

# Effect of Clustering and Collaboration on Product Innovativeness: The Case of Manufacturing Small and Medium Enterprises (SMEs) in Kenya

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## Abstract

The study aimed at determining the effect of clustering and collaboration on product innovativeness (PI) in the context of manufacturing SMEs in Kisumu, Kenya. To answer the questions this empirical study raised, a sample of 126 SMEs on the basis of the manufacturing hubs of Kisumu, Kenya. This study provided evidence in support of clustering and collaboration on product innovativeness. Further research is needed to confirm and extend the present results by replicating the principal features of this study with SMEs in other regions within Kenya. The conclusions drawn from this study could inform efforts in designing different supportive actions for different cluster manufacturing SMEs based on their product knowledge gaps within the wider innovation policy initiatives.

**Keywords:** Small and medium-sized enterprises, Manufacturing, Clusters, collaboration, Product Innovativeness, Kenya

## 1. Introduction

The concept of 'clusters' is used relatively in the research literature. This may be due to the fact that 'clusters' and 'clustering' encompass a wide range of dimensions and schools of thought. Due to the long history and the wide nature of the term, it goes by different names in the

literature such as ‘industrial districts’, ‘agglomerations’ (Marshall 1920; Martin & Sunley, 2003)), ‘knowledge communities’ and ‘dynamic knowledge systems’ (Reve, 2009). Depending on the field of interest, scholars have offered competing definitions on the concept of clustering. Cortright (2006) argues that a cluster consists of firms and related economic actors and institutions that draw productive advantage from their mutual proximity and connections. This is a general definition drawing on ideas from geographic, social and competitive studies. Andersen (2010) uses the term cluster when referring to firms in a region with high levels of agglomeration or geographically proximate or co-located.

Clustering is generally characterized by the economic infrastructure of an industry, such as specialized business services, human resources and training institutions (Asia Pacific Economic Co-operation -APEC, 2006). According to Boja (2011), clustering entail co-operating at industry level but competing at firm level. Drawing on Moyi and Njiraini, (2005) the researcher is in agreement that clustering facilitates new ideas spreading and information flow critical to innovation capacity development. In this study clustering is characterized by the collaborative relationships that exist between manufacturing MSEs and their business partners as well as with research institutions/universities. Clustering is thus defined as the interconnection and association between a manufacturing MSE and its partner firms (institutions in a particular field) that facilitate development of novel, radical and exclusive products which fulfill unmet market needs.

## **1.2 The Problem**

Despite the widely held view that clustering plays an important role in fostering incipient industrial development, especially in poor regions (Schmitz & Nadvi, 1999) and also enhance the ability to innovate (Frisillo 2007). Little is known of the effect that clustering has on product innovativeness among manufacturing SMEs in developing countries such as Kenya. In order to remain competitive, SMEs do need to continually improve and enhance their products innovativeness (Salavou & Avlonitis, 2008). Most of the manufacturing SMEs in Kisumu Town seem to be operating in clusters, manufacture similar products and target the same market, thus their product innovativeness levels seem to be low. This has resulted in an increased inter-firm rivalry since firms are competing for not only customers but also skills supply in the labour market. This therefore underscores the importance of undertaking a study on the effect of clustering and collaboration on product innovativeness among manufacturing SMEs in Kisumu Town, Kenya. The paper is organized as follows. Relevant literature is reviewed and synthesized **first**, followed by research methodology. The results are then presented along with discussion. Finally, conclusions and implications are discussed.

## **2. Literature Review**

### **2.1 Porter’s Cluster Theory and Firm Innovativeness**

Porter’s work must be the most popular cluster-related theory based on the volume of comment both supportive and critical. Porter’s work is the benchmark for most state and local

cluster initiatives (Benneworth, Danson, Raines, & Whittam, 2003; Simmie, 2004), and his theory has become the standard concept in the field of cluster theory (Martin & Sunley, 2003). It is widely applied by policymakers throughout the world, not least because Porter has promoted his concept as a key policy tool and has himself advised many policymakers. Porter sees innovation as critical to the success of firms, and suggests that innovation and competitive success are often geographically concentrated, giving as examples entertainment in Hollywood, finance on Wall Street, and consumer electronics in Japan (Porter, 1998).

Critical to Porter's analysis of clustering are the dynamic effects created by interaction of industry and place (Porter, 2003). His theory of the local 'diamond' notion on successful local cluster development depends on four main factors: first, context for firm strategy and rivalry inside the cluster, such as competition and collaboration that put pressure on productivity and the need for firms to innovate and improve: clusters are based upon inter-firm linkages. Lindqvist (2009) avers that firms in a local environment tend to develop relations of rivalry, where the firm down the road is often seen as the "prime enemy". Benchmarking in relation to neighbors is more direct, partly for reasons of local prestige and partly, presumably, because direct comparison is simplified (Malmberg & Maskell, 2002).

Second, the diamond stresses that sophisticated and demanding local buyers contribute to a cluster's competitiveness and innovativeness. Third are the related and supporting industries, such as the supporting suppliers and ancillary industry can assist innovation. The diamond model points to the fact that innovation and competitiveness tend to spill over across firms and industries locally (Huggins & Johnston, 2010). The presence of supporting institutions may positively impact the upgrading of other firms in the local system by not only helping to streamline production and reduce transportation costs, but also enhancing competitiveness through fostering innovation in joint developments. Additionally, the local presence or absence of other industries with activities that are either related or complementary to the cluster's activities can profoundly influence the cluster's competitiveness and innovativeness (Aylward & Glynn, 2006; Miller, So & Williamson, 2011).

Finally, the factor conditions: which include access to infrastructure such as land supply, access to skilled workers and research institutions. According to Lindqvist (2009), the specialized factors develop to fit the needs of a particular economic activity, such as the availability of specially trained labor or a research infrastructure that is specifically oriented to the cluster's needs. These conditions are important as factors of location since they are difficult to move and difficult to imitate in other regions.

Studies have shown that firms in the cluster have better access to common knowledge than non-cluster firms (Almeida & Kogut, 1997; Dahl, Pedersen, & Dalum, 2003). Thus, they tend to search locally for information used in innovation. Additionally, the proximity of firms in the cluster enhances direct observation of competitors (Rogers, 1995). A firm that observes others may try to mimic them and inadvertently generate innovation. When the imitator cannot simply contact the other firm to learn more about an innovation, it will rely on cues from observing the other, increasing the likelihood of mutation and innovation. Firms outside the

cluster would have access to neither the cluster common knowledge nor the ability to directly observe their rivals, so would not be able to use these conduits for innovation. Thus:

Hypothesis 1: locating in the Cluster enhances products innovativeness

## **2.2 Collaboration between SMEs and Business Partners**

Waits (2000) argued that the industry cluster concept has proved to be a powerful framework for firms to organize, collaborate, and work with other institutions to meet their needs and their interests. Within the cluster, firms tend to cooperate not only with other firms in the same cluster but also with potential innovative partners such as suppliers, customers, universities, and research institutions who have specific kinds of resources and know-how (Moyi & Njiraini, 2005). The entire set of collaborative activities established then becomes a network. All collaborations differ in importance and intensity, and firms build up and maintain only those relationships which are valuable to them (Gemunden et al, 1996). According to Branzei and Vertinsky (2006), innovative firms actively scan external sources of knowledge, seek diverse partnerships and learn. This external idea sourcing may prove particularly critical in situations where relevant skills tend to be dispensed among highly specialized players (Rodriguez, Fernandez , & Martins, 2007).

Business partnerships are generally perceived as a mode of steady collaboration among vertically integrated firms. As opposed to spondaic occasional relations of firms, partnerships result in an increased trust and more efficient coordination of activities (Navickas & Malakauskaitė, 2009). The main incentives to form partnerships are the possibilities to: reduce operation costs, increase personnel qualifications, better access to specific information, broad supply of labour force (Pavlovich & Akoorie, 2005) ; easy access to capital resources, improved technological base, enhanced innovation , creating new products, increased sales and competitiveness as well as complement one another (Najib & Kiminami, 2011). Since innovation is influenced by collaboration, it may be advantageous for manufacturing SMEs to maintain their close “cooperative competition” to continue their innovativeness.

**Hypothesis 2:** Collaboration between cluster manufacturing SMEs and business partners has a positive effect on a firm’s product innovations.

## **2.3 Collaboration between SMEs and University/research institutions**

University/research institutions are leaders in the knowledge spillovers and knowledge transformation critical to product innovation (Gao *et al.*, 2008). Owing to their outstanding advantage of technical resources and capacity, they improve and create new knowledge and excellent technology (Moyi & Njiraini, 2005). . University/research institutions play a lead role in the cluster innovation, generating new knowledge and technologies, attracting researchers, investments and research facilities, enhancing other firms R&D activities, stimulating demand for new knowledge and creating and capturing externalities. University/research institutions use external knowledge to a greater extent than firms operating in the cluster, by leveraging on their intellectual and social capital, they can act as “technological gatekeepers” for the whole

region, thus enhancing the absorption of new information into the cluster and facilitating its internal dissemination.

Lan and Zhangliu (2012) aver that the collaboration between enterprises and university/research institutions is an important type of knowledge creation and knowledge transfer. Gao et al., (2008) posit that firms can obtain new scientific knowledge as well as technological knowledge through university/research institutions collaboration. So, the innovation advantage of enterprises cluster is closely related to the interaction and cooperation between enterprises and university/research institutions. As a headstream of knowledge and the supplier of professional personnel, university/research institutions promote the knowledge, information and technology transfer and diffusion by education, training and R&D cooperation. So, the industry-university-research institute collaboration play an indispensably role in the development of novel products. Hence, the study hypothesizes that:

**Hypothesis 3:** Collaboration between cluster manufacturing SMEs and university/research institutions has a positive effect on a firm's product innovations.

### **3. Research Methodology**

#### **3.1 Design and data collection**

This study adopted a cross-sectional survey design, to provide a numeric description of the fraction of the population – the sample -through data collection process, using a questionnaire and observation guide at one point in time, with the findings being generalized to a population (Creswell, 2009).

#### **3.2 Population and Sample**

The focus of this study is at the firm level with the unit of analysis being the manufacturing SME. The sampling frame were all manufacturing SMEs registered and licensed within Kisumu town as contained in the Official Registry of SME Associations of Kisumu, (2011), The sample size was determined according to Krejcie and Morgan (1970) survey table of samples that recommend a sample size of 196 for a population 342, at 95% confidence with 5.0% margin of error. Purposive sampling was then used to select the 136 respondent owner-managers.

#### **3.3 Data Analysis**

Of all the 142 questionnaires returned, only 126 were found usable and included in the analysis. Descriptive analysis, means, ANOVA, independent t-test **and** multiple regression analyses were conducted to examine the various aspects and relationships among variables. In the current study, the dimensions of collaboration measures were the predictor variables and the product innovativeness measures were the criterion variables.

## 4. Results

### 4,1 Collaboration with Partner Firms

In order to understand the collaborative relationships among the manufacturing MSEs, respondents were asked to indicate if their firms developed working partnerships with other firms/ institutions during the 2010 -2012 period (Yes/No-1/2). Results are illustrated in Figure1.

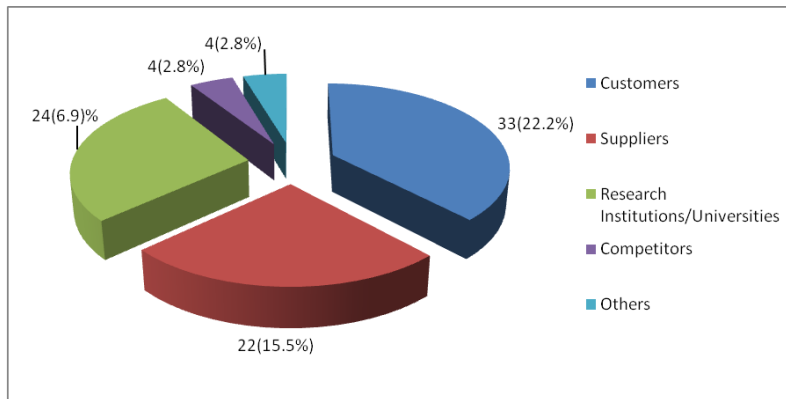


Figure 1: **Collaboration with Partner Firms**

The results indicated that 88 (69.8%) of the firms had working partnerships with other firms while the remaining 38 (30.2%) indicated no partnerships. Of these, 85% firms collaborated with 33 (23.2%) customers, 22 (15.5%) suppliers, 24 (16.9%) research institutes/ universities, while a few MSEs partnered with 4 (2.8%) competitors and 4 (2.8%) others including consultancies. In addition the activities partnered in were sought and the results are shown in figure 2.

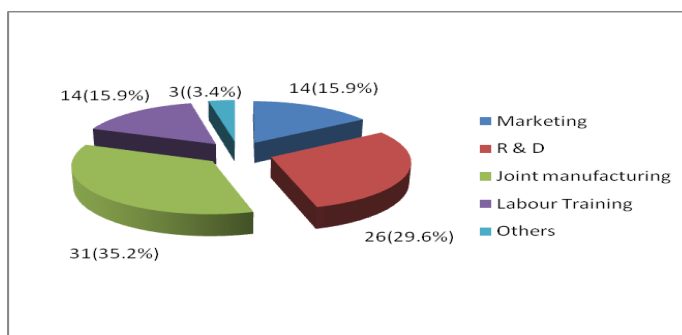


Figure2: **Partner Firms Collaboration Activities**

The results indicated that 14 (15.9%) of firms collaborated in marketing, 14 (15.9%) labour training, 25 (29.6%) R & D, 31 (35.2%) Joint manufacturing (see plate 3) and 3 (2.8%) others



Plate 1: Sisal Decatometer -a research institute collaborative innovation product

## 4.2 Innovativeness Expenditure

Funds investment in equipments, machinery, tools, R & D, or training, rather than to cover the business' day-to-day operating expenses, are indicative of a firm keen on improving its production processes or developing innovate products. This variable is useful in ascertaining the innovative activities of a firm. The distribution of the average expenditure on innovation activities is shown in Table 1

**Table 1: Manufacturing MSEs Mean Investment Expenditure**

<b>Expenditure item</b>	<b>n</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>S.D.</b>
Machinery & /equipment	81	2	47	68.82	78.73
Training	47	15	70	18.83	17
R & D	67	1.9	170	29.31	37.05

Notes: Respondents could answer more than one choice n = 126

- Values are in '000' (KES)

The results indicate that the firms invest fairly small portions of revenue, an average of 68.82 (SD = 78.73) in machinery and equipment, 18.83 (SD = 17) in training and 29.31 (SD = 37.05) in R&D. The entrepreneurs who purchased additional and more efficient machinery and equipment seem to have been aiming at increasing capacity as well as adopting innovative production process. The additional capacities could lead to a reduction in the unit production cost and, conversely, an increase in productivity.

Investment in training is critical to innovation presumably due to the enhanced absorptive capacity of knowledge-spillovers that may trickle back into the MSEs. According to Knight (2001), participants in the National Innovation System (government, firms and the other members) invest in R&D for the creation of new products, technologies and knowledge a

scenario that is emerging in Kisumu as firms collaborate with KIRDI, technical institutions and universities to access skills and special machinery as is the case between KIRDI Kisumu and leather / fish skin products manufacturers.



**Plate 2: Fish-skin processing at KIRDI,**

**Plate 3: 'Safaricom green' fish leather**

Such arrangements enable the MSEs to focus their investment on product design and internal R&D, rather than on expensive equipment.

These findings are in assonance with those of Belderbos et al., (2004) who found that supplier collaboration contributes to innovation, though incremental. Similarly, Lau et al., (2010) aver that product innovation demand that new collaborations are initiated with suppliers who posses the 'right' complementary knowledge as they contribute new technologies. As Simon (1996) observed with the Hidden Champions, creating a new market is the most effective way of innovating, but it is difficult without partnerships To achieve this, market driven product innovation is important in maintaining competitive advantage. Thus, developing closeness to the customers, suppliers and research institutions/ universities will provide the firm with a valuable source of innovative ideas, and ultimately detailed information of the firm's competitors as well as dissemination, and application of knowledge created in developing innovative products.

### 4.3 Hypotheses Testing

#### **4.3.1 Independent t-test for difference in product innovativeness of cluster and non-cluster manufacturing MSEs**

To test hypothesis 1, independent-samples t-tests were conducted to compare the dimensions of PI, product newness and product uniqueness for clusters and non-clusters. The results are presented in Table 2.



**Table 2: Mean Score differences in Product Innovativeness Dimensions between Cluster and non-cluster Manufacturing MSEs**

Variable	Cluster (n=82)		Non-cluster (n=44)		T	P
	Mean	SD	Mean	SD		
Product innovativeness	18.52	6.30	21.02	4.92	-2.456	.016
Product newness	.01	.99	-.02	1.02	.172	.001
Product uniqueness	-.19	1.10	35	4.92	-3.408	.864

The results showed that there was a significant difference in PI mean scores for clusters (M=18.52, SD=6.30), and non- clusters (M=21.02, SD=4.92),  $t(107.71) = -2.46, p < .05$ . The magnitude of the differences in the means was moderate (eta squared=.044). The results are consistent with those of Audretsch and Feldman (2004) who found that innovative firms are located in areas where there are clusters of firms with past innovation success.

For product newness, the results indicate a statistically significant difference in the mean scores, for clusters (M=.01, SD=1.09), and non- clusters (M=35, SD=4.92),  $t(122) = -3.408, p < .001$ . The magnitude of the differences in the means was small (eta squared= .0002), thus confirming the earlier findings.

Finally, there is an insignificant (n.s.) difference in the mean scores of product uniqueness between cluster (M=.01, SD=.09), and non-cluster firms (M=-.02, SD=1.02),  $t(124) = p = .172, n.s$ . The magnitude of the differences in the means was large (eta squared= .006). Taken together, the results support hypothesis 1.

#### **4.3.2 Regression Analysis**

Variance inflation factor (VIF) was used to examine multicollinearity with no value going beyond the critical level of 5 and none of the tolerance approached zero, implying no multicollinearity problem (Hair *et al.*, 2010). The results are shown in Table 3.

**Table 3: Regression coefficients Results of Collaboration Relationships on Product Innovativeness**

Variables	B	S.E. of B	B	t	P	Tolerance	VIF
(Constant)	8.862	2.901		3.055	.003		
Partner with other firms benchmarking products	.234	.367	.054	.637	.526	.869	1.150
Searching for new ideas	.149	.361	.034	.414	.679	.952	1.051
Market information from external sources	1.025	.421	.219	2.434	.016	.781	1.281
Work with research institutions	1.718	.417	.361	4.124	.000	.826	1.211
Partner in design & testing	.140	.327	.035	.429	.669	.949	1.054
	-.101	.369	-.023	-.273	.785	.876	1.141

$p \leq 0.05$

The results of the regression indicated the predictors explained 24.7% of the variance ( $R^2 = .247$ ,  $Adj R^2 = .209$ ),  $F(6, 119) = 6.508$ ,  $p < .05$ ;  $t = 3.055$ . It was found that searching for new product ideas significantly predicted PI ( $\beta = .219$ ,  $p < .05$ ) as did seeking market information from external sources ( $\beta = .361$ ,  $p < .001$ ). Nonetheless, three predictors exhibited insignificant positive effects on PI: partnering with other firms in developing new products ( $\beta = .054$ ,  $p = .526$ ); benchmarking products ( $\beta = .034$ ,  $p = .679$ ); working with research institutions ( $\beta = .035$ ,  $p = .669$ ), while partnering in design and product testing was negative and insignificant ( $\beta = -.023$ ,  $p = .785$ ).

These results indicate that both external acquisition and sharing of product ideas/ information, do contribute positively to innovation and product innovativeness of MSEs. These findings would appear to be consistent with other research views that external knowledge is an essential determinant in new product innovation (Un et al. 2010). Even though partnering with other firms, comparing products with those of other firms, working with research institutions and partnering in design and product testing are insignificant, they do contribute to an emerging trend in the MSEs products innovativeness as exhibited in plate 3.

### 5. Discussion

Regarding the first hypothesis, the analysis revealed significant differences in means of PI between cluster and non- cluster MSEs. This finding is in assonance with Bell's (2005) which concluded that locating in the cluster enhances MSEs product innovativeness.

Relative to the second research hypothesis, the results showed a significant positive effect of business partner's collaboration on product innovativeness, thus confirming earlier results as reported in figure 2. This finding is consistent with that of Najib and Kiminami, (2011) who concluded that firms tend to collaborate in order to achieve the effect of synergy in various fields of operation. Similarly, a study by Kaminski *et al.* (2008) found evidence that collaboration with other firms significantly increases SME innovativeness. Researchers are of

the view that such interactions provides firms with some of the necessary conditions required for innovativeness, namely, product idea or information transfer (Walsh *et al.*, 2009), learning and coordination of production and product development activities (Walsh *et al.*, 2011). Thus within the cluster, firms tend to cooperate not only with other firms in the same cluster but also with government agencies, universities, and research institutions. As Folta *et al* (2006) note, economies of clusters benefit firms in their ability to innovate by attracting alliance partners whose information sharing and transfer could lead to development of innovative products.

Finally, responding to the third hypothesis, the results showed an insignificant positive effect of university /research institution collaboration on PI. According to Lan and Zhangliu (2012), despite the insignificant result, as a headstream of knowledge and the supplier of professional personnel, university/research institutions promote the knowledge, information and technology transfer and diffusion by educating, training and R&D cooperation thus playing an indispensably role in the development of novel products.

## **5.1 Conclusions**

This study investigated effect of clustering and collaboration on product innovativeness of manufacturing MSEs in Kisumu Town with a view to generating appropriate mix of clustering strategies for the improvement of their product innovativeness. This was in relation to MSEs lack of continual improvement and enhancement of their product innovativeness. The study established that clustering and collaboration significantly enhance PI.

In view of these findings the study concludes that clustering does indeed have a positive effect on manufacturing MSEs product innovativeness. This finding reinforces Porter's (1998) cluster theory that stresses how the diamond elements combine to produce a dynamic, stimulating and intensely competitive business environment which in turn amplifies all of the pressures to innovate and upgrade. Thus, clustering is the manifestation of the diamond at work.

## **5.2 Recommendations**

Despite its limitations, this study contributes substantially to academic knowledge and practice, in addition to highlighting key areas warranting future investigation. At the national context, the study generates appropriate mix of clustering strategies and contribute to policy efforts towards enhancing the manufacturing MSEs' product innovativeness and hence competitiveness.

The researcher recommends the setting up of MSEs clustering policies that promote collaborations with university/research institutions for purposes of sharing information/ accessing the diverse knowledge base on new product design, development and production. Such collaborations and the direct contact with entrepreneurs in the same field will reduce risks and durations of the innovation process because of direct or informal information transfer

between partner firms and university/ research institutions, hence enhanced product innovativeness.

### 5.3 Areas for Further Research

Future studies replicating this study across multiple industries and sectors using a larger sample would increase the understanding of MSE clustering concept. The study did not investigate firm-specific factors influencing product innovativeness in relation to knowledge spillover, such as absorptive capacity. Since the study focused on the effects of clustering, it did not measure absorptive capacity or similar firm-specific factors that may influence firm ability to translate information into innovative products. Therefore, this is a line of investigation that future research should embrace.

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