

Infrastructure and Technology Planning and Development for Sustainable Industrial Growth: Lessons from Wood Enterprises in Kenya

Dr Ng'ang'a S.I.

Dean, School of Business
Karatina University College
Kenya

Abstract

This paper interrogates industrial development in Kenya. It presents a discourse in support of modernizing local technologies and focusing on small manufacturing enterprises (Jua Kali) to anchor sustainable industrial development in Less Developed Countries. The trend in production and performance in Wood Industry in Kenya is used to demonstrate that relying on modern technology brought in by foreign Direct Investment does not always lead to sustainable development. The paper is informed by a longitudinal survey of the performance of manufacturing and Wood Industries in Kenya.

Key words: Modernizing technology, Local technology, Sustainable development, Infrastructure planning and Development and Wood Industries.

Introduction

The paper adopts the UNIDO (1998) definition of sustainable development thus “sustainable development that meets the need of the present without compromising the ability of the future generation to meet their own needs”. Industrial growth and/or industrialization here refers to the ability of an economy to acquire developed status on the basis of industrial outputs for both domestic and export markets, the industrial sector contributing to the GDP and the balance of payment in international trade. Sustainable development will be realized when economic growth that guarantees fulfillment of human needs and continuous improvement in human living conditions, social development that ensures equity in temporal and intergenerational development; and a balance between exhaustible and renewable natural and environmental resources. To operationalize the word sustainable development, UNIDO (1998) has distinguished three types of capital into man-made capital: machines, buildings and infrastructure. Human capital; knowledge and skills and natural capital; non-renewable, renewable and quasi-renewable natural resources, and state that for sustainable development to be realized a minimum condition where the per capital value of the total stock of capital should not be decrease over time must be maintained. Yet, it is known that the composition of the stock in total capital may change as the non-renewable natural capital is exploited, human capital increases with advancement in knowledge, skills and technology to exploit the natural resources and as population increases.

This introduces the tripartite relationship between infrastructure, technology, industrial growth and the role of small manufacturing enterprises in less developed countries (LDC) which is the subject of this paper.

Literature Review

Infrastructure and Industrial Development

The relationship between infrastructure, technology and industrial development has been a subject of interest to scholars, planners and policy makers. It is agreed in principle that for sustainable development to be achieved infrastructure and technology has to be continuously improved and developed. Infrastructure can be seen as the stock of fixed capital equipment in a country, including factories, roads, schools, etc. considered as determinant of economic growth (Collins English Dictionary). Infrastructure and related services, is required for two basic reasons; it is necessary to help “make other things to happen” and it is part of the mandate of government, whether central or local, to deliver basic services to end-users, be they poor, rich or middle income.

Infrastructure feeds and is fed by trade, it fuels direct foreign investment; it backs up the creation and sustainability of industrial clusters, etc. Infrastructure and its related services cuts costs and raise competitiveness. Its supports productivity and efficiency in manufacturing and distribution. It creates and sustains markets. It opens the way for more employment, income and prosperity. And this refers to all kinds of infrastructure, hard and soft: ports, airports, railways systems and networks, roads, power, communications, water, wastewater, waste management and IT.

Although it's essentially an obligation of the government, other stakeholders can/should play a role in its development. Privatization has been suggested to inject professionalism (Heris, 2003) and supported by the government through Build Operate and Transfer (BOT) AND Build Operate and Own (BOO) strategies (GOK, 2004, 2005). Collaboration and partnership is the other approach advocated for infrastructure development (Kristiansen, 2003) and encouraged by the government (GOK, 2002). The other approach is Community Based Development to encourage local participation in infrastructure provision through programs such as Local Authority Transfer Fund (LATF), Constituency Development Fund (CDF) and National Management Committee (NMC) (GOK, 2005). These approaches seek of bolster social sector infrastructure and in some cases roads, water and electricity. Industrial clustering in provision of infrastructure have also been attempted to tap industrial capacity of a region (Harria, 2005) and establishment of Kenya Industrial Estate and Jua Kali Sheds is a case in mind.

Even with all these strategies the absence of adequate infrastructure services is one of the main problems that hinder efforts to develop the micro and small enterprises in Kenya. Technology and innovations are the engines of economic growth (Juma et al, 2005). While infrastructure planning and development and technological development are two of the most important areas of development policy, practitioners and academics alike tend to consider them as separate issues. The focus of infrastructure development in recent years has shifted from merely construction of physical facilities to appropriate provision of services (Conceicao et al, 2003). Environmental and social factors have become part of infrastructure development and planning. Yet most infrastructure projects are not explicitly linked to technological development efforts (Juma et al, 2005). More so, targeting local small manufacturing enterprises (SMEs) that should underpin sustainable industrial development in LDCs. Conceicao et. al. (2003) noted that an essential aspect of economic planning in African countries is fostering the development and maintenance of infrastructure in a way that is appropriate to local conditions and consistent with ecological considerations and other principles (Conceicao at al, 2003). Planning for infrastructure development should be put at a par with other planning processes. Infrastructure serves as strategic foundation for the application of technology to development. As an essential element of country's long-term development efforts, it should include direct links to human resource development, enterprise creation and research and design (Conceicao et. al., 2003).

Technology and Industrial Development

Technology is a tool for development, which involves the application of organized knowledge of facts about the physical world, natural laws and science of doing things. It consists of products, materials, and equipment, tools and processes skills. Technology aims at facilitating innovation in product design, diversification and quality improvement, thus enriching market opportunities (Kenya, 1998). According to Jhingan (2003) technology is defined as the use of modern or improved systems equipments to achieve a better product or process. The challenge for the LDCs is that knowledge and systems that work in developed countries do not seem to work equally as well. In particular technology development, transfer and diffusion in LDCs seems a big challenge especially if not coupled with infrastructure development that supports SMEs.

Beardshaw (1992) noted that for Less Developed Countries (LDCs) the problem of infrastructure and technology development is basically how to accumulate capital. "It can be said that poorest nations of the world are caught in a vicious circle of poverty. Low incomes lead to low savings, low savings retards the growth of capital; inadequate capital prevents rapid growth in productivity; low productivity leads to low incomes, and so on. Other elements in poverty are self-enforcing. Poverty is accompanied by low levels of skill, literacy and health. These in turn prevent the adoption and adaptation of new processes of technologies" (Beardshaw 1992).

Less Developing Countries (LDC) resort to Foreign Direct Investment (FDI) yet this is not the panacea to sustainable industrial development.

Jhingan (2003) asserts that for technological development to thrive a society or a country has to pass through a long historical process, i.e. from the simple to complex techniques, from those satisfying local needs to those meant for distant markets and from those using local resources to those requiring foreign capital. However Kuznets in Jhingan (2003) traces some distinct pattern in the growth of technology as: Scientific discovery or an addition to the technical knowledge; an invention i.e. making the use of already existing knowledge to useful end; an innovation implying a significant application of an invention to economize production; an improvement signifying a minor useful change in an invention and the spread of invention usually accompanied by improvements.

Local/Traditional technology

Indigenous knowledge is predominantly tacit or embedded in the practices and experiences of a community (Sukula, 2006). It is commonly exchanged through personal communication and demonstration: From master to apprentice, from parents to children, from neighbor to neighbor etc. World Bank (2007) states that Indigenous knowledge systems are 'at risk of becoming extinct'. "Local or indigenous knowledge develops over time from a detailed understanding of local environmental conditions, and is modified in response to changing conditions. It is a resource that can help development processes become more sustainable (Dixon, 2003). Unless Indigenous knowledge is properly documented, analyzed and disseminated, there is a risk that within one generation the knowledge could be lost forever (World Bank, 2007).

Indigenous knowledge is a very broad term that comprises all aspects of life - food, farming, and hunting, medicine preparation and treatment, arts, crafts and technologies used by indigenous cultures around the world (World Bank, 2005). What distinguishes this knowledge from western knowledge systems is its integration in the culture and cosmology as a whole. It is now increasingly recognized that Indigenous traditional teachings and practices have played an important role and has served as a foundation for the survival of indigenous communities/culture not only in Africa but also elsewhere (Hajara, 2005). Unfortunately, indigenous and local communities often do not have strong traditions of ownership over knowledge that resembles the modern forms of private ownership.

Experiences have shown that development efforts that ignore indigenous knowledge, local systems of knowledge, and the local environment generally fail to achieve their desired objectives (Hoppers, 2004). Currently there is a growing global recognition of the role indigenous knowledge can play in complementing modern scientific and technological intervention in social and economic development and cultural and political transformation. There is further recognition of the important role of local communities in contributing their indigenous knowledge systems to enhance the sustainability of development programs. Agricultural growth and development is crucial to Kenya's overall economic and social development (Ngulube, 2002; Government of Kenya, 2002a). It accounts for a large part of the activities undertaken by poor households who live in rural areas, majority of them being women. Rural communities are coming up with indigenous technologies in agriculture production. But this knowledge is tacit and therefore difficult to codify. It is therefore necessary to consider and build upon it when introducing technologies to foster industrial growth and sustainable development. Even where modern technology would work, failure for any reason results in enormous capital resources tied down and production curtailed completely. Figure 1 and 2 demonstrates how local technology, though simple and rudimentary can yield results where modern capital intensive technology fails.



Figure 1: Chepkube a local technology hatchery and brooder (Hatches eggs, cooks, keep food warm and acts as a brooder utilizing the same firewood)

Sources: Yegon et al (2007)



Figure 2: Modern incubator and hatchery at Moi University Chepkoilel with a capacity of 4,900 eggs (Two of this type were installed in early 1990s and for one reason or another has not produced even a single chick to date).

Sources: Yegon et al (2007)

Theories of technology have traditionally been informed by the determinist ideology. Technology determines states that the path for development is dictated by technical necessities. Further the pursuit for efficiency is believed to be the guiding force that controls the direction of the path. The determinist ideologists state the technology can be explained without reference to any social context within which it exists. This implies that technology is “out of social control, yet it has great social impact” (feenberg: 1999). Two main principles underpin the determinist technology. First is the consideration of the fact that technology is seen to be autonomous in nature and determinist state that the development of technology progresses along a fixed path. The second principle states that the society and social structures must adapt to the predetermined technological laws. In essence the society is seen to be based on technology.

Technology acquisition for the SMEs in the less developed countries is the process of acquiring knowledge and skills for the purpose of improving production process. It is the borrowing of technology from one place to the other, which in this case refers to acquiring from developed economies. Technology acquisition can be obtained through either of the following; learning, diffusion, adoption, transfer, imitation, innovation or invention.

In Kenya there is still heavy reliance on imported technology which hardly fit the country's capabilities. The Small Manufacturing Enterprises (SMEs) have found themselves caught up in conflicting demands of copying and using new technology which at times is not appropriate to the Small Manufacturing Enterprises. As shall be exemplified by the case of Wood Industry, none of these seem to be taking place in Kenya and instead of sustaining wood industries they are actually dying off.

Small Manufacturing Enterprises (SMEs) and Industrial Development

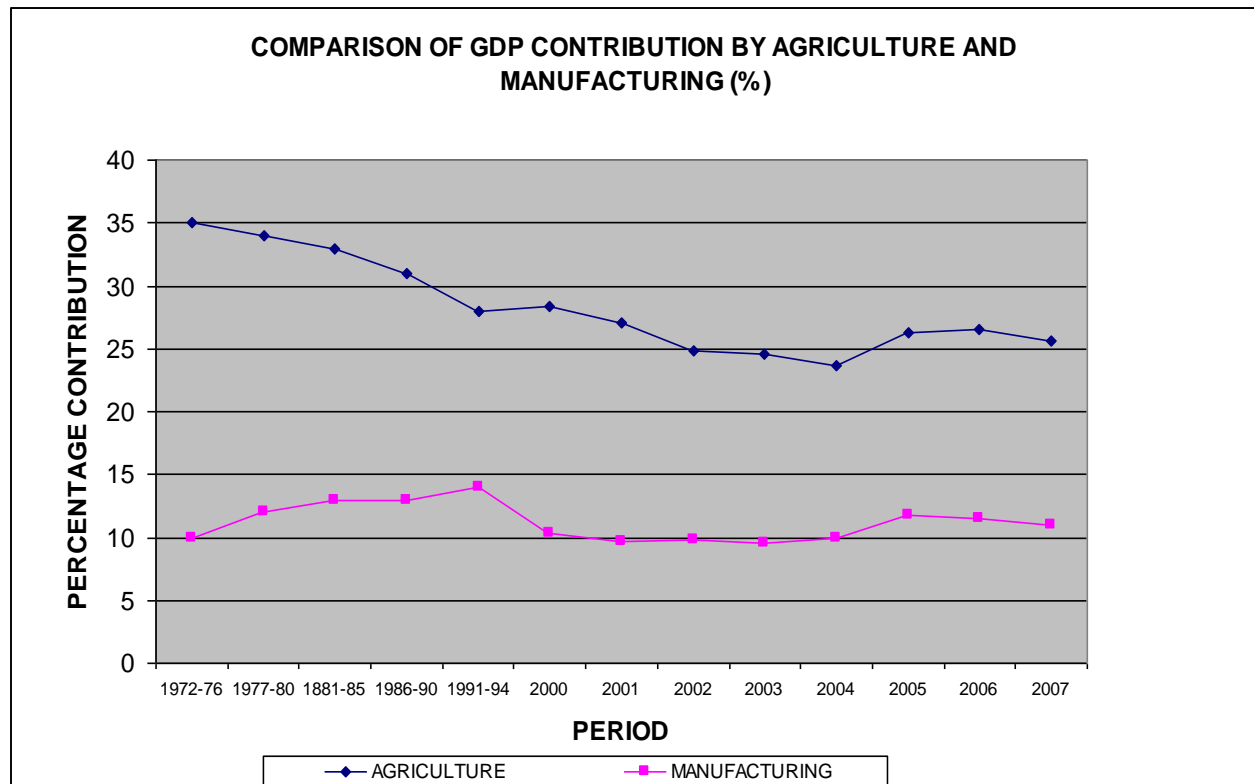
Kenya's industrialization strategy has tended to focus and favors foreign investors. UNIDO (1998) observes that foreign direct investment (FDI) should be utilized to benefit the entire economy but it is not the only option for successful industrialization to take place. Risks in FDI approach to industrialization include; possible negative impact on the balance of payment when the level of imported technology, raw materials and components are high and cash out flows of profits and dividends puts a burden on the current account resulting in higher balance of payments; possible race to the bottom in terms of competing with generous investments incentives and the danger of creating a dual economy with modern enclave type of foreign sector co-existing with traditional domestic firms (bid). 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, and 2005). Specifically, sessional paper NO. 1 of 1996 on industrial transformation by the year 2020 noted the dimension of the Jua Kali enterprises in creating employment, providing attractively priced goods and a training ground for developing entrepreneurial skills that is required for industrialization (Kenya, 1996). Yet, in spite of these policy papers and support strategies their in stipulated, the performance of the SMEs is still dismal. Kenya's Jua Kali sector is composed mainly of extremely small (1-2 persons) young firms (87.6 %) of all micro and small enterprises, which are highly vulnerable to general economic conditions and that rarely grow or graduate through medium to large firms.

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 six years thus hardly gain from experience (Kenya, 1999). The term "Jua Kali" and small manufacturing enterprises (SMEs) are used synonymously in this paper to mean enterprises/ firms in value addition or provision of services to enterprises/ firms that engage in manufacturing and fabrication and employs between 1 and 100 people. In recognition of the potential of SMEs to anchor industrialization, Kenya, in its sixth development plan advocated restructuring of ownership of enterprises in the Kenyan economy as the only way through which nationals will graduate to the competitive system where they can participate on an equal footing with non-Kenyans (Kenya, 1989). This was viewed as an industrial development goal, which provided a policy justification for using small scale and Jua kali enterprises owned by indigenous Kenyan to address the sensitive issues of ownership of industries.

According to Kenya (1997), the Jua Kali sector must be fostered to continue to expand and grow for it is expected that more jobs will be created in the sector than any other off-form sector. The national baseline survey (Kenya, 1999), indicates that employment in the small and medium scale is nearly 15% of the total employment in the country and that it is 36.4% of the total non-agricultural employment. This has come to be recognized and accepted as a fact. The question that still nags scholars and policy makers is on the quality of jobs and the level of earnings from such jobs and whether such jobs are sustainable in the long run given that SME's tend to provide low priced goods and services for low income customers. A significant 13% of workers in the formal sector comprising family members and apprentices are unpaid. This problem is both an economic and moral issue.

The trend in the performance of the manufacturing sector in Kenya since early 1970's (fig3) fairly of the FDI based strategy and hence the need to plan and support infrastructure and technology development for SMEs

Figure 3: Trend of the GDP Contribution of the Manufacturing since 1972.



Source: Adapted from Economic Surveys (GOK 2003, 2007 and 2008)

UNIDO (1998) observes that SMEs, creates jobs, complement big business and that it is important to build up an industrial sector that effectively combines large, medium and small enterprises. Medium enterprises are important for a resilient and flexible economic structure hence the need to develop programmes and strategies that support the integration of the SME sector into the industrialization process. It is therefore important to support and develop infrastructure that facilitates adoption and diffusion of technology among SMEs that produce some surplus so as to spur capital formation and stimulate growth for sustainable industrial development. In the light of the problem faced by LDC in technology transfer that matters then, is the type of technology package transfer that is most appropriate for them. Jhingan (2003) affirms that appropriate technology package for transfer should be one that contributes to increasing the level of technology, generating employment, reducing inequalities and also increasing the economic growth rate in the LDCs.

The problem statement

As seen in fig 3, the performance of the industrial sector in Kenya has been declining over time. Since they were mainly anchored on industrialization strategies favoring Foreign Direct Investments (FDIs), a new strategy focusing on local small manufacturing enterprises is inevitable. This paper addresses the question of how effective modern technology has been in anchoring industrialization in Kenya as exemplified by the Wood Industry sub-sector.

Methodology

This is a longitudinal survey study of the performance of Wood Industries in Kenya since 1976 informed by secondary data subjected to regression analysis.

The Wood industry in Kenya

Forests are the most important asset of a country’s wealth, an asset that even very poor countries possess or could possess, for they provide a renewable raw material for a whole range of industries which have acquired great importance in many industrially advanced countries.

Forest industries furnish a very wide range of products, both consumption goods and intermediate goods flowing into many sectors of the economy, the demand of these rises sharply with economic growth. The industries vary considerably in their raw materials and other factor requirements, (Leslie, 1987).

Alternative technologies can be successfully employed based on renewable resource intimately linked with agriculture. These features shows that forests industries can play a significant part in promoting economic growth in presently low-income countries like Kenya. Wood removed from the forest can be used either as fuel wood or for industrial purposes.

In Kenya, sawmilling was the first forest industry to be established in 1958 by Timsales Company. Sawmilling does not require a high degree of technical skill on the part of its labor force, but only on the part of a few key technicians. It is much more flexible in location, in size of plant and in finished products and is one of the primary forest industries. The possibility of utilizing sawmill residues modified the economies of sawmilling and encourages the integration of forest industries. These potentialities have scarcely been realized in Kenya. Kenya has not realized the importance of creating giant integrated forest industry complexes. Instead the industry seems to be plagued by a myriad of problems leading to a total ban of all logging activities by the minister in charge of environment and natural resources, except for a few large firms.

As at 2009 virtually all large saw mills had collapsed before the ban on logging in the 1990's. This suggest a serious lack of planning since the government could not sustain supply of log wood and no single sawmill could be sustained by private supply of logs. An acute shortage of a renewable resource and while expert of saw timber is no longer tenable large construction centers meet their supplies from report from neighboring countries at very high costs. The problem here is not that of modern or local technology though much could still have been done to improve efficiency, rather the problem is infrastructure planning a challenge that needs to be addressed urgently.

Pulp and paper industries, is the second of the primary industries in terms of raw materials requirement and value of output. The only paper industry in Kenya that uses virgin pulp is PanAfrica Paper mill, Webuye. The other paper industries are small and only use recycled paper. The paper industries that use waste papers are Kenya paper mills, Thika, Mathu paper mills, Chandaria paper mills and Highland paper mills, Eldoret. This industry is much more localized than sawmilling industry, mainly because although wood costs represents the main item in total production costs, and a cheap wood supply is essential, other process materials and production factors assume considerable importance. The Pan Africa Paper mill (figure 4) has been plagued by a myriad of problems including supply of raw materials and costs that could be explicitly linked to the processing technology employed



Figure 4: Pan African Paper Mills (Pan Paper) producing more than 80% of the country's paper

Again the challenge in the sustainability of pulp and paper industries is basically that of infrastructure, technology and management. The firm being the only one that uses virgin pulp in Kenya, its failure leads to the total collapse of the sub sector.

Panel products industries are very few in the country and therefore the consumption rate is very low. Examples of panel products are plywood, blockboard, fibreboard and particleboard. Plywood has seen great expansion both in the use of hardwood plywood for decorative purposes, (panel, doors, table tops and the like) and of utility softwood plywood for construction purposes. This expansion has been bound up with technical developments (improved glues, surface treatment and new products), with the favorable price trend of plywood as compared with sawnwood, and with labor-saving application of plywood in the construction industry.

The most important factor in the location of plywood mill is the availability of large-diameter logs of good form, whether indigenous or exotic suitable for peeling or slicing. With veneer-size logs becoming progressively scarcer, technical progress in the industry have concentrated on making use of smaller-diameter logs and lower quality material, for example, by cutting out defects, patching and reducing core size.

There are miscellaneous and secondary forests industries. These industries are smaller but are extensions of saw milling and veneer industries. Wood turning, with handles of agriculture implements and sport goods, wooden ware and spools as principal products, the manufacture of match blocks in the form of sawn wood or veneer is another. Small plants are suitable for producing shingles, pencil slats and briarwood pipe blocks, where appropriate raw materials are available. The manufacture of cooperage and other wooden containers and of wood wool is complementary to certain food and drink exporting industries as well as to the shipping of many manufactured goods.

The chemical distillation of wood yields a large variety of products, the more important of which are charcoal and methyl or wood alcohol. When coniferous woods are used, various oils and tars are produced. The common household and commercial uses of cooking and heating, charcoal has a number of important industrial uses, such as in steel manufacture, water purification and tobacco curing. The capital requirements for wood distillation plants are not excessive nor are the technologies a major challenge.

Charcoal may be produced in simple pit methods requiring no capital. Charcoal production has remained largely a local technology affair but considerably consuming huge chunks of forest resources. With the ban in logging and lack of adequate private forest resources for charcoal burning, this has become a hide and seek affair and the worst hit at the moment is the shrubs and small bushes in the national parks and semi arid areas which signals danger for the wildlife conservation and the degradation of the environment.

A number of extractives from wood and bark provide the raw material for several small but important industries. Some species of pine are suitable for the tapping of a resinous exudates used for the manufacture by distillation process, of turpentine and resin. A considerable amount of labor and little capital are required in the industry. The trees may also be used for their timber. The production of tannins, most important raw material in the hide and lather industries, may be based on a number of woody and herbaceous plants e.g. quebracho from South Africa (Leslie, 1987).

Sverrisson (1990, 1992) observed that the woodworking industries are *prima facie* candidates for indigenous industrialization based on the domestic market. Salient characteristics of the domestic market oriented industrialization industries include, high transport costs, which protect them from the competition of import (Oloya 1992). The furniture industry being a sub sector of the woodworking industry would, according to Sverrisson (1990, 1992), be more suited to this approach in industrialization although there is an increase in the supply of imported plastic furniture in the Kenyan market.

It has been noted that the expansion in this type of industries in Kenya has been more in the increase of the number of small firms since the optimum scale of production is small (Oloya 1992). The proliferation of small factories or workshops has been spontaneous since no inducement has been used to encourage them. However, a decline in their performance has been reported in Nakuru, (Sverrisson, 1992) and in the woodworking industry in Tanzania (Levy, 1993).

The challenge in this sub sector is failure to modernize local or traditional technologies leading to gradual replacement of the poor quality products with imported form the products as illustrated by discarding of the traditional folding chair (figure 5) once available in every African homestead and replacing it with a metal folding chair (figure 6).

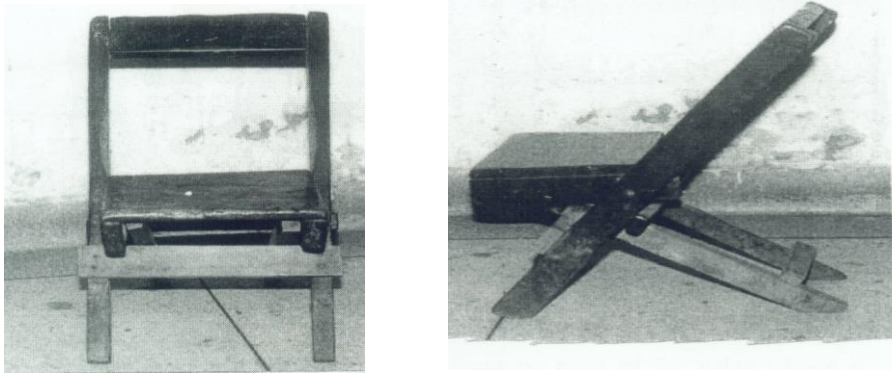


Figure 5: *Folding chair imported into the Kenyan market from Korea*
Source: Ng'ang'a et al (2006)



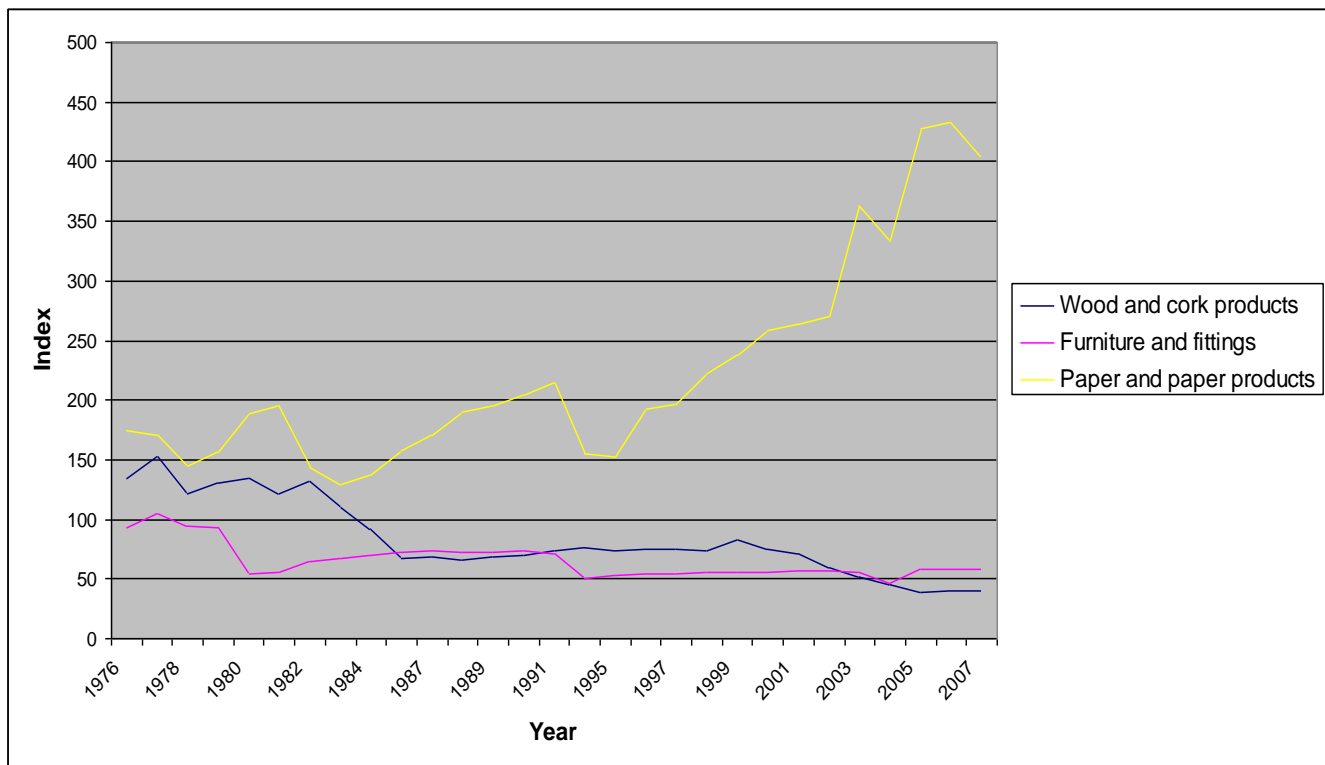
Figure 6: Folding chair imported into the Kenyan market from Korea

Source: Ng'ang'a et al (2006)

The effect again is the total collapse of the sub sector and modernizing local technologies in this sub sector becomes more than urgent.

Trends in the wood industries production Kenya

It has been shown (figure 3) that the GDP contribution of the manufacturing sector in Kenya has been declining over time. The wood industries production quantum index with 1976 as the base year (figure 7) shows a similar decline except for the pulp and paper products.

Figure 5: Wood Industries production quantum index (1976=100)

Source: Adapted for economic survey (GOK, 2000, 2001, 2003, 2004 , 2005,2007 and 2008)

A regression analysis of the wood and Cork, Furniture and fittings quantum index against time show a very strong negative relationship $r = -0.850$ and -0.745 respectively. Only paper and pulp production quantum index shows a positive liner relationship ($r = 0.771$) with time. Incidentally, this is not sustainable. With the collapse of the only major pulp and paper industry (Pan Africa Paper Mills) that produces 80% of the pulp and paper products then, the sub sector virtually dead.

This paints a very gloomy picture of the wood industry in Kenya. For sustainability of industrial development there in need to not only modernize technologies but also to plan and develop infrastructure the support and facilitate technology acquisition, adoption transfer and diffusion to and among stats which should be foundation under planning industrial growth and sustainable development in LDCs.

Conclusion and way forward

The thesis propounded here is that in Less Developed Countries (LDC) like Kenya, modern technologies supported and propagated by Foreign Direct Investment (FDIs) is not the route to sustainable industrial development. The sad state of wood industries in Kenya attests to this. Modernizing local technologies should be given a chance as a way of enhancing SMEs competitive advantage. In LDCs the industrial sector has to compete for domestic market with cheap, quality products imported from developed and developing countries employing modern technologies that benefit from economies of scale and the support of an advanced infrastructure development. The way forward is for the governments in LDCs to formulate policies that encourage stakeholders to plan and develop infrastructure that in turn support modernizing of local technologies for the growth of small manufacturing enterprise. This will initially pursue import substitution strategy where the countries and the firms have comparative advantage and when technologies are well developed to modern status and competitive advantage attained, the SMEs can then venture into the export market. To further argument this discourse there is need for an empirical study that will demonstrate the relationships between infrastructure developments, technological developed and enterprise growth in Kenya. The result will inform the nature and structure that should be provided in the infrastructure planning and development in support of small manufacturing enterprises.

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