to address a gap in research literature on the role played by these gatekeepers and their external networks in supporting the adoption and adaption of both coded and non-coded ‘tacit’ knowledge and technology within clusters, particularly in developing countries. This paper shows how both ‘artisan engineers’ (as these gatekeepers are known in Ghana) and the movement of labour between firms can play a key role in the diffusion of innovation within sectors where the informal economy is dominant. However, these gatekeepers also face constraints that shape their activities.

This paper also contributes to understanding innovation in the context of the informal networks where institutional weaknesses such as the limited recourse to law courts, may prevent traditional R&D public agencies and large private corporations from playing the coordination role that they play elsewhere as innovation gatekeepers (Costantini and Liberati, 2014; Yoon et al., 2015). Hence the presence of entrepreneur gatekeepers and their appreciation and understanding of both the international knowledge circuits and networks, and the local business environment, strategically position them to fill this role and turn into vehicles for cluster innovation. The research is informed by scholarly work on both cluster networks and knowledge transfer (Granovetter, 1983; Becattini et al., 2010) and entrepreneur gatekeepers’ studies (Allen, 1977; Morrison, 2008; 2019) to elucidate how economic actors in clusters are able to draw on external knowledge and adapt this knowledge for the benefit of local clustered firms.

This paper therefore seeks to answer the following questions: Who are the main gatekeepers of knowledge and technology within processing business clusters in Ghana? How are

gatekeepers able to combine codified and tacit knowledge generation? And how do these gatekeepers identify, adapt and transfer new knowledge and technologies within this context? The study adopts a qualitative methodology based on an original empirical study carried out within two food processing and exporting clusters in the Eastern region of Ghana, the small-scale artisanal palm oil cluster and the pineapple cluster. The palm oil growing and processing cluster was chosen as these businesses are estimated to have contributed substantially to Ghana's annual palm oil production and exports while creating sustainable livelihoods for large numbers of poorer farmers (Osei-Amponsah et al., 2012; MoTI, 2015). The pineapple cluster was chosen as exports have grown substantially over the last few years (Ayakwah et al., 2018) to meet the conventional and fair-trade markets in Europe. The two clusters are situated within agricultural communities where several processing businesses are actively operating for local and international market communities. Most importantly, a value chain exists comprising local communities, farmers, local and international processors and supporting institutions (Osei-Amponsah et al., 2012).

The paper begins with a review of extant literature on networking and knowledge transfer more generally, and knowledge and entrepreneur gatekeepers in particular, from where the three research questions that lead the empirical study were extrapolated. The next section explains the methodological approach adopted to answer the research questions. The main findings of the research are presented in the following section, which is followed by a discussion of the main findings and implications of the study to theory and practice.

2. Literature review

2.1 Clustering in emerging and developing economies

Literature on the nature and functioning of clusters has been predominantly based on developed economy settings (Martin and Sunley 2003; Motoyama, 2010; Isaksen and Trippel, 2016). Several calls for cluster policy as an integral part of industrial policy thinking in developing and emerging economies has popularised the cluster concept (Schmitz and Nadvi, 1999; OECD, 2007; Ayakwah et al., 2019; Felzeensztein et al., 2019, Benner, 2020). Research on clusters in developing and emerging economies has been on the rise with scholars probing into the nature, performance and competitiveness of clusters and their production in the international market (Clark and Ramirez, 2013; Sonobe and Otsuka, 2016; Knorringa and Nadvi, 2016; Felzensztein et al., 2019)

Research in developing and emerging economies has found that cluster successes is linked to collective efficiency and collaboration within inter-firm relationships (Clarke and Ramirez, 2014; Ayakwah et al., 2018). For example, Felzeensztein et al. (2019) identify key roles of trade associations in Chilean and Argentinian wine clusters in promoting collaboration, and Perez-Aleman (2005) identify the importance of cooperation among Chilean food firms leading to the establishment of an institutional framework to coordinate production and flow of research ideas and new knowledge among clustered firms.

2.2 Knowledge, networks and gatekeepers in clusters

The literature further shows that the introduction of new knowledge and innovation sustains the operations of cluster making them competitive (McDermott and Rocha, 2010; Ayakwah et al., 2019). In a context of increasingly globalised market economies, knowledge that is

captured from international sources is of vital importance for the competitiveness of local firms and clusters within developed and developing countries (Morrison et al, 2013; Arif and Sonobe, 2012). In order to insert and embed local businesses into global production and commercialisation structures, these external networks can in fact serve as ‘global pipelines’ (Morrison et al., 2013) in transferring new knowledge into local production system and structures leading to innovation (Klumbies, 2011). However, existing literature has mainly focused on how this new knowledge and innovation are obtained from external sources with the support from multinational companies and government institutions (Martinez et al, 2012; Clarke and Ramirez, 2014; Benner, 2020; Ascani et al., 2020).

There is limited literature on the contributions of individual entrepreneurs, particularly small entrepreneurs, to the transmission of codified new knowledge and innovation into developing and emerging economy clusters. This paper addresses this gap by examining the ability of local entrepreneurs to adapt and diffuse externally codified knowledge within clusters in developing and emerging economies.

The literature on innovation in clusters also makes a strong case for the need to incorporate external knowledge through external networking strategies so as to meet technological standards of international trade and be able to compete in global markets (Munari et al., 2011; Alvarez and Iske, 2015). Firms often build external networks to access knowledge that is not already part of their repertoire and that may be beyond their reach. These external networks are key channels used to access distant relationships which complement the more localised information and communication ecology created by the co-location of people and firms within clusters. Bathelt et al. (2004) argue that the build-up of trans-local ‘pipelines’ allows more information and news about markets and technologies to be ‘pumped’ into internal

networks from afar. The balance of external knowledge and dense local interaction shapes the dynamism and ‘the buzz’ which assists in both decoding the codified knowledge captured from such global pipelines and diffusing it within clusters.

A key issue, however, highlighted in the works by Munari et al (2011) and Morrison et al (2013), is that there is a ‘unique’ tacit knowledge aspect associated with these innovations that may come through the pipelines external to the firm clusters and that makes technological diffusion a bottle neck for knowledge adaptation and adoption process. There is therefore a recognition that recipients, translators and diffusers of this non-codified tacit knowledge, otherwise called knowledge ‘gatekeepers’, play a critical role in absorbing and defusing knowledge ‘acquired’ in the buzz (Munari et al., 2011; Morrison et al., 2013; Morrison, 2019). The critical issue then is to understand how gatekeepers’ absorptive and diffusive capacities operate (Cohen and Levinthal, 1990), and how different locations and clusters can harness the different forms of external knowledge attracted and its diffusion, especially through informal and formal networks of co-located firms, and entrepreneur gatekeepers among them.

Previous research has focused on the key roles for MNCs, government agencies and other international organisations (Universities, research organisations, international organisations among others) as pivotal in the gatekeeping activities in developing and emerging economies (McDermott and Rocha, 2010; Clarke and Ramirez, 2014; Ascani et al., 2020). In the cases of salmon and tomatoes clusters in Chile, collective action and cooperation among firms have led to the establishment of a formal *institutional framework* through which production is coordinated and ideas, new knowledge flows among co-located firms (Perez-Aleman, 2005). The Chilean government played a central coordinating role in this process leading to the

establishment of the product brand and clusters' reputation in the international market. A similar situation is observed in both the Peruvian mango cluster and the wine cluster in Argentina which have undergone technological upgrading by using local-based knowledge as well as knowledge brought by multinational companies and public agencies (McDermott and Rocha, 2010; Clarke and Ramirez, 2014).

In this paper, we focus on the roles of entrepreneur gatekeepers and how they capture, diffuse and adapt knowledge, combining codified and uncodified knowledge generation. In a seminal paper published in 1977, Allen introduced the idea of knowledge 'gatekeepers' and established that they are the privileged channels for effectively transferring external technology into an organisation. Gatekeepers are a group of individuals central to the information network. Gatekeepers have typically been exposed to external sources of information as a result of their formal and informal links that they build with external actors (Morrison 2008; Morrison et al., 2019). Building upon Allen (1977), Giuliani (2011) who studied technological gatekeepers in the context of clusters, they argue that they are often related to firms with strong external connections which contribute to the acquisition and diffusion of external knowledge within the local business environment. Critical to these gatekeepers is their ability to search and extract external knowledge and, as a result, adapt and transfer new techniques within the local environment. By so doing, gatekeepers ensure that external knowledge is locally diffused, enabling local firms with no external connections to access and use new knowledge, acting thus as central nodes of local networks.

Gatekeepers have also been linked to leading businesses in clusters that play a dominant role in vertical supply chain networks (Boschma and Ter Wal, 2007; Morrison, 2008). Suppliers of leading firms benefit from extensive knowledge exchange in order to ensure that they are

able to produce quality products that fulfil international standards. In effect, these leading firms may become the catalyst in driving and creating new knowledge into other businesses (Albino et al., 1998; Giuliani 2011; Di Maria et al., 2019). The introduction and adaption of new technology benefit these gatekeepers by improving suppliers' product quality (Mesquita and Lazarini, 2008). Over time, these leading firms in the vertical supply network may seek to maintain their roles as gatekeepers particularly when their linkages ensure a reduction in the cost of doing business and encourage learning opportunities and the developing of synergies between suppliers and producers (Lorenzoni and Lipparini, 1999; Giuliani, 2011; Giuliani et al., 2019).

Gatekeepers in clusters are not limited to vertical relationships only. Firms in developing economies have to compete in the global market with considerable levels of heterogeneity. In order to survive, they may cooperate with one another within similar horizontal networks to facilitate the flow of knowledge into the cluster (Schmitz and Nadvi, 1999; Clarke and Ramirez, 2014). Cooperation plays a crucial role in the operation and survival of clusters in developing economies, particularly in relation to the development of collective efficiencies (Schmitz and Nadvi, 1999; Arif and Sonobe, 2012). In a Sub-Saharan African context, the activities of key knowledge gatekeepers and their ability to adopt and adapt external knowledge for the benefit of other firms in the cluster have not been studied in depth.

Several studies have shown that clusters in developing economies thrive on knowledge shared among local firms and therefore, the collective efforts of firms in the cluster may ensure that they can access new knowledge from these potential gatekeepers (Schmitz and Nadvi, 1999; Dyer and Hatch, 2006; Harorimana, 2013). However, firms have to combine collaboration with competition. Firms may be hesitant to share their acquired new knowledge

among their horizontal networks since protecting new knowledge benefits them in terms of competition that occurs within the clusters (Porter, 1998; Harorimana, 2009). It is therefore found that more embedded social and trust-based relationships are needed to successfully transfer new knowledge among local firms (Harorimana, 2013).

Considering that knowledge diffusion in clusters involves an interactive process between the bearer and the receiver, studies show that, gatekeepers have to be interactive and learn through formal and informal relationships with external sources (Allen, 1977; Morrison, 2008; Harorimana, 2013 Balland et al., 2016). This ensures that they are able to transfer codified and tacit information through their business networks in clusters. Acquired external knowledge may be embedded with location-specific attributes or techniques which may impede its transfer and adaption. During transfer, these peculiar tacit practices have to be addressed by recipients of this decoded knowledge. Also, it is important to note that the transfer of knowledge by gatekeepers may be smoother if businesses operate with homogeneous operational structures although this is far from being the norm within developing economies (Giuliani, 2011). The critical issue is thus to identify how local firms are able to adopt and adapt external codified and non-codified knowledge from gatekeepers, considering the differences in their structure of operation.

This paper argues that the definition of a gatekeeper of knowledge and technology within the context of clustered businesses is not cast in stone. This study defines entrepreneur gatekeeper(s) as an individual/group of individuals linked to core knowledge networks by virtue of their external exposure and that have the capacity to access these knowledge for use in the clusters. We explore how particular local actors, through their exposure to international markets, can become an important source through which external knowledge

and technologies are acquired and hence they can be classed as gatekeepers. The mechanism by which these entrepreneur gatekeepers are able to generate knowledge and technology (through both tacit and codified means) may however vary among clustered businesses. As a result, it may have a significant level of influence on the way technologies are adopted and adapted to in developing economy's clusters and for that matter their innovative activities.

3. Methodology

3.1 Research Setting: Promotion of business entrepreneurship in Ghana

Ghana's post-independence witnessed significant economic growth as a result of industrialisation and the adoption of import substitution industrialisation policy (inward-looking strategy) by the Ghanaian government (Aryeetey et al, 2000; Dana, 2007; Killick, 2008; Aryeetey and Kanbur, 2008). The policy orientation led to the proliferation of large state-owned enterprises (SOEs) which were heavily subsidised (Aryeetey et al, 2000). As a result, the small and medium-size business sector received less government attention and support, despite the enactment of the Ghanaian Business Promotion Act (Act 334) in 1970 (Aryeetey et al, 2000; Boadi et al., 2017)

By the 1980s, after several episodes of coup d'états and natural disasters, the economy had virtually collapsed (Aryeetey et al, 2000; Boadi et al., 2017). Consequently, the country adopted an IMF-inspired economic liberalisation programme (Economic Recovery Programme – ERP) in 1983 and subsequently, the Structural Adjustment Programme (SAP) (Aryeetey et al, 2000; Dana, 2007). The policy aimed to create an enabling environment for small businesses (Hinson and Abor 2004; Boadi et al., 2017) and support economic growth (Aryeetey and Kanbur, 2008), with main policies including Vision 2020 in 1996; Ghana

Poverty Reduction Strategy I – GPRS-I in 2002; The Growth and Poverty Reduction Strategy II in 2006; and Ghana Shared Growth and Development Agenda in 2010 (Killick, 2008; NDPC, 2017). Today, despite the myriad of challenges including macroeconomic instability, competition from imports and regulatory issues, private businesses provide over 90% employment and are the primary generator of exports (USAID, 2009; Ayakwah et al., 2018).

Two Ghanaian clusters (i.e. palm and pineapple) were selected primarily due to the degree of successes they have experienced in recent years in terms of exporting to international markets (Osei-Amponsah et al., 2012; Indexmundi.com 2015; Ayakwah, 2016) and the different approaches that they apparently adopted in relation to inter-firm cooperation and innovation. The palm cluster is situated in the Kwaebibirem district, a predominantly farming community which plays a critical role in supporting the local economy (Osei-Amponsah et al., 2012; Ghana District, 2014; Ayakwah, 2016). Estimates show that there are more than 300 processing palm businesses concentrated within the Kwaebibirem district of the Eastern Region, mostly dominated by small-scale processors (Ghana District, 2014; Ayakwah et al., 2018). The pineapple cluster in turn is located at Nsawam in close proximity to Accra, Ghana's capital, and therefore benefits from the nearby sea and international airports. The cluster is dominated by MNC and private indigenous investors who primarily produce for the international market (Ghana District, 2014). The expression 'pineapple' is adopted because of its dominance in the Nsawam area of study although other fruits are processed in the cluster.

3.2 Research Design

This paper adopted a qualitative and an exploratory research design based on interviews and field observations which were used in order to unearth how entrepreneur gatekeepers are able to adopt, adapt and diffuse knowledge and technology in the cluster and the external sources of knowledge and technology they draw upon. This approach ensures that an in-depth

appreciation and interpretation of the state of affairs in two food processing clusters is presented (Dana and Dana, 2005) and allows for further conceptualisation of current dominant theories (Flick, 2018).

Purposeful sampling was used to identify a cross section of types of businesses which are representative of the two clusters. The process started with interviews of key informants and local business organisations which provided information on processing businesses as well as farmers. A 'long list' of potential cases was identified from different sources as there was an absence of an updated database comprising information about local fruit processing firms in both clusters. A snowball sampling technique was used to extend this list and then to identify and recruit 21 food producing and processing businesses. Personal referrals contributed to minimising the number of rejections to invitations to participate in the study. Only 2 processors and 1 farmer rejected the invitation. The final sample of participants included: farmers (n=5), processing business owners (n=16), heads of research institutions and government agencies (n=7) and machine artisans (n=2) (see Table 1).

In the first phase of data collection, processors, suppliers and other key informants were interviewed in order to identify key gatekeepers who have sought out and adapted new technologies and their sources, within two food processing clusters. In-depth semi structured interviews were conducted to ensure that there is some level of standardisation for cross-case comparability. The process allowed the researchers to appreciate the entrepreneurs' environment and how they operated (Dana and Dana, 2005; Bleiker et al, 2019). A second phase of data collection involved follow up interviews with the participants exploring some of the arising issues in more depth. A third phase of interviews was conducted after detailed analysis in order to probe issues related to gatekeepers.

Table 1: List of interviewees

Participants/Organisation	Pineapple Cluster	Palm Cluster
Fruit farmers	3	2
Processing businesses	7	9
Artisans	2	0
Business Advisory Centre (BAC)	1	1
Oil Palm Research Institute (OPRI)	0	1
Ministry of Food and Agriculture (MoFA)	1	1
National Board for Small Scale Industry (NBSSI)		1
Ministry of Trade and Industry (MoTI)		1

Interviews were recorded when consent was given by the interviewees. Interviews were conducted by the researcher in English or Akan (a local language mostly known as ‘Twi’). Transcripts in Akan were all translated into English and systematically analysed using NVivo 10 software. The first round of interview data analysis identified key themes (NVivo nodes) such as international access to tacit technology; collaboration between gatekeepers; reengineering technologies and social ties in technology sharing. In a second stage of analysis, commonalities and differences within and between each cluster were extracted in order to uncover further themes for this study. This led to a further round of interviews to probe these issues in more depth and a final stage of analysis to draw out issues related to the types of gatekeeper, codified and tacit knowledge and the adaptation of technology.

4. Findings and empirical data

4.1 Identifying key gatekeepers in clusters

The first part of the empirical section identifies who the main gatekeepers are in the two clusters (RQ1) through the eyes of processing businesses and other institutions. The respondents were specifically asked how they acquired technical knowledge in order to enhance their operations. It was found that each of the two fruit processing clusters studied had a distinctive feature that clearly distinguishes its gatekeepers as discussed below.

Gatekeepers in the pineapple cluster

The critical knowledge and technology introduced in this cluster relates to a new variety of pineapple seed. Four out of the seven interviewees reported that the first few seedlings brought into the cluster came from one single pineapple farmer (Pineapple Participant 4). The owner of a pineapple processing business (Pineapple Participant 7) explained how Pineapple Participant 4 played a key introducer role and this entrepreneur “brought MD2 pineapple from Costa Rica and planted it in Ghana”. Five of the seven pineapple processing businesses interviewed also reported that the Ministry of Food and Agriculture (MoFA) played a key role as the main institution through which the knowledge of this new variety of pineapple was then introduced to the other pineapple growers in the cluster, beyond the original firm (Pineapple Participant 4). The processing businesses explained that MoFA had helped them from the onset in procuring and planting the MD2 variety after it had been brought into Ghana by pineapple Participant 4.

[MoFA] has provided us the seedlings [and] supported us with information on how to plant the MD2 in the initial cycle was done. In our second cycle of planting, they only came to observe and inquire if we have any problems (Pineapple Participant 2; Nsawam, 2014)

The success of the introduction of this ‘technology’ and the new external knowledge is attributed to collaborative efforts involving pineapple participant 4, their contacts in Costa Rica and MoFA. Further collaboration with other local businesses in the cluster resulted in the sharing of knowledge about the cultivation of this new variety. The extract from pineapple participant 4 illustrates this statement:

My boss invited [Costa Ricans] here and they came to educate us on the planting, the structuring, the fertilisation, and everything on it...[and]... [MoFA] also came into the initiative and took over the initiative till the MD2 pineapple became widely planted (Pineapple Participant 4; Nsawam, 2014)

The collaborative effort was particularly necessary since the MoFA’s department in the municipality indicated in the interview that they had a good appreciation of the local environment, ensuring the successful cultivation of the MD2 pineapples for export in the cluster. The head of the MoFA at Nsawam explains that “the ministry [...] have the officers who understand the climatic, topographic as well as the agri-business activities of Nsawam and have been active in cultivation of MD2 variety”. The collaboration of these gatekeepers - that is, the Costa Rican and Ghanaian farmers and the MoFA - was thus instrumental in the

introduction and cultivation of MD2 pineapple variety as a dominant crop for export in this food processing cluster.

Gatekeepers in the palm cluster

All the participants in the palm cluster shared the view that the original introduction of palm processing technology in the palm cluster is linked to the work of a Dutch engineer named ‘Mr. Kramer’. The interviewees in this cluster explained that this engineer introduced the first mechanical palm processing machine back in the 1980s, in the wake of palm fruit and palm oil trading boom that occurred at that time.

[As a result of this boom], a lot of people began to develop machines to extract these essential palm oils. This led to the proliferation of machine called ‘Kramer Kramer Kramer’ [which] is named after some Dutch engineer who started the extractor up in the district. As a result, people refer to any location where extraction is being done as Kramers. Extraction firms: Kramers, can be found all over the towns in the Kwaebibirem districts. Some towns have 10, others have 15, and 13 or more. In effect, every town has a pool of Kramers operating and taking advantage of the abundance of palm fruit in the district to produce palm oil’ (Palm Participant 1, Kwaebibirem, 2014)

Thereafter, several ‘machine artisans’ produced machinery which was adapted to the local context and that supported the fruit processing activities within the cluster. Interestingly, the name ‘Kramer’ has since then been used to refer to any palm processing machine which

adopts locally manufactured machinery in their operations. There are a range of different machines now available to meet different local needs. A ‘machine artisan’, explained that machines vary based on the quality of work to be done, whether manual or electronic, and the cost of producing them. The explanation offered by artisan participant 1 illustrates this point:

We have more than four types of machine. The first one is [made] by adding some other parts to the pounding component which we adopt through manual means, to extract the oil for the processors. We also have another one that we make that processes and extracts the oil but the oil it brings out is not clear, it comes mixed with the sludge, which requires further cooking, like the refinery, before you are able to get the oil. We also have another machine that follows. For that machine, the method in the second machine is applied in a different form... [Also] ... there is a new one I am still working on. For that one I have manufactured it for about four businesses. That new one is very huge and also expensive, very big, for industrial [use]. This new one is based on different things (Artisan Participant 1; Kwaebibirem, 2014)

Another key finding relates to the role that ‘artisans’ played in this local technological process of innovation. The majority of palm processing businesses interviewed indicated that their machinery needs are met by these local ‘artisans’ or the local producers of the machinery, as they refer to them. Palm participant 9 explains: “...the machine producers around are able to make new machines for most of us in this town”. Interviewees highlighted that these ‘machine artisans’ have not travelled abroad to acquire this new knowledge and machine technology, but have been able to develop their manufacturing skills locally, by

learning from imported new technologies and adapting it to the local context. In this way, these artisans are themselves gatekeepers. Artisan participant 2 argues that through their manufacturing skills and dexterity, they have been able to replicate imported machinery by large and medium-scale MNC locally. He reported that artisans did not have to travel or be trained abroad to do this job but that their skills are somehow innate as “we are born with the skills, [and] are able to mould and create machines for processors”. In effect, all these artisans require is their ability to observe and understand the imported technology locally in order to replicate intricate machine technology relevant to processors in the palm cluster.

In time, these ‘artisans’ have become the main source of new types of machines which are said to successfully meet the needs of local fruit processing businesses and they are even offering technical advice and information to other local businesses. The artisans are an integral part of their business community as they offer an opportunity for firms to access affordable and suitable technology within the cluster. One palm processor explained that ‘[the artisans] are our friends and part of us, we know them, and we call on them when we need them’ (Artisan Participant 2, Kwaebibirem).

To summarise, by being located in the cluster and being part of the community, the artisans are well placed to appreciate the needs of the palm fruit processing businesses and at the same time, they are strategically placed as a technology gatekeepers who can address the machine needs of processing businesses in the cluster, by learning from afar.

4.2 Unifying Codified Knowledge and Tacit Knowledge Generation

There were several ways through which businesses were able to acquire new technologies and in both the pineapple and palm processing clusters, there is evidence of the gatekeepers

and other key stakeholders combining the codified and tacit knowledge. This knowledge is then shared through informal channels and social relationships.

Codified and tacit knowledge for new pineapple technology

The findings show that tacit sources of knowledge are a vital element of crop technology transfer into the pineapple cluster. For example, by working in Europe, the director of Pineapple Participant 4 identified the MD2 breed of pineapple (which had a growing international market demand) and wanted the cluster to benefit. As the interceptor of such knowledge, this entrepreneur decoded the new knowledge on MD2 pineapple variety through training and direct participation in the cultivation in its country of origin, Costa Rica. Thereafter this business supported the adaptation and transfer of the new variety back to Ghana by making them accessible to other local farmers. With the aim of making the pineapple available for export, the manager of this firm explains how the director embarked on the search for the MD2 pineapple variety from Costa Rica to make it available to farmers in the cluster:

Our director, Mr Koranteng, was staying in Europe by then and he discovered the variety when he was in Italy. So, he read about the crop and tracked it from its source and [found out] that it was originally from Costa Rica, so he followed up to that country for more information. He went there, saw the farmers and they gave him every training on it. They taught him how to produce the crops and everything that accompanies it So ever since [MD2 variety] came we also didn't keep everything to ourselves; we gave it to our

sister farmers so that they can grow it as well. So we spread the [MD2] variety... (Pineapple Participant 4; Nsawam, 2014)

The gatekeeping partnership of Ghanaian pineapple farmer, MoFA and Costa Rican farmers also helped sharing the technology more widely. The manager in pineapple participant 4 explained that through their initiative, the Costa Rican farmers were invited to train pineapple producers within the Ghana cluster on how to prepare and cultivate this new variety of pineapple. This form of external interaction with farmers in the cluster serves not only to transfer coded knowledge about the cultivation of pineapples but also some unwritten (tacit) knowledge acquired over the years in the cultivation of the product (e.g. learning by doing). Interacting in this way minimises the bottlenecks associated with the transmission and absorption of external knowledge as traditionally observed in Africa.

Codified and tacit knowledge for new palm processing technology

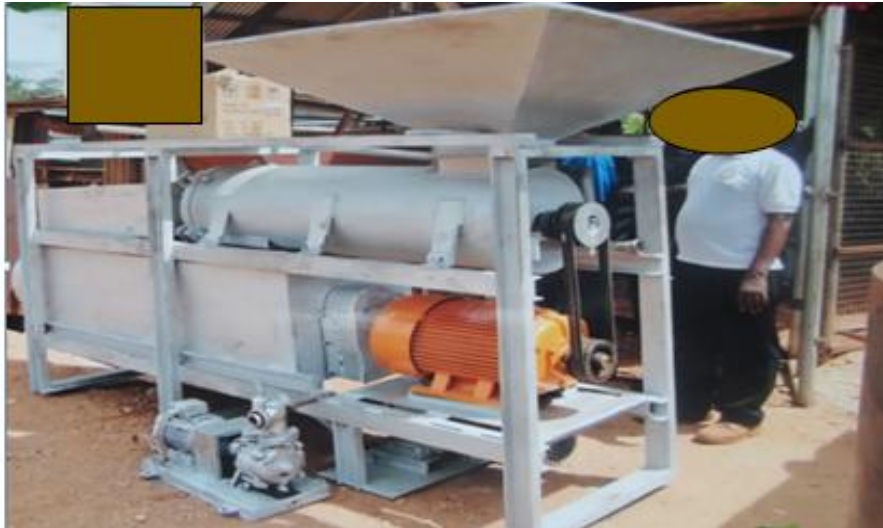
Analysis of the interviews also showed that the artisanal engineer gatekeepers in the palm processing cluster combine the codified knowledge of imported processing machines, arriving with manuals, with their tacit knowledge of local manufacturing processes. The three larger palm processing businesses interviewed reported that, in their businesses, coded knowledge is introduced by buying imported machinery and operation manuals. This is explained by the manager of palm participant 2, a large-scale palm processing business:

We import them [the machinery]. Our importers come with the machines. We import them from Malaysia and more recently we have imported some

machines from Britain. Some by sea some by air, so we get the information (Palm Participant 2; Kwaebibirem, 2014).

These imported machines have become the basis on which ‘machine artisans’ are able to sustain their flows of new knowledge and adapt technology to the needs of local palm processing businesses. Critically, artisans are able to reengineer and adapt manual and electricity powered pressing machines that extract palm oil, the steam boilers for cooking the fruits, loading ramps and palm fruit hoppers that strip the product from the palm bunches. These and many other machines were observed at ‘machinery artisan’ workshops in the cluster (as shown in Figures 1 and 2).

Artisan participant 1 reveals how his innovative manufacturing activities are supported by his ability to collect ideas from machines which have been imported by larger firms and MNCs. He refers to the tacit skills of the local artisanal engineers who use their existing ‘intelligence’ and tacit knowledge to adapt new imported technology to the local market conditions. Hence the technologies reengineered by the local artisans have been specifically adapted for local use, primarily for the benefit of small-scale and some medium-scale processors.



Source: (Photograph taken by the author, 2014)

Figure 1: Machine Artisan processing equipment (1)



Source: (Photograph taken by the author, 2014)

Figure 2: Machine Artisan processing equipment (2)

Movement of labour between businesses is also a way of sharing further tacit knowledge as reported by seven out of nine palm oil processing businesses. Owner-managers explained that unwritten information and operating techniques had been transferred as a result of the movement of labour. In particular, all medium to small-scale businesses in the palm cluster

said they relied on contracting skilled labour from large companies to fill their knowledge/skill gaps.

Most of us have worked in other companies before starting our business. You may have the farm, but the machine and the operations require someone who understands the operations to make sure you are making enough palm oil... the machines are there but you need a good miller to run your business (Palm Participant 7; Kwaebibirem, 2014)

Informal apprenticeships were also seen as a way of combining tacit and codified knowledge. The artisan engineers were found to be providing apprenticeship training schemes to the youth, thereby disseminating their innovations. The artisan participant 2 explains how apprenticeships are offered and the rise of several artisanal workshops in the cluster.

I have developed a lot of machines and I have a lot of experience... [So]... students from secondary school serve as my apprentice to learn innovations and I work with them. So, we have people like these students who are born with talents, like talented engineers [...] Soon, they will also become independent artisans (Palm Participant 2, Kwaebibirem, 2014).

The process of knowledge sharing and diffusion from gatekeepers is also aided by family based networks. Family relationships were at the centre of tacit knowledge and technology sharing in the palm processing cluster and an important source of business creation. Four of the palm processing businesses interviewed explained that their family members are an integral part of their operations, particularly in the context of small-scale businesses. Palm

participant 2 (a family-based enterprise) offered training and knowledge on technologies used in the operation of the palm business to all their family members. The recent rise in the number of small-scale processors (mostly ex-farmers) is associated with gaining tacit and codified knowledge from family ties. They explained that the new entrants master valuable knowledge on running their family-based processing businesses due to their relationships with other processors, which is facilitated by family relationships within the cluster.

4.3 Gatekeepers develop and adapt new knowledge and technologies

Developing and adapting knowledge in the pineapple cluster

The development and the adaptation of external technology has been acknowledged to require collaborative efforts from several stakeholders. Most of the pineapple processors explained that the farmer gatekeeper set in motion the processes to adapt the MD2 variety of pineapple. As the interceptor of such knowledge, this entrepreneur decoded the new knowledge by learning how to cultivate the crop in Costa Rica. However, he required collaborative efforts from public sector research institutions such as Ministry of Food and Agriculture to acclimatise the MD2 variety within Ghana and adapt the crop for businesses, replacing existing varieties within the pineapple cluster.

The interview with pineapple participant 4 revealed that, for effective adaptation of the new technology, actors in the pineapple cluster worked with the farmers in Costa Rica to transfer knowledge on the production of the MD2 pineapple variety. By so doing, gatekeepers were able to bring in tacit knowledge that is unique to the Costa Rican environment. However, in order to successfully adapt the MD2 pineapple variety in Ghana the gatekeeper, Costa Rican farmers and the Ministry of Food and Agriculture had to work together. Pineapple participant

4 offers an explanation as to how the MD2 breed of pineapple was adapted in the cluster (see Figure 3).

[MD2] initially it wasn't favourable with the climate over here. So, we acclimatised it. That is where the Ghanaian agronomists [from Ministry of Food and Agriculture] came in to help. My boss invited the Costa Ricans here and they came to educate [our sister farmers and ourselves] on the planting, the structuring, the fertilisation, and everything about it. We did the first training at our farms ... before the Ministry of Food and Agriculture came into the initiative... [And] ...we have benefitted hugely from them and people have benefitted hugely from it (Pineapple Participant 4; Nsawam, 2014)



Figure 3: MD2 Pineapples from Costa Rica
Source: Photograph taken by the author, 2014

Developing and adapting knowledge in the palm cluster

The process of knowledge adaptation that took place within this cluster was also acknowledged by the palm processors. Eight out of the nine palm processing businesses interviewed indicated that they relied on ‘machinery artisans’ not only in repairing machines, but also to adapt their machines to changing market needs and clients’ specifications.

The artisans or ‘machine artisans’ were specifically asked about how they had developed their skills in the first place. A machine artisan described this skill as his ‘inbuilt intuition’ which assists him in producing imageries of machines he has seen around. He believes that these images return to him in the form of ‘visions’ which are then translated into drawings and eventually produced into prototypes. He further explains these ‘in-built things’:

If you see any artisan, there is some sort of inbuilt things which the ‘Obroni’ [foreigners] referred to as science. There is something within [them] that triggers design in the mind even when you are sleeping. So, when the person rises he is able to capture those images and transform them into drawings. That is the basic truth [...] it appears like a vision. Even now if someone passes by with a machine, I am able to take a mental picture of it, or visualise it (Artisan 1; Kwaebibirem, 2014)

This artisan also believes that their ability to create machinery has a spiritual dimension with creativity associated with ‘something within given by God’:

... [I] visualise it, it comes within a twinkling of an eye. [I] internalise it and immediately begin to draw. For such individuals if they combine their talent with education, then they become extraordinary. That is how I am; I was not an apprentice, I didn't have any master, but [it] is just that I enjoy doing the work of God. [...] For I believe that anything that is science is from nature, God has created everything and we are just refining and exploring it to get something from it (Artisan 1; Kwaebibirem, 2014).

Artisans interviewed explained that the 'gift' of innovation is theirs to give to society as it is given by God. By relating their creations to 'God', the innovation loses ownership and becomes socialised. In this sense, innovative ideas and reengineering practices do not subscribe to international norms of Intellectual Property Right (IPR) issues. This is directly linked with the rather weak legal institutional structures observed in Ghana as well as a lack of enforcement of IPR regulatory frameworks. By linking spirituality to reengineering of external technologies, gatekeepers are able to normalise the loose interpretation of intellectual property regulations in order to make machines available for smaller businesses owned by poorer members of the cluster. This in turn leads to the proliferation of these machines.

5. Discussion

Our first research question explored the identity of the gatekeepers. The evidence reveals that knowledge gatekeeping in developing economies like Ghana goes beyond the activities of MNC and public sector institutional collaborations. We show how entrepreneur gatekeepers play key roles in new knowledge adoption, adaptation and transference, particularly within business clusters. Based on the analysis of the evidence presented, gatekeepers in the two

Ghanaian clusters fall into two main categories. Firstly, there are those gatekeepers who, by their international exposure, serve as the ‘pipeline’ for introducing new technologies such as the engineer introducing palm processing machinery or the farmer introducing MD2 pineapples. This fits the definition of gatekeepers offered by Giuliani (2011). However the businesses in this category of gatekeeper were not the leading firms in the cluster and had no dominant roles as defined by Boschma and Ter Wall (2008), and Morrison (2011).

The second category of gatekeeper had very limited external exposure or international links. Their ability to reengineer new imported technology resulted in the decoding of knowledge embedded on the new technology in order to make the machines relevant to the local environment. They are found to be more protective of their knowledge compared to the first category of gatekeepers (Porter, 1998, Harorimana, 2009).

The second research question examined how gatekeepers combine codified and tacit knowledge. The evidence demonstrates that entrepreneur gatekeepers in Ghana have been able to acquire new knowledge tacitly and in codified form alike. In doing so, they have served as the ‘pipeline’ through which production techniques were generated (Bathelt et al., 2004; Balland et al., 2015). This process was further supported by collaborations between local and international institutions so as to decode more codified knowledge and make the externally acquired knowledge accessible to local businesses. As a result, the study moves away from those models of simple technology diffusion and adoption to highlighting gatekeepers’ abilities to merge both tacit and codified knowledge in the diffusing process, placing them at the heart of the innovation process. This ensures that bottlenecks that Munari et al. (2011) and Morrison et al. (2013) said to limit the adoption of internationally acquired

tacit knowledge are minimised, if not eliminated completely. Such a merger of these forms of knowledge is critical for developing economies that seek to harness gatekeepers' capabilities in transferring technology and adapting them to local circumstances.

More importantly, gatekeepers are able to create a critical opportunity for collaboration so as to harness the strength of local institutions and support the blending of tacit and coded knowledge acquired. Hence, by combining the gatekeepers' appreciation of the business environment, the embedded socio-cultural milieu, and the weak IPR regulatory frame, the artisans are able to reengineer new machines that is appropriate for the local economy. Even though some of these gatekeepers had no international exposure, their earlier interactions with external engineers helped them to create an enabling environment to decode knowledge that is embodied into imported machinery from large-scale processing companies.

Our third research question explored the process of adapting and transferring technology in the Ghanaian context. Even though the pineapple cluster is more outward looking with direct sales to foreign markets and the palm cluster is more inward looking, the findings revealed that newly imported technology was equally adapted in both clusters. In the case of the pineapple cluster, this occurred through one entrepreneur's exposure to the international market, his efforts to trace the source of the new variety and its adaptation to make it better fit the local context as well as accessible to other businesses in the cluster. The pineapple processor moved to Costa Rica and tacitly learnt how to produce the MD2 pineapple and then introduced the knowledge to Ghana (Balland et al., 2013; Maskell, 2015; Tortoreillo; 2015). In the palm cluster, 'artisans' served as mediators for processing technology from abroad. The artisans in the palm cluster created appropriate palm processing technology by imitating

technologies from abroad (Leamer and Stopper, 2001; Stopper and Venables, 2004; Gertler and Levitte, 2005). Thus, the study provides a different perspective on how external knowledge can be transferred into clusters in developing economies.

The evidence also revealed that gatekeeping goes beyond serving as ‘pipelines’ for transferring knowledge and technologies to include the ability to adapt the technology so as to meet the needs of other local businesses. Gatekeepers worked together towards acclimatising the MD2 pineapple and training farmers on the cultivating skills peculiar to Costa Rica in order to adapt to the MD2 variety as the dominant crop for export in the cluster. In the palm cluster, the ability of gatekeepers to replicate and adapt technology from abroad has led to the emergence of indigenous innovative systems that thrive on providing machinery to meet the processing needs of businesses such as in the palm cluster. Hence these gatekeepers do not only replicate but consciously work to adapt technologies by building machines of different shape, size, and purpose, at a relatively lower cost, to meet the specifications of local businesses which, over recent years, have been critical in securing the local farming community a livelihood for their families (Sarkar and Pansera, 2017). While some farmers have struggled with growing the cash crop, further innovation has led to more attention to sustainability such as reducing agrochemical use in pineapple production and getting fair trade status for the products by ensuring good working conditions and higher pay to their workers (World Bank, 2016).

Finally, linking belief system to reengineering technologies by gatekeepers offers a different appreciation on mainstream discussions on IP and regulatory frameworks in developing economies, particularly in Africa. The palm oil processing artisans referred to their ability to

understand and adapt new technologies as a ‘gift from God’ and thus, provides them with a moral justification to avoid a strict interpretation of intellectual property rights. Informality allows many in poverty to access technology and thereby add value to their produce and create sustainable livelihoods. However, lax enforcement of IPR regulations is also a disincentive to some investors and hence it may limit other opportunities in the future.

Conclusion

In the face of limited information on entrepreneurial knowledge gatekeepers within developing economy clusters, this study enhances our understanding of the role that business entrepreneurs can play in knowledge and technology transfer and its potential outcomes in terms of economic development (notably, imports) and public policy.

This paper also sets out the importance of combining tacit and codified knowledge in the innovation process. The evidence demonstrates that the importation of technology requires gatekeepers to be able to travel abroad and gain exposure to new ideas, and have the opportunity to build up their tacit knowledge in other countries before returning home. However, there is high degree of serendipity in the process of identifying potentially successful innovations. The diffusion of knowledge from the gatekeepers to other businesses is also shown to be based on combining tacit and codified knowledge – sometimes this occurs is in collaboration with the public sector or large companies as we have shown.

These findings have a significant practical implication for business start-ups and sustainable economic growth in developing economies. To start with, policy makers need to give

attention and support for both traditional forms of knowledge transfer and entrepreneur gatekeepers. This can engender innovativeness among businesses and this can in turn contribute towards a more sustainable growth in developing countries. Future innovation strategies in African economies need to recognise the roles that these entrepreneurial gatekeepers can play in the innovation process and technology development alongside public agencies and MNCs. Innovation policies can thus be focused on identifying the potential key gatekeepers and subsequently supporting them. Innovation strategy does not necessarily have to be focused on the most expensive technology and larger businesses, as there is room for rapid increases in productivity and added value from technology developed and adapted by local artisans for smaller businesses, sometimes operating in the informal economy. There is therefore a need for a focus on providing artisans with appropriate technology that can be adapted to local conditions. Public policy and philanthropic foundations can help enable artisans by reducing the limiting factor of intellectual property rights and ensuring that there are not any barriers for the poorest to access technology that will more likely provide them with sustainable livelihoods. In particular, innovation strategies could support the existing apprenticeship structures that are found in many parts of Africa, usually operating without any public sector support.

The study also has some implications for future research. To start with, there is the need for further research beyond a single country case in order to identify best practices in the transfer of technologies more generally. Unlike East Asian countries, like China, where there is extant research on returnee entrepreneur gatekeepers and their role in technology transfer, there is the need to investigate the peculiar challenges entrepreneur gatekeepers face in the adoption and transference of new knowledge and technology across Ghana and in other Sub Saharan African countries. While this paper focuses on technology, there is also much potential for

innovation in the business models, and other ‘soft’ innovations, supporting food processing activities in Ghana e.g. for fair-trade markets. We also show how there are considerable commodity differences and geographical differences in knowledge absorption, adaptation and diffusion. In the search for sustainable livelihoods and poverty alleviation in Africa, there is therefore the need to understand how indigenous innovation systems operate, the integration of the formal and informal economic activities and how more sustainable practices can be supported. This may help to inform the establishment of specific evidence-based support programmes aimed at promoting the activities of entrepreneurial innovation gatekeepers in the region.

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