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Determinants of SMEs growth (wood enterprises): Infrastructure, technology and collective efficiency

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Economic development is said to be dependent on industrial development. Industrialization is seen as key in the promotion of sustainable development since it creates productive employment, generates value added capital and makes a significant contribution to economic and social development. However, the trend in the performance of the manufacturing sector in Kenya raises questions on the effectiveness of the strategy used in planning for sustainable industrial development. This paper explores the factors essential for the active participation of small manufacturing enterprises in contributing towards sustainable industrial development. Data was obtained from wood based enterprises owner/managers (284) who were sampled from three Districts; Kericho, Nakuru and Uasin Gishu all in the Rift valley province of Kenya using multistage sampling strategy. Data was collected by use of questionnaires, observation and documentary analysis. The study found that the infrastructure accessed by wood industries in Western Kenya is poor, the technology employed low, the wood enterprise growth poor and collective efficiency also poor. The relationship between infrastructure and technology development is significantly linear, between infrastructure development and wood enterprise growth and between technology development and wood enterprise growth is also linear. However, the relationship between collective efficiency and wood enterprises growth is logarithmic. It has also emerged that the relationships between collective efficiency and technological development is also logarithmic. Using multiple regression analysis, it was shown that technological development is a very important determinant of the growth of small wood enterprises compared to the others. The study reveals the need for industrial development paradigm shift to a focus on small manufacturing enterprise's infrastructure and technological development planning based on the collective efficiency paradigm that should anchor sustainable industrial development.

Key words: Small manufacturing enterprise, wood enterprise growth, infrastructure, technology, collective efficiency, sustainable industrial development.

INTRODUCTION

Kenya's industrialization strategy has tended to focus and favors foreign investors. United Nations Industrial Development Organization (UNIDO, 1998) observed that foreign direct investment (FDI) should be utilized to benefit the entire economy but it is not the only option for successful industrialization to take place. A rethink of this strategy has been going on since 1986 with the recognition of the importance of the informal sector, the small and the micro enterprises and the small manufacturing enterprises in social economic development (Kenya, 1986, 1992, 1996, 1997, 2005). Yet, in spite of these policy papers and support strategies there in stipulated, the performance of the SMEs is still dismal. SMEs, have a high death rate, (60%) closing down within their 1st year of operation, 40% less than 2 years old and 66% less than 6 years; thus hardly gain from experience (Kenya, 1999).

Lukacs (2005) observes that there is little or no technological dynamism in this group, and few 'graduate'

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into large size or modern technologies. In this subsector study, the wood industry is used to examine the extent to which collective efficiency paradigm is used in supporting the growth of the wood enterprises and by extension SMEs. The use of the wood industry is appropriate since forests are, important renewable assets of a country's wealth that even poor countries have or could posses. Forests provide renewable raw materials for a wide range of industries with wood industries providing a wide range of products for consumption and intermediate purposes thereby contributing to economic growth and development of a region or country.

Problem statement

In Kenya, the performance of the wood industry has continued to decline over the years. As at 2009, virtually all large sawmills had collapsed leading to the closure of Pan Africa Paper Mills that was producing 80% of the pulp and paper products in Kenya. Between 2001 and 2002, the wood and cork subsector performance dropped by 56% while import of timber increased from 78.2 to 606 m^3 in the same period (Kenya, 2003). While the poor performance in the wood industry has been attributed to the ban of logging which in itself is a manifestation of poor infrastructure planning, it is also indicative of the challenges faced in the growth of small manufacturing enterprises within this sector. There is however, insufficient literature on the use of networking and collective efficiency as a paradigm that informs infrastructure and technology development that in turn support the growth of SMEs in LDCs.

Objectives of the study

The purpose of this study was to investigate the extent of the influence of the collective efficiency, infrastructure development and technology development on the growth of wood enterprises in urban and rural settlements in western Kenya and hence, the role they should play in planning for sustainable industrial development.

Literature review

Since SMEs in LDCs are unable to develop infrastructure and technology significantly on their own, then collective efficiency paradigm need inform the infrastructure planning and development, so that SMEs engage in joint actions. Collective efficiency here, refers to joint actions or collective efforts that are made by enterprises working together to facilitate their individual enterprises improved performance. The thesis here is that this joint actions needs to be engineered in the planning and developing of industrial infrastructure, targeting to support SMEs

access better or improved technology and hence, the growth of the individual enterprises and the sector as a whole and its contribution to the industrialization process.

The joint actions, as noted by Nadvi and Schmitz (1994) works better when small manufacturing enterprises work/operate in close proximity in clusters. Nadvi and Schmitz (1994) and Schimitz (1995) notes that industrial clusters are concerned with local growth processes that arise from sectoral and regional concentration of small and medium sized firms that facilitates gain in efficiency and flexibility. As pointed out by Schimitz (1995), the concept of collective efficiency is facilitated by the clustering on a number of subsequent development factors which include labor division, specialization by SMEs, rapid production of specialized products, emergency of suppliers to handle raw materials, component parts and machinery; emergency of service providers such as technical, legal, communication among others; emergency of marketing agents; emergency of a pool of skilled workers and formation of consortia or associations for specific services and lobbying all of which need to be considered in infrastructure planning and development. In infrastructure planning, Ombura (1997) points out that infrastructure networks are useful instruments within network economies. Infrastructure planning begins with industrial location choices which place spatial distribution of industry in reference to other social aspects. A spatial planning approach ensures the most efficient use of land by balancing competing demands within the context of sustainable development (Rozee, 2003; UNICEF, 2008). It becomes an ongoing, enduring process of managing change by a range of actors, in the interests of sustainable development (Tewdwr, 2004).

A sustainable industrial policy and development strategies encompassing a variety of inter-related economic, social and environment objectives such as encouragement of an open and competitive economy, the creation of productive employment and protection of the natural resources through efficient use of renewable and non renewable resources is required. Such a policy and strategy should create a self sustaining industrial sector having strong linkages with domestic economy. This, network analysis approach in infrastructure planning portends that co-operative mechanism should be established alongside the competitive rules of behavior and take advantage of collective differentiation and learning (Ombura, 1997). It emphasizes pooling together to create infrastructure for use in network economies.

This leads to the combined improvement in the fields of technology, marketing, transportation, communication, access to services and waste management with the benefit of reduced costs in overcoming difference. This should work together or in conjunction with the systems theory which requires that facility configuration be done in a distinctive but interrelated and inter-dependent pattern (Catamase and Synder, 1988). Small manufacturing

enterprises represent such systems where interactions between infrastructure and technology determine enterprise development trends in a collective and networking environment. This brings to the fore the need for industrial infrastructure planning and development that seeks to promote access to, acquisition and development of technologies that lead to improved efficiency, effectiveness and productivity of the small manufacturing enterprises. Thus, SMEs cannot attain growth unless they employ technologies that allow for competitiveness. The technology acquisition and development can only be facilitated by appropriate and relevant infrastructure to be determined in a networking and collective approach.

In technology development, Gushesh (2003) indicates that technology is accepted by society depending on the social context, the perceived ease of use and perceived usefulness in addressing society's immediate needs. This means that society should be involved in determining what technology it needs and the direction along which it should be developed (constructivism). According to Gushesh (2003) technical design is influenced by society since human needs are seen to have cultural base. Thus, cultures and societies would have different definitions of technology that would be appropriate to the context of that society. That would explain why modern technologies that have succeeded in developed countries, fail in less developed countries and hence the need to engage local communities in participatory approaches when developing technologies appropriate to their context.

Conceptual framework

This study is informed by collective efficiency theory in SMEs growth, networking and systems approach in infrastructure planning and development and constructivism in technology development as expounded earlier. All these paradigms encourage stakeholders to come and work together for the betterment of their operations, improved productivity and economic development of society. This calls for small manufacturing enterprises to act together in an environment conducive for such joint actions. This forms the basis upon which this study is conceptualized as illustrated in Figure 1.

RESEARCH METHODOLOGY

The study sourced data from owners/managers of wood enterprises located in three districts; Uasin Gishu, Kericho and Nakuru in the Rift Valley province of Kenya. The three districts were selected purposively because Rift Valley province has 47% of Kenyan forests with the three districts having 61.1% of the small wood enterprises (Kenya, 1999). The selection of the wood enterprises was through a combination of multi-stage sampling, using a list of wood enterprises from the forestry department and snowballing for some micro enterprises whose sampling frame was non-existent. A sample of 284 wood enterprises comprised of 181 furniture producing enterprises, 100 sawmillers and 3 panel producers were

used.

Prior to the commencement of the actual survey, the survey instrument was first reviewed by peers for content validity and then pre-tested to evaluate its suitability. Further, a test-retest method was used to examine the reliability and consistency of the instrument. The test-retest administered with a two-month period in between gave correlation a coefficient of 0.931, indicating high reliability of the instrument. At the data collection stage, the data collected was verified using past records and repeat visits to ascertain the data's reliability and validity. Out of the 284 wood enterprises, 203 completed the survey instrument indicating an impressive 71.5% response rate.

DATA ANALYSIS

A measure of infrastructure development accessed by wood products manufacturing enterprises was obtained by aggregating individual enterprise score on infrastructure they access divided by the total possible score. The results show that the infrastructure development index (IDI) ranges from 0.04 to 0.71 with a mean of 0.3235 and a standard deviation of 0.09057 which is low. Similarly, a measure of technological development (TCI) was shown to range from 0 to 0.54 with a mean of 0.148 and a standard deviation of 0.08 which is also low. To test whether there is a relationship between infrastructure development and technology development, a linear and log linear regression analysis was carried out and it emerged that there is a significant linear, exponential, and logarithmic relationship albeit weak in all cases. Since, the linear relationship is stronger (r = 0.451 and R^2 = 0.2) compared to the exponential (r = 0.395 and R^2 = 0.155) and the logarithmic function (r = 0.372 and R^2 = 0.139) then, the relationship is essentially linear.

The wood enterprises growth index (GI) ranges from of 0.01 to 0.89 with a mean of 0.1625 and a standard deviation of 0.132 indicative of low growth. A test of the relationship between wood enterprise growth and infrastructure development shows that the linear relationship (r = 0.459, R^2 = 0.211) is stronger than the exponential (r =0.4, R^2 = 0.16) and logarithmic relationship (r = 0.394, R^2 = 0.155).

Analysis of the relationship between wood enterprise growth and technological development, shows that the linear relationship has a greater (r = 0.863, R^2 = 0.744) compared to the logarithmic function (r = 0.759, R^2 = 0.576) the exponential (r = 0.754, R^2 =0.569). A collective efficiency index (CEI) is low with a mean of 0.1029 and the relationship between collective efficiency and wood enterprise growth shown to be more logarithmic (r = 0.350, R^2 = 0.123) than it is exponential (r = 0.261, R^2 = 0.68) and linear (r = 0.261, R^2 = 0.68). The logarithmic curve fit (Figure 2) with R^2 =0.94 indicates that 9.4% of the change in GI can be attributed to the unit change in CEI. This shows that the logarithmic model better explains the relationship between collective efforts in wood industry and the growth of wood enterprises as compared to linear and exponential models. A multivariate
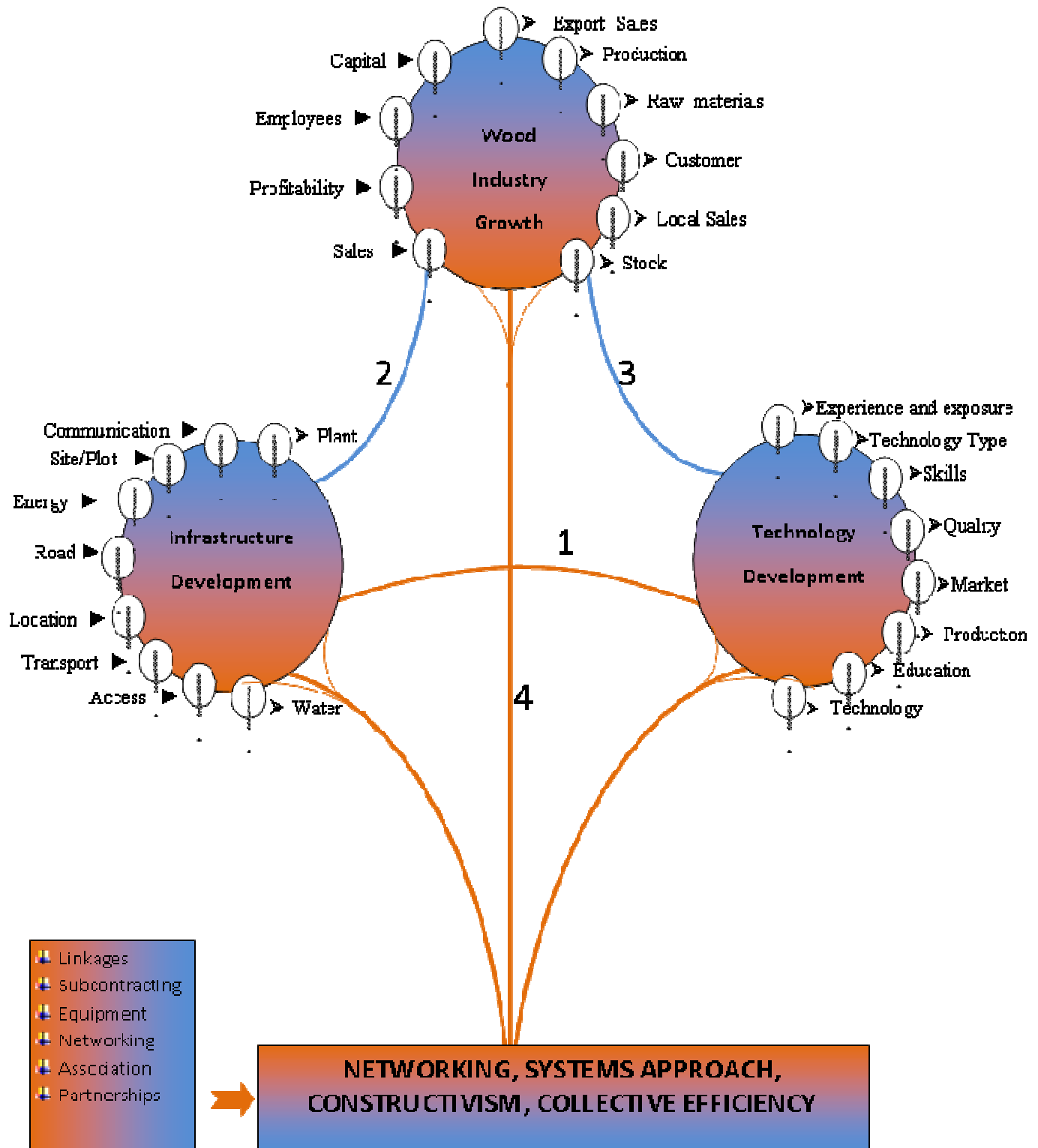
Figure 1. Interrelationships between infrastructure, technology and the growth of small manufacturing enterprises based on collective efficiency. The relationships marked 1, 2, 3, and 4 in the model were investigated and a measure of their development and use synthesized into indices. The variables technological complexity index (TCI), infrastructure development index (IDI), wood enterprise growth index (GI) and the collective efficiency index (CEI) were synthesized from the respondent's responses on items relating to the sub-variables shown around each variable in the model, Figure 1 and expressed as a ratio ranging from 0 to 1 and also expressed as a percentage.
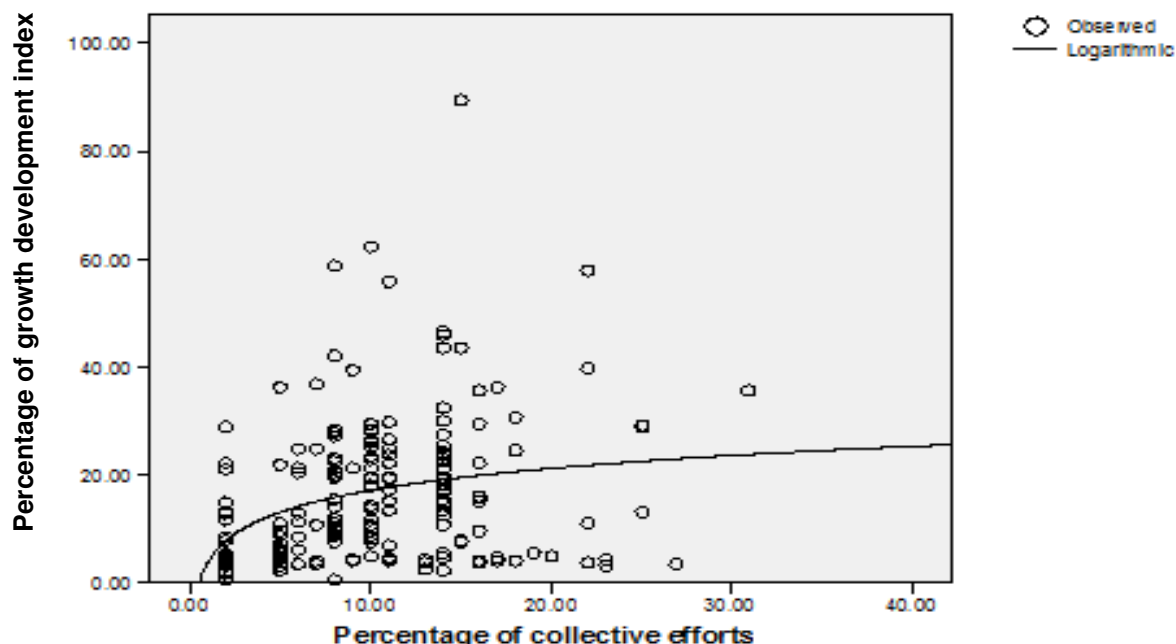Source: Author.

Figure 2. Logarithmic curve fit of GI against CEI.

Table 1. Effects of factor inputs on the growth of wood enterprise.

Factor	N	Mean	STD	Multiple regression standardized Beta value	Significance 1-tailed test	Zero order correlation coefficient
Wood enterprise growth index (GI)	202	0.17	0.132	-		1.0
Infrastructure development index (IDI)	202	0.32	0.091	0.076	0.000	0.449
Technological complexity index (TCI)	202	0.15	0.080	0.859	0.000	0.860
Collective efficiency index (CEI)	202	0.10	0.059	-0.088	0.000	0.271

analysis of the infrastructure development index (IDI), technological complexity index (TCI), and collective efficiency index (CEI) as the independent variables is tested for the extent to which they influence the wood enterprise growth (GI) as the dependent variable. The effect of the factor inputs in the order of importance is as summarized in Table 1, showing that technological development is the single most important factor in the wood enterprise growth followed by infrastructure development. This shows that technology development has more effect on the wood enterprise growth, followed by infrastructure development and the least effective is collective efficiency. Acting together, the combined correlation coefficient $r = 0.865$ and coefficient of determination $r^2 = 0.745$ with a standard error of estimates of 0.069 shows that the three factors have a strong effect on the growth of wood enterprises.

The emerging model is:

$$GI = -0.066 + 0.076IDI + 0.859TCI - 0.088CEI$$

This shows that there is need to address the three independent variables together when seeking to support

wood enterprise growth and development. Infrastructure planning is the key, since it supports and coordinates technological development and enterprises collective actions that in turn support the enterprise growth.

DISCUSSION

This study sought to explore the collective efficiency as a paradigm that could inform infrastructure planning and technology development in less developed countries (LDCs) to enhance SMEs growth. In their papers, Schmitz (1995) and McCormick (1999) convincingly extol the virtues of collective efficiency to the growth of SMEs. They demonstrate how collective efficiency framework could be leveraged by all aspects of infrastructure, technology, institutional development and pooling together in network economies. In this paper, we hold this as true and pursue collective efficiency as a paradigm that could be deliberately pursued in infrastructure planning and development in LDCs. It has been noted that infrastructure and related services aid the development of networks within clustering SMEs that support the

creation and sustainability of the clusters. The findings from this study indicate that although the extent of collective efficiency and wood enterprise growth are both low, there exists a significant logarithmic influence of the collective efforts on the wood enterprise growth and linear relationship between infrastructure and technology development.

This brings to the fore the question of the extent to which collective efficiency has been engineered or deliberately built into the infrastructure planning in SME clusters within which they operate. McCormick (1999) observes that clustering has the potential to facilitate industrialization and that this potential is not always realized. It was observed that many clusters get stuck at low levels of production and distribution and are affected by social, political and economic institutions that shape human interactions and create distinct patterns of business operations and organizations (McCormick, 1999). It is these institutions we propose here, that should be targeted in infrastructure planning and development within clusters in order to respond to opportunities and challenges, clustering firms cannot rely on incidental external economies but need to resort to planned joint actions (Schmitz, 1995; McCormick, 1999).

However, Schmitz (1995) observes that clustering in developing countries has not been the outcome of planned interventions by the state but has emerged spontaneously from within. Further, Schmitz (1995) opines that it is difficult to create clusters from earlier and that they develop best as endogenous process. This is where infrastructure planning and development in support of collective efficiency comes in. The use of the collective efficiency framework in infrastructure planning and development in less developed countries would become a continuous process of managing change by a range of actors towards sustainable development (Tewdwr, 2004). The collective efficiency and network-based approaches in infrastructure planning would combine co-operative mechanisms with competitive rules of behavior while at the same time taking advantage of differentiation and learning as noted by Ombura (1997). The logarithmic model emerging from this study is important, in that it throws caution to infrastructure planners and developers not to expect collective efficiency to benefit growing manufacturing enterprises perpetually. Rather, the rate of change in the enterprise growth is higher with higher level of collective efforts initially up to a certain maximum point when further joint actions do not benefit the wood enterprise. At this point, the wood enterprise would have developed sufficiently to influence directly the kind of infrastructure and technology they access and employ.

They would therefore be expected to operate more independently and spatially located in areas designated in physical planning parlance as "industrial sites" as opposed to "light industries site" more suited for clustering enterprises. This logarithmic model would also fit in the typology of clusters espoused by McCormick (1999) that include:

i) Clusters laying groundwork for industrialization that build a productive environment and prepare the way for emerging collective efficiency;
ii) Industrialization clusters that have clear signs of emerging collective efficiency and have greater specialization and differentiation of firms leading to stronger bilateral production linkages and finally;
iii) Complex industrial clusters that included firms of different sizes and depend more on large firms for bilateral and multilateral co-operation in joint actions.

This suggests that in infrastructure planning and development, collective efficiency should inform the planners on the growth process and arrange to provide facilities and institutions that commensurate with the growth path. The collective efficiency model has been criticized on several fronts. McCormick (1999) argues that collective efficiency itself does not explain why the clusters themselves do not advance and that collective efficiency is not always sufficient for understanding its impact on cluster development. Schmitz (1995) points out that collective efficiency does not always imply collective capacity to compete, adapt and innovate since it does not lead to an island of unity and solidarity and that the nature of inter and intra firm relationships range from exploitative to strategic collaborations.

Perhaps, this can be attributed to the fact that, as observed by both McCormick (1999) and Schmitz (1995) the clustering and collective efforts has not been as a result of deliberate and planned support structures for the SMEs operating in this clusters. Sanyu and Kri (2007) recommend that clustering approach should be adopted in planning for and in support of micro, small and medium manufacturing enterprises in Kenya. This paper rooting for collective efficiency paradigm in the planning and development of industrial infrastructure for the growth of SMEs in LDCs has several limitations. First, the subsector (wood enterprises) approach would limit the application of the findings to the wood industry, for it blunts the extent of generalized-ability of findings as noted by Schmitz (1995). Secondly, the collective efficiency has not been pursued consciously as a paradigm by both industry players and infrastructure planners and providers.

Consequently, the low extent of its use and effects on the SMEs growth would not be an adequate indicator of its efficacy. Thirdly and finally, the extent of clustering and poly-dispersion of enterprises in itself affects study findings on the extent of collective efficiency, a factor that has not been adequately operationalized and delimited in the study. Wood enterprises were sampled from town centers or settlement townships in their natural spatial locations without any effort to isolate specific location on the basis of wood enterprises concentration or designated light industry sites in such town centers. The study findings do however, provide a basis for policy development as an interdisciplinary and comprehensive approach directed towards regional development and

physical organization of space according to an inclusive strategy.

CONCLUSION AND RECOMMENDATION

In conclusion, while the wood enterprise growth indices indicated low growth and low collective efficiency indices, collective efficiency significantly influences wood enterprises growth logarithmically. This indicates that wood enterprises operating in clusters and engaged in external economies and joint actions will benefit differently depending on their level of growth. They gain more initially with increased levels of collective efficiency and afterward level off, implying that at some point in an enterprise growth, increased joint actions may not continue to influence enterprise growth. For industrial infrastructure planners and developers, that is important since it indicates that micro and small enterprises need supportive infrastructure, institutions and structures that enable them to gain from collective efficiency. They will however, outgrow such mechanisms to a point where they are able to influence their own infrastructure, technology, structures and supply chain partnerships and collaborations.

It is therefore recommended that collective efficiency would be important in informing, planning and in the development of industrial infrastructure supportive of SMEs growth. Such growth would lead to graduation from micro, small, medium and eventually large enterprises, along which infrastructure improvement and technology up gradation would be expected but by then, SMEs would have developed their own muscles and capability to innovate and develop their own competitive strategies. Further, similar cross-sectional research studies are recommended among enterprises where both clustering and collective efficiency has been engineered and infrastructure developed according to plan supportive of all or most of the facets of collective efficiency.

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