Institutional Support for Collective Learning: Cluster Development in Kenya and Ghana

Banji Oyelaran-Oyeyinka and Kaushalesh Lal*

Abstract: The study analyses the role of institutional infrastructural and collective learning in adoption of new technologies. The data for the study come from the Suame cluster in Ghana and the Kamukunji and Kariobangi clusters in Kenya. The clusters are dominated by micro and small enterprises (MSEs). The findings of the study suggest that policy measures need to be taken by governments in developing countries to improve the performance of MSEs. It is found that greater participation of the private sector is required in setting up training and information service centres within clusters. These institutions could provide need-based skills for better usage of new technologies. This is more relevant for information and communication technologies (ICTs) such as e-mail and the Internet. These institutions could also be useful in searching function- and job-specific ICT tools which are not only expected to be efficient but cost effective. Such collective cluster initiatives are expected to result in better cluster performance.

1. Introduction

The traditional technology policy framework advances two broad reasons for supporting small firm activities. The first is the perceived market failure in the labour and technology markets and the second is the incidence of weak, or absence of, markets and institutions in developing countries (Metcalfe, 1994; Lall, 2001). As most analysts agree, there is pervasive market failure in developing countries, while widespread institutional[1] disarticulation exerts a far greater impact on small rather than large producers. Institutional weaknesses raise transaction costs and thereby constrain firms from taking advantage of market opportunities while market failures limit access to

*Oyelaran-Oyeyinka and Lal are senior researcher/professor and researcher respectively with the United Nations University-Maastricht Economic and Social Research and Training Centre on Innovation and Technology (UNU-MERIT), Maastricht, The Netherlands. Tel: 0031-43-3506300; fax: 0031-43-3506399. The author to whom all correspondence should be sent is K. Lal, e-mail: Lal@intech.unu.edu

markets and innovation possibilities.[2] From a policy perspective, expansion of small and medium enterprises (SMEs) generates employment and does it in ways that create positive externalities due to their wider geographic spread and quantitatively larger numbers. Support to SMEs is therefore seen as a way of attenuating the negative effects of unemployment and to generate economic growth.

While small and medium firms' development remains central to the economic development of African countries, they have not fulfilled their expected mandate due to a number of well-known structural constraints (Pyke and Sengenberger, 1992). Small firms lack the managerial and technological capabilities that are routinely internalized by large firms. In recent times, the exposure of African industry to international competition from the 1980s further laid bare the structural fragility of the region's industrial system. The policy response to the internal resource scarcity of SMEs and recent competitive pressures had been for state and private agencies to attempt to develop institutions and services to promote competitiveness within small firms. Central to this approach is the effort to upgrade product quality, improve design and packaging, and to raise the overall human skills of firms through *real service* provision (Pyke, 1994; Schmitz and Cassiolato, 1992). Services are supposed to be delivered by an array of agencies that are themselves technically weak, poorly funded and largely ineffectual. The shortcomings in the types of public intervention point analysts to private options to eliminate policy biases (Hallberg, 2000). However, much of the alternative prescriptions would still require considerable state action. They include: eliminating market failures that lead to cost disadvantages and restrict access to markets; facilitating access to information; removing discriminatory practices against small producers; and improving public goods.

However, there has also been a move towards greater systemic support in contrast to the previous orientation of traditional technology policy that deals largely with the conception of firms operating in isolation. This view suggests that SMEs and clusters in developing areas will need sustained systemic support to cope with the new competitive domestic and global market (Pyke and Sengenberger, 1992; Levy *et al*., 1999; King and McGrath, 1999). Greater systemic coordination in the provision of infrastructure and information, for instance, would lead to gains in *collective efficiency*. The aim of the study reported in this paper is to examine the role of institutional support and the ways clusters in two African countries learn through the provision of collective support. In doing this we attempt to answer the question whether clustering as an industrial organization strategy does foster collective learning and promote enterprise performance.

The paper is organized as follows. In Sections 2 and 3 we provide a review of the literature on learning in clusters, the characteristics of the clusters

in the two countries and the analytical framework respectively. Section 4 reports the statistical findings and the final section provides a summary and conclusion.

2. Enterprise Support in Developing Countries

Support for enterprise involves both real services and the provision of information about technology flows within national boundaries among enterprises and institutions. For this reason, government policies in developing and advanced industrial countries alike have evolved a battery of measures to assist small and medium manufacturing firms in the technological change process. However, significant market segmentation in underdeveloped countries gives certain categories of enterprises greater access to funds. For instance, large firms are more likely than small firms to obtain loans (Oyelaran-Oyeyinka, 1996). Even then, this kind of access may be limited to routine operation-type technological activities. In Africa, micro-enterprises are an integral part of the industrial system, yet they do not count for much in official statistics and as such rank low in priority for state support. Resources for innovative research and development (R&D) and training are not easy to obtain. Capital market and skills market failures, which are more pronounced in poor countries has led governments of such countries to formulate policies to selectively channel funds to a less favoured group of firms. They have set up specialized institutions to provide long-term finance.

Unlike in most industrialized economies, private Research and Development Institutions (RDIs) are practically non-existent, and publicly funded laboratories are often isolated from productive enterprises. This phenomenon is not peculiar to African countries. OECD (1999) found that the most important source of knowledge for firms is the interaction between the firm and its suppliers. Firms learn more by analysing competitor's products than from government laboratories. In Australia, the most significant sources of knowledge external to the firm are ideas and information from suppliers and customers. Government laboratories and university research are considered relatively unimportant. Working capital and long-term capital are often in short supply, so also is specialized finance for innovative activities. The former poses particularly unique problems, since machinery and equipment are largely imported, and so have to be funded fully or in part, through purchase of foreign exchange. Under recent reform policies, access to the foreign exchange market became more difficult for SMEs due to devaluation of local currencies, which made foreign currencies more expensive.

An important debate that currently preoccupies policy makers and scholars alike is the role of information and communication technologies (ICTs) in

promoting the growth and competitiveness of small firms but there is a dearth of systematic study on the role ICTs play in enhancing the productivity and market reach of small producers in sub-Saharan Africa (SSA). The paper derives from a study conducted in the Kamukunji and Kariobangi clusters in Kenya and the Suame Cluster in Ghana to examine the role of collective support structures in clusters and the ability of micro and small enterprises (MSEs[3]) to absorb ICTs.

2.1 Cluster Characteristics

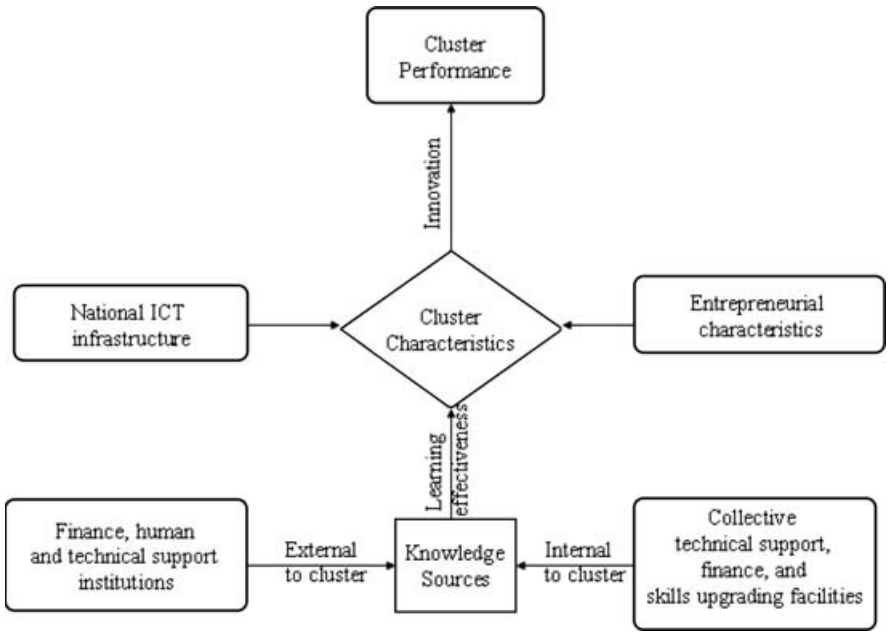
The Suame Cluster (also known as 'Suame Magazine') is located in the heart of Kumasi (northern Ghana). The Kamukunji cluster lies within the inner part of Nairobi, 3 km from the Central Business District (CBD). Comparatively poor people occupy this area and most work within the informal sector. Kariobangi is a rapidly expanding cluster about 15 km to the east of Nairobi. Unlike Kamukunji and Suame, no scholarly research has been done in the Kariobangi cluster. Even though the two enterprise clusters in Kenya are geographically separated, they are comparable in terms of enterprise size and other contextual factors such as infrastructure, historical development and extent of government and non-governmental support activities.

We know of no specific policies to introduce ICTs in clusters and collective learning seems to have arisen as a response to collective needs. Entrepreneurs have been known to find substitutes in the absence of state policy and inadequate public goods (Brautigam, 1997). Our aim is to analyse the role of formal and informal institutions for learning in these clusters. These include communication centres in Suame operated by private sector enterprises commonly named *Business and Communication Centres.* Generally, these centres offer the following services at a fee: telephone calls, facsimile, word and data processing services. Ghana Telecom has installed a number of public telephone booths within and outside the cluster although they are insufficient in comparison to the population of the Suame cluster. The Business and Communication Centres in Ghana are similar (in structure and nature of business) to the *telephone bureaus* in Kenya. Access to a variety of ICT services within the Kamukunji and Kariobangi clusters is limited except telephone services that are widely available from telephone bureaus. In addition to telephone booths, there are a few communal ICT centres providing computer services, although services could sometime be erratic.

3. Analytical Framework

The literature on cluster performance and innovation suggests that building up of the enterprise knowledge base in clusters results from the flow of

Figure 1: Theoretical framework



knowledge from external as well as internal sources (Beaudry *et al*., 2000; Kline and Rosenberg, 1986; McCormick, 1998; Oyelaran-Oyeyinka, 2003). The creation and use of knowledge depends on the type of clusters. For instance, dynamic clusters use knowledge from external and internal sources of innovations and skill upgrading while less dynamic clusters rely heavily on external sources. Expectedly, non-innovative or static clusters may not be equipped with sufficient knowledge infrastructure to enable firms to carry out innovations. However, the innovative capability of firms and clusters cannot be attributed to inter- and intra-firm flows of knowledge alone, it is equally influenced by internal firm factors such as the attitude of owners or managing directors (MDs) of firms. The characteristics of MDs such as entrepreneurship, education and knowledge base are critical variables. Collective learning and skill upgrading facilities are more relevant for clusters of SMEs. For instance, the idea of Collective Service Centres was adopted as a means to provide small and medium-sized firms with economies of scale in the municipality of Modena in Italy. The centres were primarily responsible for providing information, a key requirement of the New Competition (Best, 1990).[4] A theoretical framework encompassing these characteristics and other factors that determine cluster performance is depicted in Figure 1. It is a model of how support systems contribute to the technological capability building efforts of firms.

It shows that external and internal knowledge derive from several institutions such as technical, financial and skill upgrading institutions, although we were not able to capture finance in our analysis due to lack of data. The greater the sources of knowledge, the more effective the learning processes, and the higher the propensity for better cluster performance. Since the focus of the study is on adoption of ICTs and cluster performance, we included the role of national ICT infrastructure. The adoption of ICTs is significantly influenced by local and national ICT infrastructure (Lal, 2001).

Bivariate and multivariate techniques are used to examine the effects of collective learning opportunities on cluster performance. Bivariate analysis relates firms' characteristics to the degree of the adoption of ICTs while performance of firms is analysed in a multivariate framework using ordinary least square models.

3.1 Methodology and Data

Quantitative firm- and cluster-specific data were collected using semi-structured questionnaires in the summer of 2001. Firm-specific variables included history of firms, product profile, type of ICTs used, ownership of ICTs, potential benefits of ICTs, size of firms and financial data. The cluster-specific data related to presence of technological support and skill upgrading organizations in and outside clusters, if owned by associations and individuals, type, frequency and duration of training provided by the existence of institutions. Although firms share information with us, financial information is largely missing. The main ICT tools used by firms were: fixed and mobile telephone, facsimile, computers, CAD/CAM, e-mail and Internet. These technologies were measured on a binary scale, that is, 1 for users of these technologies and 0 for non-users. Subsequently, a composite ICT index was computed for each firm by taking the average of all the technologies used by the firm. We have used this ICT index as a measure of the intensity of ICT adoption by firms in the analysis.

3.2 Hypotheses

H1: The provision of collective technical, information and skills upgrading facilities leads to higher performance in clusters.

For small producers in relatively poor African countries, the cost of staying competitive in skill-based and technology-driven markets is enormous. For this reason, small enterprises require support for the upgrading of skill. There are two main implications. First, it means that support for autonomous firm-level technical change should be sought from a much wider variety of sources. Within the firm, the sources include the production lines and the machine

shops, among others, rather than focusing exclusively on the R&D laboratory. Second, external support services crucial to the growth of firms come from public and private sources including private associations. The knowledge acquired contributes to improving old vintage plant which promises as much economic returns as investment in new vintage plants. Innovation is expected to lead to higher enterprise performance.

Collective skills and information upgrading support to industry vary in the depth of service. In developing countries, research and development institutions (RDIs), the universities and technical institutes, local engineering consultants and foreign partners provide support to domestic industry. In addition to universities and RDIs, there are institutions providing information, metrological services (standards, testing and quality control). Three forms of institutional support, namely public, private services and network associations, are possible. Government support is delivered through technology centres or public RDIs) with broad mandates to assist SMEs in carrying out innovation. Private associations are voluntary trade and manufacturing organizations supported through membership dues. Service providers from the private sector operate as consulting organizations and deliver services at a cost.

H2: Qualification of owners is related to the types of technologies adopted and consequently for innovation and cluster performance

In SMEs, almost all the decisions are taken by owners or MDs, and this makes decision-making processes very different in SMEs compared to large firms with an established hierarchy. For this reason, decision-making processes in small firms are highly influenced by the knowledge and academic qualification of enterprise owners, while in large firms no single individual is responsible for decisions taken due to the hierarchical nature of firms. Therefore, the skill acquisition process[5] in small firms follows a different trajectory. Small enterprises tend to employ less qualified persons and subsequently seek to upgrade skill by providing on-the-job training. However, the crucial question relates to the type and the adequacy of training provided. A relatively more qualified manager is in a better position to decide on the suitability of a particular training for workers. We hypothesize that MDs with engineering degrees would choose ICT-based learning processes, and would favour training workers in advanced ICTs.

4. Statistical Results

We analysed the data using bivariate as well as multivariate methods because greater degrees of freedom were available in bivariate tests but did not capture the interaction of other variables on the adoption of ICTs. On the other hand,

the multivariate test allows an examination of the composite role of several indicators at the cost of degrees of freedom. The results are presented in the next two subsections.

4.1 Bivariate Analysis

Table 1 presents the ownership and use of ICT tools by sample firms in Kenya and Uganda. The table shows that significantly fewer firms own, compared with the users of ICT tools. The pattern is uniform across both countries. For instance, fixed telephone is used by 79 per cent in Ghana and 92.2 per cent in Kenya whereas the ownership is 22 per cent and 24.4 per cent respectively in the countries. As expected, the use of mobile telephone is much less compared to fixed ones in both the countries. However, the ownership pattern is the same in Kenya but is much higher (40 per cent) in Ghana.[6]

The use of facsimile varies significantly in the two countries. Only 5 per cent of the sample firms were users of facsimile while in Ghana the users were more (15 per cent). Another important observation is the greater ownership of facsimile in Ghana. It is clear from Table 1 that the ownership rate of ICT tools in Ghana was much higher than in Kenya while the use of ICTs is similar in both countries. From the relatively widespread usage of ICT tools, there is evident demand for it but resource-poor small firms are unable to own the facilities themselves. In Table 2 we present the distribution of firms according to the intensity of ICT use and the availability of skilled workforce. MDs of sample firms were asked whether they have workers with sufficient and desired skills for effective use of new technologies. The response was recorded on a binary scale. Table 2 shows positive association of degree of the adoption of ICTs and the opinion of MDs regarding availability of a skilled workforce. For instance, in Ghana, 57.4 per cent of MDs who believe they have a trained workforce were users of less advanced[7] ICTs (ICT index is

Table 1: Ownership of ICTs and use

	Kenya		Ghana	
Technology	Ownership (%)	Usage (%)	Ownership (%)	Usage (%)
Fixed telephone	24.4	92.2	22	79
Mobile telephone	24.4	41.1	40	44
Facsimile	1.7	5.0	15	15
Stand-alone computer	2.2	10.6	8	9
E-mail	1.1	4.4	3	4
Internet	0.6	2.8	1	1
CAD/CAM	0	0	0	1

Table 2: Skill intensity and the use of ICTs

Country	ICT Index			Total firms
	< 0.25	0.26–0.50	0.51+	
Ghana				
Yes	31 (57.4)	26 (83.9)	5 (100.0)	59
No	4 (7.4)			3
No. employees	14 (25.9)	5 (16.1)		17
Total firms	54	31	5	90
Kenya				
Yes	60 (53.6)	39 (69.6)	8 (66.7)	107
No	41 (36.6)	16 (28.6)	4 (33.3)	61
No. employees	9 (8.0)	1 (1.8)		10
Total firms	112	56	12	190

Note: Figures in parentheses are column percentage.

Table 3: Availability of skill upgrading facilities

Sources	Type	Ghana	Kenya
Internal			
	Formal training institutions	6 (6.7)	1 (0.6)
	Apprenticeship	64 (71.1)	173 (96.1)
	NGO	1 (1.1)	
External			
	Formal training institutions	3 (3.3)	76 (42.2)
	Apprenticeship	1 (1.1)	41 (22.8)
	NGO	4 (4.4)	1 (0.6)
	Formal organizations		12 (6.7)

Note: Figures in parentheses are column percentage.

less than 0.25) whereas all the MDs of advanced ICT using firms confirmed they have workers with the desired skills.

Although owners with the required skilled workers with past demonstrable ability to use ICT tools were better inclined to adopt more advanced ICTs in Kenya also, 33.3 per cent of MDs who did not have workers with desired level of skills still adopted advanced ICT tools.

The results presented in Table 3 show the nature and availability of internal and external skill upgrading facilities. The table shows that apprenticeship training within clusters is the most common source of skill upgrading in both countries. This is illustrated by the fact that MDs of 71.1 per cent of firms in Ghana and 96.1 per cent of firms in Kenya found internal apprenticeship the most accessible mode of skill upgrading. However, the data also suggest that the Suame cluster in Ghana has more formal training institutions within clusters than Kenya. This is reflected by the fact that 6.7 per cent of MDs in Ghanaian firms reported the existence of a formal training institution in

Suame while merely 0.6 per cent of MDs of Kenyan firms acknowledged the presence of internal training institutions.

The two prominent training centres in the Suame cluster are the Suame Intermediate Technology Transfer Unit (ITTU) and the National Vocational and Technical Institute that provide institutional training. Apart from these two formal training institutes, there are other private collective service centres. Enterprise owners, especially those in vehicle servicing and trading, are trained through apprenticeship and on the job training; including family members. Ninety per cent of the respondents have acquired the necessary skills through this mechanism. Three forms of training providers were identified. These are formal learning institutions, the master craftsman and non-governmental organizations (NGOs). The main training provider is the master craftsman in the cluster and they provide training to 90 per cent of the workers since the majority of the employees and the entrepreneurs receive on-the-job training as apprentices. Only 8 per cent of the 71 respondents received training from formal training institutions and 2 per cent from NGOs. These training providers are responsible for both internal and external training. Other formal training institutions located outside the cluster provide for only a small proportion of the skills acquired.

The situation is exactly the opposite with regard to availability of training institutions outside the cluster. A fairly large number of firms (42.2 per cent) reported that external training institutions are the main sources of skill upgrading in Kenya while the percentage of firms that share this view is very small in Ghana — merely 3.3 per cent. This is because Suame has a fairly good share of internal cluster facilities compared with the two clusters in Kenya. Another distinguishing aspect of external training institutions in both the countries is that apprenticeship is considered as a relatively more important source of skill upgrading in Kenya compared with the enterprises in Ghana.

Table 4 presents the association between the intensity of ICT adoption and the participation of workers in ICT training programmes. Participation in training programmes is not within the control of workers. This depends largely on the attitude and vision of the MD. If MDs appreciate the utility of training programmes in relation to the type of ICTs adopted by firms, it is very likely that the owner might send their workers for training. The availability of training programmes within the cluster is expected to be another factor that could influence the decision of providing training to workers. The table shows that MDs of advanced users of ICTs in the Ghanaian sample firms are inclined to providing training while MDs of low intensity ICTs using firms have less propensity to do so. This is reflected by the fact that MDs of 100 per cent of advanced ICT using firms encouraged their workers to participate in ICT training programmes whereas merely 5.6 per cent of MDs of low intensity ICT using firms sent their worker for training. The

Table 4: Participation in ICT training programmes

Country	ICT Index			Total firms
	< 0.25	0.26–0.50	0.51+	
Ghana				
Yes	3 (5.6)	3 (9.7)	5 (100.0)	11
No	50 (92.6)	28 (90.3)		78
Total firms	54	31	5	90
Kenya				
Yes	5 (4.5)	3 (5.4)	3 (25.0)	11
No	106 (94.6)	53 (94.6)	9 (75.0)	168
Total firms	112	56	12	190

Note: Figures in parentheses are column percentage.

Table 5: Benefits of using ICTs

Benefits	ICT Index			Response rate
	< 0.25	0.26–0.50	0.51+	
Ghana				
Time management	36 (66.7)	27 (87.1)	3 (60.0)	66 (73.3)
Cost effectiveness	24 (44.4)	18 (58.1)	3 (60.0)	45 (50.0)
Enhanced profits	19 (35.2)	13 (41.9)	4 (80.0)	36 (40.0)
Increased sales	11 (20.4)	11 (35.5)	4 (80.0)	26 (28.9)
Exposure to wider markets	14 (25.9)	12 (38.7)	5 (100.0)	31 (34.4)
Total firms	54	31	5	90
Kenya				
Time management	79 (70.5)	53 (94.6)	10 (88.3)	142 (74.7)
Cost effectiveness	43 (38.4)	35 (62.5)	7 (58.3)	85 (44.7)
Enhanced profits	22 (19.6)	16 (28.6)	9 (75.0)	47 (24.7)
Increased sales	34 (30.4)	27 (48.2)	8 (66.7)	69 (36.3)
Exposure to wider markets	34 (30.4)	23 (41.1)	7 (58.3)	64 (33.7)
Total firms	112	56	12	190

Note: Figures in parentheses are column percentage.

skill-biases of educated owners thus play an important part in the skill acquisition efforts of the enterprise.

The relation between workers' participation in training and intensity of ICT adoption in Kenya is significantly different from that of Ghana. A fairly large number of firms (75 per cent) that did not send their workers for training adopted very advanced ICT tools. MDs of merely 4–5 per cent of low intensity ICT using firms sent their workers for training. Apart from other factors, the necessity and utility of training programmes could have also been the reason for the low level of participation in Kenyan sample firms.

Table 5 presents the distribution of firms according to the intensity of ICT adoption and the perception of various benefits of their use. Although the literature on the adoption of ICTs suggests numerous other benefits such

as augmentation of competitiveness, flexibility in product designs, just-in-time (JIT) delivery system, we have considered the benefits indicated by the sample firms. The results presented in Table 5 suggest that there is a positive association between the benefits and the intensity of ICT use. The pattern is uniform across both countries. For instance, better management of time is considered one of the benefits of ICT use. It was expected that MDs of advanced ICT using firms could manage their time more productively than others. However, the results presented in Table 5 do not support the argument. In Ghana, the smallest percentage of MDs (60 per cent) among various levels of ICT using firms reported that the adoption of ICTs contribute to better management of time. In Kenya, while 88.3 per cent of advanced ICT using firms found that better time management is a benefit of the ICT adoption, a greater percentage (94.6 per cent) of middle level ICT using firms reported better time management. The results suggest that the adoption of more advanced ICT tools does not proportionately contribute to better time management.

The other benefits, such as cost effectiveness, enhanced profits, increased sales, access to a wider market, are positively related to the degree of ICT adoption in Ghanaian sample firms. For instance, 80 per cent of advanced ICT using firms reported an increase in sales due to ICT adoption while only 20.4 per cent of low intensity ICT using firms shared the same views. The result is similar in Kenyan firms except the benefit with regard to cost effectiveness. Nearly 63 per cent of middle level ICT using firms found the adoption of ICTs cost effective while a lower proportion (58.3 per cent) of advanced ICT using firms shared the same opinion.

Technological change in small producers is decisively influenced by the knowledge and disposition of the owner. Another reason is that enterprise owners finance investment largely by own savings and might be resource-constrained. They would therefore not invest unless there are clearly perceived benefits. In turn, the perception of MDs with regard to the adoption is significantly affected by the academic qualification and experience they have. Given the nature of the sample firms in this study, we examined the relationship between MDs' qualifications and the degree of ICT adoption. The number of years of schooling has been used as a proxy of education. The results are presented in Table 6.

As expected, the education level of MDs is positively correlated with the degree of ICT adoption in Ghana as well as Kenya. It can be seen from Table 6 that 72.2 per cent of MDs of low level ICT using firms studied up to 8 years whereas only 20 per cent of MDs with similar qualification adopted advanced ICTs in Ghana. However, the situation is reversed where MDs are more qualified (9+ years). Only 20.4 per cent of MDs with 9 or more years of schooling adopted low level of ICTs while 80 per cent MDs with similar qualification adopted the most advanced ICTs. The association between ICT

Table 6: Education level of MDs and the adoption of ICTs

Level of education	ICT Index			Total firms
	< 0.25	0.26–0.50	0.51 +	
Ghana				
None but literate	4 (7.4)	1 (3.2)		5 (5.6)
4–8 years	39 (72.2)	22 (71.0)	1 (20.0)	62 (68.9)
9–12 years	11 (20.4)	6 (19.4)	4 (80.0)	21 (23.3)
13+ years		2 (6.5)		2 (2.2)
Total firms	54	31	5	90
Kenya				
None but literate	1 (0.9)			1 (0.5)
1–3 years	2 (1.8)			2 (1.1)
4–8 years	35 (31.3)	11 (19.6)		46 (24.2)
9–12 years	69 (61.6)	30 (53.6)	4 (33.3)	103 (54.2)
13+ years	5 (4.5)	15 (26.8)	8 (66.7)	28 (14.7)
Total firms	112	56	12	190

Note: Figures in parentheses are column percentage.

adoption and the qualification of MDs in Kenya is similar to that of Ghana. However, Table 6 shows that in general Kenyan sample firms were being managed by more qualified MDs.

4.2 Multivariate Analysis

The ordinary least square (OLS) technique was used in identifying firm- and cluster-specific factors that influenced the adoption of ICTs. We analysed Kenya and Ghana data separately because clusters in both the countries differ substantially in terms of collective skill upgrading facilities, provision of ICT training institution, and the availability of technological support within cluster. Parameter estimates of OLS models for Kenyan and Ghanaian data are presented in Tables 7 and 8 respectively. The explanatory power of equations is not very high, because the list of explanatory variables is not sufficient enough to explain the adoption of ICTs.

Three estimations of the OLS model were carried out to overcome a multi-colinearity problem. From Table 7, profit margins, sales turnover and MDs' knowledge base emerge significant in influencing the degree of the adoption of ICTs. The cluster-specific variable that played a decisive role though negative, in the adoption of ICTs, is cooperation among firms. Cooperation is represented by sharing of ICTs by neighbouring firms. This is an important validation of the assumption of benefits accruing to co-locating firms. Its negative significance in influencing the adoption of ICTs suggests that firms that are advanced users of ICTs did not share their ICT facilities with neighbouring firms. The most widely expressed view is that firms might not

Table 7: Determinants of the adoption of ICTs in Kenyan SMEs clusters

	Dependent variable: ICT Index			Remarks
Independents	Model I	Model II	Model III	
Constant	0.218	0.233	−0.153	
Time management	0.014	0.011		Does your enterprise derive quality time management
	(0.394)	(0.308)		
Cost-effective	0.010	0.011		Does your enterprise derive cost effectiveness
	(0.376)	(0.402)		
Profit margins	0.095***			Does your enterprise derive enhanced profits
	(3.564)			
Cost benefit	−0.012	−0.014		How is the balance between the cost and benefits of ICTs
	(−1.207)	(−1.439)		
STO		0.049 *		Does your enterprise derive increased sales due to ICTs
		(1.882)		
MD_EDU			0.079***	Managing director's education
			(5.345)	
Use_your_ICTs In Clusters			− 0.021*	Do enterprises around you use your ICTs
			(−1.725)	
Use_of within Clusters (NBR)			0.029	Do you use the ICT facilities of neighbouring enterprises
			(1.453)	
R-square	0.131	0.075	0.202	
Degrees of freedom	151	152	177	

Note: *** 1%; ** 5%; * 10% level of significance.

cooperate due to fear of leaking their business secrets to other firms. Table 7 also shows that the perceived benefit such as better time management and cost effectiveness were not significant in influencing the decision of MDs to adopt more advanced ICT tools. The results are similar to the bivariate results where only a small number of advanced ICT using firms reported benefits from ICT adoption.

Regression analysis results for Suame cluster data are presented in Table 8. Two variables, namely sales turnover and cooperation with firms, play similar roles in influencing the adoption of ICTs in the Kenyan cluster. The surprising result is that unlike Kenya, profit margins emerged significant in Ghana but with a negative sign. This is contrary to what we found in the bivariate analysis (Table 5). The plausible explanation for these results lies in the degree of freedom of estimates. Results in Table 7 are based on 36 firms while firms included in regression analysis are 22. Other firms were dropped as data for one or more other independent variables were missing.

Another surprising result is that MDs' education was not significant in influencing the degree of ICT adoption. This might be because only a few

Table 8: Determinants of the adoption of ICTs in Ghanaian SMEs cluster

	Dependent variable: ICT Index		Remarks
Independents	Model I	Model II	
Constant	0.613	0.147	
Time management			Does your enterprise derive quality time management
Cost-effective			Does your enterprise derive cost effectiveness
Profit margins	−0.817**		Does your enterprise derive enhanced profits
	(−2.270)		
Cost benefit	0.058		How is the balance between the cost and benefits of ICTs
	(0.642)		
STO	0.430**		Does your enterprise derive increased sales due to ICTs
	(2.169)		
MD_EDU		−0.012	Managing director's education
		(−0.531)	
Cluster effect		0.154 ***	Do you have physical access to ICTs owned by the agencies within the cluster
		(2.881)	
Use_your_ICTs		−0.053**	Do enterprise around you use your ICTs
		(−2.406)	
Use_NBR		(0.500)	Do you use the ICT facilities of neighbouring enterprises
		(0.500)	
R-square	0.291	0.286	
Degrees of freedom	22	56	

Note: *** 1%; ** 5%; * 10% level of significance.

firms were managed by highly qualified owners but adopted middle level ICT tools. Table 8 also shows that one of the cluster-specific variables, that is, 'use of ICT infrastructure owned by agencies within cluster' has played a very crucial role in the adoption of ICTs. This finding supports our hypothesis that existence of technological support institutions within a cluster encourages adoption of new technologies which in turn contributes to cluster dynamism. This point again supports the hypothesis that collective service provision in the proximity of firms foster usage of new technologies.

4.3 Discussion of Results

This study suggests that cluster performance brought about by the adoption of new technologies depends on two sets of factors. One set of factors comprise firm-specific characteristics which are: academic qualification and knowledge of MDs, skill intensity of the workforce, motivation of MDs to provide workers with regular training for effective use of new technologies, sales turnover, and profit margins. The second set of factors consists of

cluster-specific variables which are: the presence of training and collective technological support institutions within the cluster; and the benefits of inter-firm sharing of facilities. The adoption of ICTs indirectly depends on the local and national ICT infrastructure since these provide the backbone for firm and individual level use of ICTs. However, we did not empirically investigate the impact of ICT infrastructure on the adoption of ICTs by firms located in clusters in Kenya and Ghana due to inadequate data.

The study found a considerable gap in ownership and use of ICTs in Kenyan and Ghanaian sample firms. There could be two main reasons for that. One, firms do not own them due to the complexity of technologies relative to their level of operation. Second, ICT tools are very costly. Low capacity utilization is also regarded as a hindrance in making the decision to purchase new technologies although given the types of technologies in this study, low capacity utilization may well be irrelevant. Such a wide gap in ownership and usage of new technologies provides justification for collective service initiatives in industrial clusters. One of the prime reasons for the cluster-oriented approach to industrial development is to share the resources which are economically unviable for individual firms to own. Clusters in both countries have sought to attenuate the problem of small producer isolation by utilizing collective services such as provision of training and technological support institutions.

The study also finds evidence that MDs of firms are more inclined to train workers if such facilities are available within the cluster. Skill upgrading activities are positively related to the education level of MDs. More qualified MDs are more inclined to train their workers because of better understanding of technologies and their benefits. By taking collective actions and organizing orientation programmes to MDs, owners can be exposed to new technologies. This in turn is expected to widen the understanding of less qualified MDs and they might appreciate the use of new technologies in core activities of their business. It is expected to encourage adoption of new technologies and consequently collective actions might lead to better performance of clusters.

Firm-specific factors that emerged significant in determining the degree of adoption of ICTs are in line with the existing literature (Lal, 2002; Drew, 2003). The relationship with size of operation and intensity of new technologies used is bidirectional. Firms with a larger size of operation are better equipped to adopt new technologies as they have enough financial resources at their disposal. The adoption of more advanced technologies contributes to higher sales turnover as is evident from this study. MDs' knowledge and educational background is important in the adoption of new technologies by SMEs because the decision to adopt lies with the owner unlike in large firms where decisions are taken by groups of people rather than any individual. Better informed and knowledgeable MDs are in a better position to do the cost benefit analysis of new technologies.

Consequently, firms managed by professionals are expected to be early adopters of new technologies. Although it may not be possible to send less qualified workers for formal training, their understating can be augmented by organizing orientation programmes. Cluster initiatives in this regard can boost the adoption of new technologies. The emergence of MDs' education as a significant determinant of the adoption of ICTs supports our hypothesis.

The emergence of cluster-specific variables as a determinant of the adoption of new technologies is an important contribution to the existing literature. The findings validate our hypotheses and suggest that cluster performance can be improved by taking joint actions in the form of technological and human resource development support. In addition to the presence of specific organizations providing training, an important *clustering effect*, a positive economic externality, is the incidence of inter-firm knowledge flows through the provision of training and exchange of information. For instance, the survey found that 60 per cent of the enterprises provide training for other enterprises within the cluster; with 80 per cent providing technical training while 18 per cent provide training in marketing. This is an important finding since most apprentices are unable to afford the fees charged for basic training. Some of the owners of the enterprises admitted that the trainees find it difficult to pay training fees and trainees are obliged to pay in kind through services to the master craftsman. This practice of providing financial support to the apprentices is in conformity with what prevails in other clusters in Kumasi, and the country in general

Collective actions are also needed to make new technology widely available to all firms. This was achieved in the Suame cluster in Ghana by the setting up of ICT service providers. Corresponding efforts have not been made in Kenyan clusters. On the other hand, the Suame cluster has more formal training institutions within the cluster compared to Kenya where firms resort to external service providers at considerably high cost. Consequently, a fairly large number of MDs of advanced users of ICTs in Kenya adopted new technologies despite having no workers with desired skills. In some sense they took a risk in adopting new technologies. This risk factor in the adoption of new technologies can be reduced by establishing more skill upgrading institutions within clusters.

6. Summary and Conclusions

The study analyses data collected from the Suame cluster in Ghana and the Kamukunji and Kariobangi clusters in Kenya. The clusters are dominated by MSEs. Firm- and cluster-specific data were collected though a semi-structured questionnaire. We employed bivariate and multivariate techniques.

Firm- and cluster-specific factors emerged as significant determinants of the adoption of ICTs. The firm-specific factors are: MDs' knowledge and educational background, increased sales turnover, higher profit margins and inclinations of MDs in upgrading workers' skill. The cluster-specific factors are represented by the availability of skill upgrading facilities within the cluster, existence of technological supporting institutions within the cluster and provision of formal training institutions.

The findings of the study suggest policy measures to be taken by governments in developing countries to improve the performance of SMEs. We suggest that state policy encourages greater participation of the private sector in setting up training and information service centres within clusters. These institutions could provide need-based skills for better usage of new technologies. It is also recommended that MDs of micro, small and medium-sized enterprises be given incentives to upgrade the skills levels of their workforce. This could be done by subsidizing the cost of new technology for small firms. New technologies can be put within the reach of small firms by setting up technology service-providing organizations. This is more relevant for ICTs such as e-mail and the Internet. These institutions could be useful in searching function- and job-specific ICT tools which are not only expected to be efficient but cost effective. Such collective cluster initiatives are expected to result in better cluster performance.

Acknowledgment

Country level studies were coordinated by Winnie Mitullah in Kenya and Rudith King and George Obeng in Ghana.

Notes

1. We follow the definition of institution provided by North (1996): 'Institutions are the rules of the game of a society or more formally the humanly-devised constraints that structure human interaction. They are composed of formal rules (statute law, common law, and regulations), informal constraints . . . and the enforcement characteristics of both'. However, as Nelson and Nelson (2002) correctly observe, to see physical and social technology as 'constraints' is problematic. They illustrate: 'A productive social technology is like a paved road across a swamp. To say that the location of the prevailing road is a constraint on getting across is basically to miss the point. Without a road, getting across would be impossible, or at least much harder.'
2. Markets fail due to the problems of 'asymmetric information' and the so-called 'appropriability' factor. On the former, the difficulties in obtaining

information on borrowers lead to the rationing out of such agents, notably small producers, by lenders in the financial markets. Concerning the latter, the inability of firms to capture the full benefits for instance, of R&D investment and workers' training, often lead to under-investment in these activities relative to what is socially optimal; see Biggs, T. (2002) for empirical evidence from developing countries.

3. The abbreviation 'MSEs' is used comprehensively to include the micro and small enterprises as well as the entrepreneurs. Sometimes the word 'MSEs' is used interchangeably with the word 'cluster'.

4. As Best (1990, p. 225) explains it, 'By cooperating in the provision of services with substantial economies of scale, small firms can maintain their independence in production without being reduced to subcontractors for products designed in the central office of a giant firm'.

5. Siegel *et al.* (1997) suggest that three types of skill empowerment may result when a firm adopts advanced manufacturing technologies which are: (a) training, (b) changing employees' job responsibilities, (c) creating new jobs and career opportunities for employees.

6. Mobile telephony was only being introduced in Africa at the time we carried out the survey.

7. As can be seen from the definition of ICT index presented in Section 3.1, the lower value of index means the firm is using low-end ICT tools such as telephone (fixed and mobile). A larger value of index suggests that the firm is using more complex ICT tools such as computers equipped with office management and CAD/CAM systems. Firms with the highest value of ICT index are the users of latest ICTs such as e-mail and the Internet.

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