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# Technological Capability in the Nigerian Leather Industry: A Firm-Level Case Study

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(b) build a continuous interactive process of knowledge diffusion by fostering linkages among and between researchers researchers and the private sector, policy-makers and other end-users; and
(c) disseminate and encourage utilization of research results through publications, a biennial international conference, dissemination seminars, and policy round tables.

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**Dr. Osita Ogbu**
**Executive Director**

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# Chapter One

## Introduction

Until the beginning of the 1980s, technology in the Third World was analysed by reference to two major issues. The first issue centred on the question of inward technology transfer, and the debate here was focused on the extent to which technology transferred to the less developed countries (LDCs) from the industrialised countries was appropriate. The second issue related to the merits and demerits of the various modes of inward technology transfer to LDCs: licensing agreements, franchises, foreign direct investment (FDI), commercial imports of capital goods and turnkey projects, among others (Enos 1989, 1991: Hill 1992).

Since the 1980s, certainly against the background of successful industrial transformation in the so-called newly industrializing countries (NICs) of East Asia and Latin America and an opposite process of debt crisis and industrial stagnation in sub-Saharan Africa (SSA), the focus of the debate shifted completely to examination of "indigenous technological capability." The latter incorporates the knowledge and expertise needed to generate and manage technical change, including skills, experience, and institutional structures and linkages ( Bell and Pavitt 1993). The concept of 'indigenous technological capability' has now become the new paradigm with which to identify the forces propelling industrializing in the NICs. Analogously, the gaps in income technology separating the NICs from SSA countries are explained by reference to the weakness of 'indigenous technological capability' on the part of the latter.

Understanding how technology is acquired and changed, the types of resources required to effect the latter type of technical change provides an insight into a major dynamic of industrial development. Moreover, for SSAs in particular, understanding the main constraints in technology-handling capabilities in the firms constitutes the first necessary steps in the articulation of public policies designed to promote national industrialization. Current technology policies in SSA countries seem to lack this input: knowledge of what transpires within firms in terms of technology learning possibilities and constraints.

The research results reported in this study centred on a firm-level case study of technology capability – specifically, on the leather-tanning firms in Nigeria whose development has spanned well over four decades. The present study generally departs from existing studies with a macroeconomic orientation (Enos 1991; Lall 1992; Teitel 1993) and focus on examination

of availability or otherwise of particular aspects of technological resources (see Lall 1991; Oyejide 1993).

The industrial firm is known to constitute the repository of available technology in any economy, to be the most important actor in technology accumulation, precisely because it is within the firm that both so-called tacit knowledge as well as tradable knowledge are nurtured. Gaining insights into how SSA firms generate tacit and traded technologies and, hence, the types and stages of technical knowledge that transpire within these firms and, finally, the constraints and opportunities open to the firms would help to explain the underlying causes of Africa's lack of industrial dynamism. A few such studies already exist in Nigeria (see Akpakpan 1986; Ihuoma 1992; Dike and Ihuoma 1993; Esubiyi 1995).

However, these studies failed to examine the firms in their interaction with the economic environment, among other contexts.

The present study concentrated on a survey of 11 modern-sector, mechanised leather tanning firms of various ownership forms in Nigeria. It involved visits to the relevant plants, in-depth interviews with shop-floor, production managers and management staff of the firms concerned. The main focus was to find out how firm-level technological capabilities in six spheres were acquired: production, investment, minor change, strategic marketing, linkage and major change. Because emphasis was also placed on understanding the constraints and opportunities presented by the economic environment on technical change processes within the firms, additional study has been conducted on the nature of linkages relevant to the processes of technical change and technology transfer in the Nigerian leather tanning industry.

Before presenting our empirical analysis, we need to provide the historical background to the development of Nigeria's leather tanning industry, the general economic and technological features of leather tanning, and the approach to analysis of technological capability in current literature.

# Chapter Two

## Historical Overview of Nigeria's Leather Tanning Industry

Four features are discernible in the development of Nigeria's leather tanning industry. First, the industry is one of the oldest manufacturing activities in Nigeria, tracing its evolution far into the pre-colonial decades, when it generated items for the trans-Saharan caravan trade linking Africa's Western Sudan and the Maghreb countries and Mediterranean Europe (Ihuoma 1992). It is worth noting in this respect that the fine Moroccan leather often mentioned in historical texts was made from goatskins of pre-colonial Sokoto.

Second, foreign participation has played a major role in the industry's development: the first mechanised tannery was established in the late 1940s by John Holt, one of the colonial merchant firms engaged in the export trade in hides and skins. Third, imported capital inputs – machinery and equipment, chemicals, etc – constitute a dominant proportion of the industry's input demand, which suggests that the firms use input suppliers as main immediate sources of technical change and purchase of equipment and related services as main channels of imitation and technology transfer. The extent of access to foreign investment as well as imported inputs have influenced technical change patterns and processes, one key area of investigation in this study.

Fourth, quite unlike the rest of Nigerian manufacturing developed on the basis of import substitution production, the leather-tanning sector has had substantial export orientation (Ihuoma and Dike 1993), which suggests that the firms here have been exposed to price competition from the world market. This situation should, ceteris paribus, provide opportunities for relevant technical change processes to occur in the firms.

Currently, the Nigerian leather tanning industry displays a dualistic structure: a vast artisanal or peasant sector coexists with a small, modern mechanised sector. The latter is the focus of the present study. This artisanal sector has been practised on a rural cottage basis operated along family lines for centuries using traditional tanning techniques consisting of tanning pits and local vegetable tanning material known as *bagaruwa* derived from the pod of *acacia nilotica* to achieve mostly crust tanned leathers. These artisanal tanneries are concentrated in the livestock-producing zones of northern Nigeria. Their number was put at bout 1000 in 1971 (UNIDO and FAO 1971) and 924 in 1981 (Adewoye 1985). Our own estimates from this

survey put the number well above 2000 in 1996. The leathers produced by the traditional tanneries are consumed by the numerous traditional leather goods firms.

As noted earlier, the mechanised (modern) tanning firms began to evolve by the late 1940s, when the colonial merchant firms engaged in the produce trade began to convert into manufacturing in the classical import substitution style (Kilby 1969).

In 1948, two foreign missions from the United Kingdom visited Nigeria, one charged with livestock development, the other with hides and skins investigation. Both missions, however, reported on the need to improve the quality of Nigerian hides and skins and blamed the poor quality of the latter on bad flaying (Bones 1959).

The United Nations Food and Agriculture Organisation (FAO) reported on the potentialities of Nigeria hides and skins sector as well as the need for adequate technical training to upgrade its technical skills. FAO intervention had apparently resulted in a technical assistance agreement signed in 1964 by the Nigerian Federal Government and the United Nations Development Programme (UNDP - Special Fund) and the FAO, which led to the establishment of four UNDP-FAO financed tanneries, whose activities were expected to provide a demonstration effect to the traditional tanneries. Besides an research and development outfit – the Leather Research Institute of Nigeria (LERIN), now known as the National Research Institute for Chemical Technology (NARICT), as well as a technical training institute, were set up, respectively, to provide technology research back-up and train intermediate level manpower for the industry.

FAO-UNDP and British government intervention had apparently ignited the growth of foreign investment in the industry. Thus, by 1949, John Holt, one of the major colonial trading firms involved in the export trade in raw hides and skins established Holts Tanneries in Kano – the first ever mechanised tannery in Nigeria.

The post-colonial decades witnessed a rapid growth in the number of mechanised tanneries. Various estimates put the number of such tanneries at more than 30 by the end of the 1980s (Ihuoma 1992; Oyeyinka, Laditan and Esubiyi 1995: 61-62). The present authors identified the tanneries listed in Table 2.1 in the course of field investigation from which 11 firms were selected for close study.

More than 90 percent of operating tanneries in Nigeria are, as expected, located in the livestock producing savannah zones of northern Nigeria, in Kano, Sokoto and Borno States. Kano particularly harbours the bulk of these tanneries and the most modern and largest firms in the industry.

The output of the tanneries expanded from roughly 26 million $ft^2$ in 1970 to 97 million $ft^2$ in 1987 (Ihuoma 1992). The bulk of this output is now consumed internally as finished leathers, with the exported component consisting of semi-processed crust leathers. No export capacities exist in finished leather (Ihuoma and Dike 1992). Thus, in spite of its long years of development, spanning over four decades, the Nigerian leather tanning industry is yet to transform its output mix to include finished leather for export. This is an indication that there must exist within the firms constraints on acquisition of technological capability. This study has attempted to explore these difficulties and constraints.

**Table 2.1: Leather Tanning Firms (Modern Sector) Identified in Nigeria**

| S/N | Name | Location | Year Founded | Ownership | Product |
|---|---|---|---|---|---|
| 01 | First Tanneries (formerly Holts Tanneries | Kano (Kano State) | 1949 | Initially 100% owned by John Holt, now mixed | Wet blue crust finished |
| 02 | I eather Products Co. | Sokoto (Sokoto State) | 1959 | State owned | Crust |
| 03 | Great Northern Tanning Company | Kano (Kano State) | 1961 | Originally 100% foreign, now mixed | Wet blue crust (export) finished |
| 04 | Gusau Tanning Company | Gusau | 1962 | State owned | Crust |
| 05 | Limson Tanneries | Isheri (Lagos State) | 1960s | Joint (Nigerian-foreign) | Wet blue finished |
| 06 | Borno Tanning Company | Maiduguri (Borno State) | 1967 | State owned | Pickled for export |
| 07 | NARICT Tannery | Sokoto (Sokoto State) | Early 1960s | Part of FAO-UNDP technical assistance programme to Nigeria | Wet blue crust finished |
| 08 | NARICT Tannery | Maiduguri (Borno State) | -do- | -do- | -do- |
| 09 | NARICT Tannery | Zaria (Kaduna State) | 1960s | -do- | -do- |
| 10 | Oji River Tannery | Oji River (Enugu State) | 1960s | -do- | Does contract tanning. Largely lying idle |
| 11 | International Tanners | Kano (Kano State) | na | | Wet blue crust finished |
| 12 | Tanarewa Nigeria | Kano (Kano State) | na | | Wet blue pickled |
| 13 | Arewa Tannery | Kano (Kano State) | 1972 | | Wet blue chrome crust |
| 14 | Darum Enterprises | Kano (Kano State) | na | | Wet blue |
| 15 | Nabegu Tanning | Kano (Kano State) | na | | Wet blue pickled finished |
| 16 | Kano Pickling and Tanning Co. | Kano (Kano State) | na | | Pickles skins wet blue |

| S/N | Name | Location | Year Founded | Ownership | Product |
|---|---|---|---|---|---|
| 17 | Ajayi Tanneries | Lagos (Lagos State) | 1989 | 100% private (Nigerian) | Finished wet blue |
| 18 | Sule Galadima Tannery | Kano (Kano State) | 1988 | na | na |
| 19 | Harmattan Tannery | Kano (Kano State) | Established 1986, commenced production 1987 | Originally Italian, now mixed private (Nigerian-foreign) | Wet blue finished |
| 20 | Daras Nigeria | Kano (Kano State) | 1988 | | Wet blue finished |
| 21 | Challawa Tannery | Kano (Kano State) | 1993 | Foreign 100% | Produces only wet blue |
| 22 | Fine Leather Company Ltd | | 1991, starteed production 1996 | Mixed (Nigerian-foreign) | Wet blue crust finished |
| 23 | God's Little Tannery | Kano (Kano State) | 1995 | 100% Nigerian private | Produces only wet blue |
| 24 | Dange Leather Processing Company | Sokoto Kalabana (Sokoto State) | 1988 | Sole proprietorship, 100% private Nigerian | Wet blue for export (80%) crust |
| 25 | Sokoto Leather and Tanning Industry Ltd | Sokoto (Sokoto State) | Established 1985, started prod. 1988 | Sokoto State Govt-Lebanese | Wet blue crust |
| 26 | AKKAD Tannery | Kano (Kano State) | na | na | na |
| 27 | Mario-Jose Tannery | Kano (Kano State) | 1980s | Joint (Nigerian-foreign) | Finishing along with Nos 3, 18, and 26 control over 75% of leather output in the country |
| 28 | Kapitan Tannery | -do- | na | Mixed (Nigerian-foreign) | Wet blue crust |
| 29 | Darum Tannery | -do- | 1980s | -do- | Wet blue crust |
| 30 | Neital Tannery | Maiduguri (Borno State) | -do- | na | Wet blue crust finished |
| 31 | Danzami | Katsina (Katsina State) | 1980s | na | -do- |
| 32 | Bauchi State Investment Co | Bauchi | na | State-owned 100% | na |

# Chapter Three

## Economics and Technology of Leather Tanning

### Economics of Leather Tanning

Leather tanning refers to the process of converting raw hides and skins into stable, non-putrifiable material technically called leather. This conversion process is mainly chemical in nature, the two most common processes being vegetable tanning and chrome tanning.

Hides and skins constitute the major raw material input in leather production. Existing input-output studies, conducted in the context of developed countries, indicate that row hides and skins take upwards of 50 percent of the total operating costs in leather tanning (UNCTAD 1971; Lockhart-Smith and Elliot 1974), while chemicals and cleansing preparations and 'other inputs' take about 30 percent of the costs.

Studies also show that when raw hides and skins are processed into leather, their value increases, in some cases by as much as 100 percent. Their value could increase by over 250 percent depending on the price of hides and skins and the degree of leather finishing. The implication of this rapid appreciation value added is a clear indication that the manufacturing element in leather is very high. These figures are a demonstration of the gains that might be derived if countries endowed with large quantities of hides and skins were to restrict their exports of raw hides and skins and develop their own tanning industries. On output, about 68 percent of leather goes into footwear production and the balance into garments, personal products, upholstery, etc.

One of the main economic characteristics of hides and skins is its by-product nature. Essentially, hides and skins are by-products of the meat, wool and dairy industries, which means that the supply of hides and skins depends on the production of meat, wool and milk. An increase in the output of any or all these products leads to an increase in the production of hides and skins.

Conversely, a fall in the output of these items results in a decrease in the production of hides and skins. Lastly, in formal economic language, hides and skins are in joint supply with meat, wool, and milk.

It is noteworthy that leather working as a whole is an activity whose history dates back to antiquity. As far back as 3000 BC 'leather goods' were manufactured (United Nations 1972). In almost all countries, developed and developing, leather working remains a traditional activity; as such it tends to be slow in experiencing technological change. Nevertheless, certain changes seem recognizable, wrought largely by increasing application of electrical technology and precision-control equipment to meter the flow of chemicals and co-ordinate the throughput from process to process (Murray 1985). Mechanization has thus facilitated the output of leather with more consistent characteristics. Mechanized processes are now available to recycle chemicals, thereby reducing chemical costs and cost of wastage disposals.

Besides, introduction of machinery at more sophisticated levels has led to increased specialization. For example, a tannery might be designed to produce only leather for soles of footwear. Such a tannery would permit greater automation and would generate a more consistent output; the hide selection would permit better sorting for more uniformity and, finally, the hides to be tanned could be more carefully trimmed to retain only that part of the raw or cured hide that is best suited to making high-grade sole leather. The trimmed pieces of hides, which would make only marginal sole leather, could then be sold to another tanner for processing into leather for a different end use.

Alternatively, specialization might take the form of establishing wet-blue or crust facilities in conjunction with slaughterhouses. In these cases, it is possible to tan fresh hides, thereby eliminating the cost of curing; this also permits production with transporting of better quality leather. Moreover, processing at source eliminates costs associated with transporting extraneous material associated with cured hides.

**Figure 3.1: Pre-tanning Preparation of Hides and Skins**

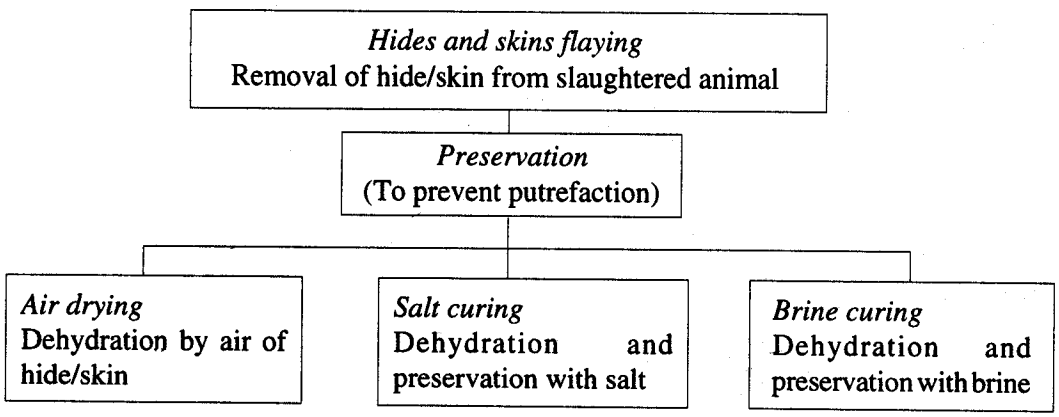
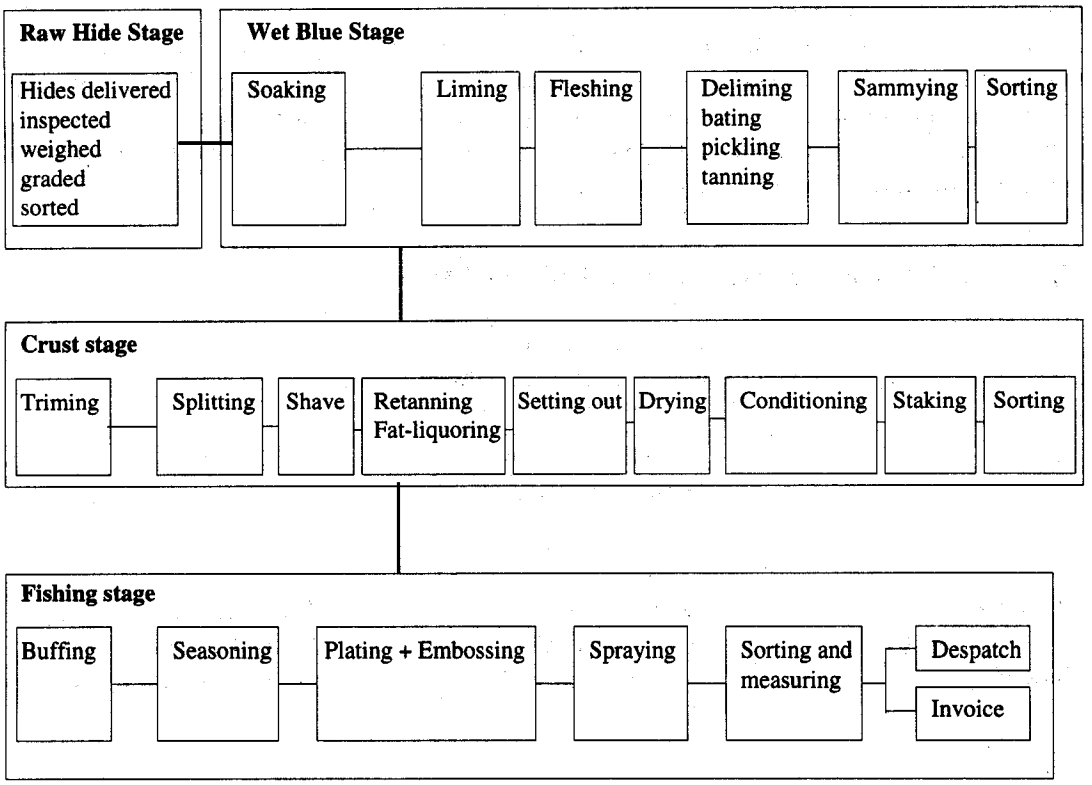


Figure 3.1 schematizes the pre-tanning preparation of hides and skins. The process consists of flaying and preservation of curing of hides and skins to prevent putrefaction. The preservation and curing can be done by one of three methods: air drying, salt curing, and brine.

Figure 3.2 also schematizes the tannage process - the real processing of hides and skins into the various stages of leather, namely, wet blue, crust, and finishing. The detailed technical descriptions, including the nature of chemical process and types of equipment used in the processing stages can be found in Thorstensen (1985). Space constraints in the present study cannot accommodate such analyses. It suffices, however, to state that tanning can take either of two processes: vegetable or chrome. The oldest sources of vegetable tannage material or tanning are found in various types of vegetable matter. In Nigeria, the common vegetable tanning is found in *bagaruwa* pods abundantly found in most West African savannas. Chrome tannage material is provided by a solution of basic chrome salts after being pickled with sulphuric acid and common salt. Chrome tanning is a more modern, speedy and efficient process than vegetable tanning, though requiring closer supervision and control because of the volatility of the chrome liquor.

**Figure 3.2: Flow Chart for the Processing of Raw Hide to Finished Leather**



# Chapter Four

## Theoretical and Methodological Issues

The present research focused on exploring the extent of technological capability existing within leather tanning firms in Nigeria. The research has been motivated by recent developments in the new literature on technology, namely, that indigenous technological capability or lack of it can help to explain the dynamics of industrialization within any country. How do Nigeria leather tanning firms and their technical change behaviours fit this new literature on technology and industrial dynamism.

Over the past one and half decades or so, a completely new literature has evolved on technology attempting to explain the underlying actors in industrial dynamism in the NICs. This literature tends to move away from emphasis on external forces to examination of indigenous forces in the explanation of technological development and long-term economic development.

The empirical counterpart of the new growth literature on Africa thus attempts to explore the underlying causes of Africa's growth tragedy (Easterly and Levine 1995; Collier and Gunning 1997). Results from these studies show that African firms are slow glowing; little new investment occur in them; even when production capacities expand they are rarely accompanied with technological capabilities, which suggests that little accumulation or technological learning transpires within the firms.

## Approaches to Analysis of Technology and Technological Capability

Current concepts of technology take a structural view and are functional in orientation. The functional forms of technology are specified in *Table 4.1*. Thus, we have process, product, and organization technology. Each functional form of technology fulfils a distinct economic objective for the firm being a distinct type of information or knowledge. Organization, for instance, provides the firm its 'control mechanism', ensuring the system's connections with the external world at the input and output terminals.

**Tables 4.1 Structural View of Technology**

| Functional Forms of Technology | Elements of Technical Skill and Knowledge | Involved Material Embodiment | Objective or Purpose |
|---|---|---|---|
| Process Technology | Knowledge of structure of capital goods; know-how/ know-why on techniques, plant layout, machine operations, maintenance, quality control, etc | Hardware: machines, tools, equipment, intermediate materials, etc. Documents containing drawings, blueprints, chemical formulae, etc. | Provides (efficient) production methods leading to cost reductions in production. |
| Product Technology | Knowledge of product specification, product design, product design etc | Hardware: Products; drawings containing product design, etc. | Satisfies market demand through better quality products by changing output mix to meet market conditions |
| Organization Technology | Know-how on running the system, reflected in knowledge of management systems industrial norms and standards, specialization and division of labour. | Software: the 'social form' of technology embodied in the institution, norms, practices etc. governing production. | Provides the co-ordination mechanisms of the system, assembling inputs and distributing output. Links firm to input and output outlets. Encourages adoption of economies of scale, etc. |

Source: Dike (1996)

## Technological Capability

Several approaches exist on conceptualization of technological capability (Fransman 1986; Lall 1992; Bell and Pavitt 1993; Ernst *et al* 1994). What informs or unites most of these approaches is acceptance of the neo-Schumpeterian notion of technological capability as cumulative, evolutionary and incremental. Technological capability would represent resources required to generate and manage technical change. These are functions of the structure and tempo of technological accumulation. Such resources are accumulated in the forms of specialized knowledge, skills and experience, institutions and linkages within the firm itself, between firms, and outside the firms (in their environment). For the purposes of the present research, we drew largely from Ernst *et al* (1994) for providing a much more dynamic picture of the linkages between and among the various variables underpinning technological learning within the industrial firm.

The model categorizes technological capability into six functional parts; (i) production; (ii) investment; (iii) minor change; (iv) strategic marketing; (v) linkage; and (vi) major change capabilities. Parts (i) through (iii) refer to those capabilities said to be relevant in the early stages of industrialization, while (iv) through (vi) are needed at the later stages when the need to retain competitiveness becomes critical.

Technological capability in its various forms as indicated above requires conscious and sustained efforts by both firms and governments to acquire; it requires awareness and macroeconomic stability, and (an appropriate) 'incentive system,' itself a combination of policy dynamics, market forces and historical practices.

'Awareness' suggests that the firm is conscious of the need to improve its technological capacity to sustain competitiveness and, hence, takes planned and strategic decisions to develop this capability over time. Technological capability acquisition decisions thus differ essentially from routine capital accumulation that merely expands production capacity. Besides, efforts in this regard must not be *ad hoc*.

## Character and Stages of LDC Technical Change

Finally, literature on this subject has identified five distinct stages in the global 'innovation chain'. According to Fransman (1985), these are: (i) search for new processes and products; (ii) adoption of the latter through technology transfer; (iii) improving upon adopted technologies to create new technological trajectories different from those existing in the industrial world; (iv) developing technologies new to the country but not necessarily new to the world; and (v) developing technologies completely new to the world.

The literature indicates that LDCs as a whole operate on (i) through (iii); few, namely the NICs, operate on (iv), which means that the development and initial commercializaton of significant or major industrial technologies remain confined to firms in the developed industrial countries. In contrast, LDC firms are confined to the diffusion stage of global technological development, involved primarily in the choice and adoption and adaptation of existing technologies. This suggests that basic and applied research leading to development of significant technological breakthroughs is not relevant to technical change in LDCs as a whole.

# Chapter Five

## Framework for Empirical Analysis

### Methodology

The framework adopted for this study follows closely that of Ernst, Mytelka and Ganiatsos (1994), as already noted. Thus to operationalize the concept of technological capability at the firm level, the following forms of capability are investigated:

(a) *Production capability* refers to the special knowledge and skills used in plant operation, where shop floor experience and 'learning-by-doing' are known to play an important role. It involves three broad types of technological learning, namely, production management, production engineering and repair and maintenance of physical equipment and assets.

(b) *Investment capability* incorporates the knowledge and skills utilized in the identification, preparation, design, setting up and commissioning of new projects, and modernisation of existing plants, identification of the types of raw material, technical inputs including personnel, etc for setting up and running of the plant.

(c) *Minor change capability.* Once set up, does the firm possess the knowledge and skills to improve and adapt continuously its products, processes and organizational set-up to changing market conditions? Minor change capability thus involves knowledge in the so-called adaptive engineering and organizational restructuring required to effect incremental upgrading of products (design and mix) as well as process technology.

(d) *Strategic marketing capability* involves knowledge and skills for exploring new input and output markets (which also involves provision of customer services and ability to understand new trends in the industry and exploit them).

(e) *Linkage capacity* refers to knowledge and skills and organizational ability associated with transfer of technology at three different levels: within the firm (intra-firm); from other firms (inward technology transfer); and between the firm and other (external) technological sub-systems (e.g. research and development institutes, science and technology (S&T) bureaucracies, university faculties, etc. Intra-firm linkages deal with

the networks within the firm to manage interaction and information sharing among different division and business functions such as research and development, design and engineering.

This type of capability is expected to improve the effectiveness of firm-level innovation strategies. On the other hand inter-firm linkages and interaction with the external environment are expected to facilitate inward technology transfer as a channel of technological learning. *Table 5.1* identifies some of the variables investigated here.

(f) *Major change capacity* refers to ability to create new technology – i.e major changes in processes, products and organization, which usually derive from in-house research and development activities and proper linkages with external research and development outfits, university faculties, etc.

**Table 5.1: Sub-System of the Economic Environment, Agents and Linkages to Industrial Firms**

| S/N | Sub-Systems | Linkages and Agents |
|---|---|---|
| 01 | Capital goods sector | * Component suppliers<br>* Equipment suppliers<br>* Technical services consultants<br>* Material, inputs importers |
| 02 | Human capital infrastructure | * Managers, engineers, technicians<br>* Universities, skill training institutions<br>* Trade organizations |
| 03 | Market environment | * Wholesalers, retailers, consumers<br>* Material input suppliers<br>* Supply and demand trends<br>* Price levels |
| 04 | Industrial structure | * Corporate networks<br>* Competitors<br>* Financial investors<br>* Shareholders<br>* Entrepreneurs |
| 05 | R&D/S&T Set-up | * Scientists in R&D institutions<br>* Technology consultants<br>* Bureaucrats in S&T ministries and departments |
| 06 | General Infrastructure | * Information networks<br>* Physical infrastructure and utilities<br>* Economic services, including financial institutions |
| 07 | Public policy | * Macroeconomic stability<br>* Investment codes<br>* Import regulations<br>* Export incentive<br>*Government technical assistance to industry |

Source: Collinson (1993)

## Survey Firms and Focus

The empirical research concentrated on the mechanized (modern-sector) leather tanning industry. Eleven such firms were selected for detailed study. This involved visits to the relevant plants, and conducting of in-depth interviews with both shop-floor, production managers, and management staff. Information gathered was supplemented with an analysis of secondary data and information on the industry as a whole - both those specific to Nigeria as well as generally relevant.

Survey firms were drawn from three zones of the country; (i) Kano and Sokoto, in the largest northern, livestock-producing Sudanic savannah belt; (ii) Lagos, which harbours the largest slaughter firms in the country (sustained continuously by an expanding population); and (iii) Oji River, located in southeast Nigeria. Oji River is neither a livestock-producing zone of significance, nor a major urban centre. Oji river, however, lies on the transit route of the thriving North-South cattle trade.

Survey firms were drawn from four types: (i) those wholly owned by indigenous Nigeria entrepreneurs; (ii) those with mixed ownership (private-government – foreign interests); (iii) wholly foreign-owned; and (iv) those wholly controlled by the government. The rationale is that the various ownership forms tend to elicit different technical change behaviours: for instance, firms with foreign interests are more likely to possess better access to foreign financing and foreign investment, external marketing linkages, etc.

Finally, the study firms were selected entirely from the modern, formal sector, thus leaving out the vast artisan informal sector firms. The definition of what is a formal-sector leather tanning firm is based on the following criteria: registration with the appropriate state authorities, which subjects the firms to the various institutional regulations on products standards, safety and health rules, waste disposal, tax assessment and other public policy instruments, and ownership and investment codes; location within so-called industrial estates, etc.

# Chapter Six

## Background to Survey Firms

### Firm Size and Output Structure

The sample firms, shown in *Table 6.1*, include the largest in the industry employing a workforce of up to 600; the next largest employs 329 people. The rest of the survey firms employ a workforce of less than 120 each. The average size of the workforce in the firm is 143.4 persons.

In Nigerian official statistics a large firm is defined as one employing a stable workforce of over 1500; 500-1500 employees is defined as a medium-sized firm; a small firm is one with less than 500 employees. By these criteria, Nigerian tanneries are typically small-sized; few can qualify as medium-sized. But the small-scale nature of these firms may in fact undermine economies of scale as well as impose severe constraints on mechanization and specialization.

The literature classifies 'leather and footwear' along with textiles, garments, etc. as belonging in 'traditional manufacturing' characterized by small-size of firms. Such firms are usually price sensitive; the main focus of their technological activities are cost-reduction and designing products for niche markets (Bell and Pavitt 1993 and references therein).

The output of the industry as a whole has expanded over time, even though output expansion is reported to be severely constrained by stagnation in the livestock industry dominated by peasant cattle Fulani (Dike 1986). However, the quantity of processed hides and skins grew at an annual average growth rate of 9.3 percent between 1970 and 1987; output expanded from 26 million $ft^2$ to 97 million $ft^2$. It seems then that the industry is one of the fastest growing sectors of Nigerian manufacturing.

The output structure indicates that most firms produce finished leather destined for the domestic market; only crust leathers are exported.

**Table 6.1: Background to Survey Firms (1996)**

| Firm | Age of Firm (Length of Time in Operation) | Scale of Firm (Size of Workforce) | Ownership (Equity Structure) | Product Mix |
|---|---|---|---|---|
| A | Established 1958; 38 years in operation | 20 | 100% | wet-blue finished |
| B | Established 1960; 37 years old | 85 | Private Nigerian 60% Foreign 40% | -do- |
| C | Established 1961; 35 years in operation | 329 | -do- | -do |
| D | Established early 1960s; more than 30 years in operation | 30 | 100% state owned | -do- |
| E | Established in 1985. About 11 years in operation | 119 | Government 60% Foreign 40% | -do- |
| F | Established 1988. 8 years in operation | 60 | 100% private Nigerian | Wet-blue crust |
| G | Established 1989. 7 years in operation | 108 | 100% private Nigerian | -do- |
| H | Established 1991; 5 years old | 65 | Originally mixed (Nigerian-foreign) Now 100% Nigerian | -do- Produces for local market |
| I | Established 1993 Just 3 years old | 108 | 100% foreign | Wet-blue crust finished |
| J | Established 1995. Just one year old | 53 | 100% private (Nigerian) | -do- |
| K | Established 1987. Only 9 years old | 600 | Nigerian (private) 60%Foreign 40% | -do- |

No.=11 Average = 16.6 yrs. Average size 143.4

Source: Field Survey, 1996

## Ownership Structure

One important feature of the industry is that foreign participation is widespread. Let us recall that the industry began to attract foreign participation right from the colonial decades in the early 1940s. As noted earlier, the first mechanized tannery was founded by John Holt in Kano in 1949.

Of the eleven firms surveyed, one has 100 percent foreign equity, three are 100 percent sole proprietorship (private Nigerian), one is 100 percent government equity, and six have mixed ownership structure (joint Nigerian-foreign equities). Foreign participation is hardly more than 40 percent in the mixed equities.

The existence of 100 percent foreign equity is a result of the revision of the indigenisation

laws of the 1970s that originally excluded foreign equity participation in the so-called low technology activities in the Nigerian economy, or otherwise limited foreign participation to minority holding.

In most cases, the foreign stakeholders are expected to source the process technology. As well, they (foreign stakeholders) supply personnel who occupy the top management positions in the firms and are responsible for the day to day running of the tanneries.

## Age in Production

The age of the firms is indicated by the number of years in production (*Table 6.1*). Our survey firms include those founded in the 1950s and 1960s – which indicate investment and production experiences running over three decades. Though the average age of the survey firms is 16 years, the majority of the survey firms (82 percent) were established in the crisis and adjustment years of the 1980s onwards.

However, there is no correlation between the age of the firms and their size (as indicated by workforce). The smallest of the survey firms employing 20 persons was, ironically, founded in 1958 – which puts the production age at roughly four decades – and this suggests that the firm had made little or no net investment. On the other hand, the largest of the firms employing 600 persons was founded in the adjustment years (1987).

# Chapter Seven

## Capabilities and Strategies

As specified earlier, six forms of technological capability are investigated in this study, based on the Ernst-Mytelka-Ganiatsos model, namely, production, investment, minor change, strategic marketing, linkage, and major change capabilities. This section reports the findings on these forms of capability.

## Production Capability

Three broad types of technological learning are normally involved here: Production management or organization; production engineering or knowledge of processes; and repair and maintenance of existing plat facilities.

### *Production Organization*

The study of firm-level organization capability is important because firms differ in size and ownership. Technology used in small-size firm tends to differ from that used in larger firms. On the other had, organization at firm level involves scale of operation, specialization and management techniques.

As noted earlier, the tanneries are small-scale employing an average workforce of 143.4 persons. The small-scale nature of the firms imposes severe constraints on specialization and mechanization. Nevertheless, all the tanneries have their operations divided into departments and in some cases units. In general most of the tanneries have three main production departments and three main service departments or units. The three main departments are: the beam house, tan yard, and finishing yard; the three main service units are finance, engineering and marketing. However, this organizational set-up is not fixed for all firms; the actual determinants of the number of departments are the extent of processing carried our and other conditions peculiar to the individual firms.

Production specialization generally takes several forms. One form might be for a tannery to be designed to produce only leather for soles of footwear, for instance such a tannery would

permit greater automation and would generate a more consistent output. The hide selection would permit better sorting for more uniformity; besides, the hides to be tanned could be more carefully trimmed to retain only that part of the raw or cured hide that is best suited to making high-grade sole leather. The trimmed pieces of hides, which would only make marginal sole leather, could then be sold to another tanner for processing into leather for a different end use. No such form of specialization was detected among the survey firms.

Alternatively, specialization might take the form of establishing wet-blue or crust facilities in conjunction with the slaughterhouses. In these cases, it is possible to tan fresh hides, thereby eliminating the costs of curing; this also permits production of better quality leather. Moreover, processing at source eliminates hides. Again, this type of specialization was found non-existent in Nigerian firms surveyed in this study.

### *Production Engineering*

In all the firms surveyed, production techniques were found to be similar; there were no marked differences amongst the tanneries. Eight or 72.7 percent of the firms surveyed take their tanning to the finishing stage; only three or 27.3 percent stop at the crust stage (*Table 6.1*). Of course, all the tanneries are mechanized, though to differing levels. *Table 7.1* shows the mechanization stages generally attained in the tanneries (indicated by the asterisks). Leather production up to the finishing stage, as shown in the table, involves about 17 stages, each stage involving, in turn, various sets of mechanization, arranged in their ascending order of sophistication.

Nigerian firms are yet to go beyond the first stages of mechanization. For instance, in soaking and liming processes, the wooden drum is in vogue; in fleshing, hand fleshing is done and mechanized techniques are yet to be widely adopted. Of course, automation, as the highest stage of mechanization, does not exist in any of the tanneries. But automation would normally guarantee precise flow of chemicals as well as co-ordinate the throughput from process to process. Low-level mechanization does affect the quality of tanning, which perhaps explains the difficulties experienced by the firms in producing for the export market. Nigerian firms, usually small to medium size, cannot export economically since they are unable to produce good quality leather in sufficient bulk owing to their size and low-level mechanization.

Even, so in some small countries the small-scale of production could be an advantage. For example, Denmark, a small country of five million inhabitants, has no significant domestic leather goods industry. All its requirements are met by imports. The market may not attract bulk exporters (who concentrate on larger markets), while its size may be an advantage for exporters (who concentrate on larger markets), while its size may be an advantage for exporters in developing countries with smaller production capabilities. Besides, Denmark as a market has other aspects of interest to developing countries. The Danes, especially men, are not the most fashion-minded of European consumers (ITC, 1963), hence styles may thus change less often, giving small producers more of a chance to keep up with requirements.

As a traditional industry, little rapid change in technological processes occurs in leather tanning at the global level relative to past trends. Nevertheless, certain changes seem recognizable, wrought by application of electrical technology and precision-control equipment to meter the flow of chemicals and co-ordinate the throughput from process. Such equipment facilitates the output of leather with more consistent characteristics across batches, and productivity is maximised or improved. Mechanization also permits installation of

environmentally-friendly equipment to recycle chemicals, thereby reducing chemical costs and cost of wastage disposal.

**Table 7.1: Alternative Techniques in Various Sub-Processes of Leather Manufacture**

| Sub-Process | Technique | |
|---|---|---|
| 01. Soaking | a. | Paddle* |
| | b. | Wooden Drum* |
| | c. | Concrete Mixed-type Vessel |
| | d. | Y-Compartmented Steel Vessel |
| | e. | Polyester and Fibre glass Drum |
| 02. Liming | 2.1 | Paddle* |
| | 2.2 | Wooden Drum |
| | 2.3 | Concrete Mixer-type Vessel |
| | 2.4 | Y-Compartment Steel Vessel |
| | 2.5 | Polyester and Fiberglass Drum |
| 03. Fleshing | 3.1 | Hand Fleshing* |
| | 3.2 | Mechanic Fleshing |
| | 3.3 | Hydraulic Fleshing |
| 04. Deliming Bating, Pickling and Tanning | 4.1 | Wooden Drum* |
| | 4.2 | Concrete Mixer-type Vessel |
| | 4.3 | Y-Compartmental Steel Vessel |
| | 4.4 | Polyester and Fibreglass Drums |
| 05. Sammying | 5.1 | Mechanical |
| | 5.2 | Hydraulic |
| 06. Splitting | 6.1 | Mechanical |
| | 6.2 | Hydraulic |
| 07. Shaving | 7.1 | Hand* |
| | 7.2 | Mechanical |
| | 7.3 | Hydraulic |
| 08.Retaining, Fatliquoring and Dyeing | 8.1 | Wooden Drum* |
| | 8.2 | Concrete Mixer-type vessel |
| | 8.3 | Y-Compartmental Steel Vessel |
| | 8.4 | Polyester and Fibreglass Drums |
| 09. Setting –out | 9.1 | Mechanical* |
| | 9.2 | Hydraulic |
| 10. Drying | 10.1 | Sun-Drying * |
| | 10.2 | Batch Toggle |
| | 10.3 | Auto Toggle |
| | 10.4 | Vacuum |
| | 10.5 | Paste |
| 11. Staking | 11.1 | Hand* |
| | 11.2 | Jay-type |
| | 11.3 | Vibratory* |
| 12. Buffing | 12.1 | Ordinary Mechanical* |
| | 12.2 | Endless Band |
| 13. Seasoning | 13.1 | Hand Paddling* |
| | 13.2 | Semi-auto Paddling* |
| | 13.3 | Auto Paddling |
| 14. Pressing | 14.1 | Mechanical* |
| | 14.2 | Hydraulic |
| 15. Spraying | 15.1 | Hand* |
| | 15.2 | Semi-auto* |
| | 15.3 | Auto* |
| | 15.4 | Curtain coating |
| 16. Measuring | 16.1 | Pin-Wheel* |
| | 16.2 | Electronic |
| 17. Intra-Factory Transport | 17.1 | Manual Handling* |
| | 17.2 | Mechanical Handling * |

Source: Huqq and Aragaw (1981, PP. 20-21)

Evidence was sought on capacity utilization in the firms. Our measures of capacity utilization are the actual or *operational* to *maximum* or *potential* production shifts; and *total actual* production in relation to maximum (installed) capacities. The firms, without a single exception, indicated that the maximum number of shifts they could operate in a day was three (each shift taking eight hours), which implies that tanneries operating less than three shifts per day (of eight hours per shift), was operating below capacity.

Our results show that no tannery runs three shifts; six indicated they run one shift, and the remaining five indicated that they do something like 1.5 shifts with the second shift taking on less than 20 percent of the workforce required in the first (morning) shift. The firms could not provide sufficiently consistent data on the relationship between total actual production and possible production permit estimates of capacity utilization to be made using this criterion. However, they were able to provide reasons for producing below capacity, as indicated in *Table 7.2*.

**Table 7.2 Reasons for Capacity Under-Utilization in the Tanneries**

| S/No | Reason | Number of Survey Firms Answering Yes | % |
|---|---|---|---|
| 01 | Spare parts | 8 | 72.7 |
| 02 | Raw material scarcity | 10 | 90.9 |
| 03 | Scarcity of chemicals | 11 | 100.0 |
| 04 | Irregular power supply | 11 | 100.0 |
| 05 | Shortage of water | 8 | 72.7 |
| 06 | Lack of market outlets | 1 | 0.091 |
| 07 | Difficulties in obtaining bank loans for operating cost | 3 | 36.4 |

Number of firms responding = 11.

Source: Field Survey, 1996

From the table, the most important constraints on capacity utilization are irregular power supply and scarcity of chemicals, raw material scarcity, and spare parts scarcity and shortage of water, in that order. Asked to indicate the sources of these difficulties, the firms answered as follows:

- Chemicals and spare parts are scarce and, hence, highly expensive because they are largely secured via imports whose costs have increased in many instances by a factor of more than 30 percent.
- Irregular power supply is a problem traced to difficulties in the economic environment - i.e. the unreliability of electrical power supply from the National Electric Power Authority (NEPA). The firms answered that maintaining back-up generators increased their operating costs by more than 100 percent.
- Raw materials (raw hides and skins) are scarce because, first, their quality is low and a lot of technological efforts are required to improve their quality; second, raw hides and skins are consumed as meat instead of being sold separately to the tanneries.

The supply of sufficient and good quality hides and skins to the tanneries is a persistent problem in Nigeria. Generally, at the global level three main categories of hides and skins are significant for the production of leather: bovine hides and calfskins, goats and kidskins, and sheep and lambskins - these combined provide upwards of 97 percent of world hides and skins. All other hides and skins are grouped as 'exotic' (skins of reptiles, e.g. snakes, crocodiles, etc, hides of lions, tigers, leopards, buffalos, etc) and provide 2-3 percent of total world hides and skin.

Whereas the bulk of world livestock production occurs in LDCs, the developed world, mainly North America, Western Europe and Australia, produce the bulk of world hides and skins. This could be explained by reference to the factors: (i) livestock productivity, measured by the ratio of slaughter to livestock population; (ii) proper flaying and preservation of hides and skins for economic use in leather production; and (iii) degree of recovery of hides and skins.

Livestock productivity, otherwise known as off-take rate (= ratio of slaughter to animal population), is generally higher for the industrial world averaging roughly 36 percent relative to 15 percent in LDCs (for cattle.) The degree of recovery of hides and skins in LDCs is also much lower, a problem traceable to human consumption of hides and skins. In many LDCs, Nigeria for one, hides are roasted after flaying and consumed as meat; similarly skins are roasted with the entire animal.

As already noted, hides and skins availability is strictly correlated to the volume of demand for meat and dairy products; thus hides and skins are by-products of meat production. An important element of this by-product relationship is the incentive to the slaughterhouses to flay and cure the hides and skins properly. If the hides and skins are not worth much to the slaughterhouses as a by-product, it becomes more profitable to speed the flaying process and ignore the problem of slaughter cuts. Similarly, it is extremely important that the removed hides and skins be quickly and properly cured and quickly transported to tanneries for immediate pre-tanning processing.

In the industrial countries, where animal slaughter is concentrated in large packing establishments and where the latter usually compete for sales, the incentive to maximize the use of by-products such as hides and skins is rather strong and over-riding, as the sale of hides and skins helps to improve the profit margins of the slaughter firms. In LACS, Nigeria for one, the slaughter houses are rarely centralized; on the country, they are scattered among small butcheries of small slaughterhouses usually located in urban centres. The incentives for the preservation or improvement of quality of hides and skins are generally absent, which results in little attention being paid to the quality and, therefore, market value of hides and skins.

Yet another economic characteristic of skins is their heterogeneity. This arises from the diverse nature of the animals - cattle, goat, sheep, etc - whose hides and skins are commonly used for leather production.

### *Cost Structure and Product-mix*

At the global level, hides and skins constitute the major raw material input in leather production. Existing input-output studies, though conducted in the context of industrial counties, indicate that raw hides and skins take upwards of 50 percent of the total operating costs in leather tanning chemical and cleansing preparation and other inputs about 30 percent (Lockhart-Smith and Elliot 1974).

In Nigeria the cost of basic raw materials, including hides/skins and chemicals, as a percentage of total cost of production as indicated by the tanneries average 50-70 percent. Chemicals take as much as 20 percent of total production cost, which ranges much higher than the global average particularly in the industrial countries, where it ranges about 7-13 percent (UNCTAD 1971). But chemicals for Nigerian tanneries are secured largely through imports.

With regard to chemicals, the industry uses a wider range of the latter than the vast majority of manufacturing industries. In addition to tanning agents used to prevent putrefaction and bring the hides and skins to a stable state, a variety of other chemicals are required. Domestic sources of chemicals are lacking; consequently, the tanneries must depend on imports. But as Murray (1985) points out, proximity to a chemical source has the advantage of lower chemical inventory costs and the ability to consult with chemists and technicians to ensure proper use of the chemicals. This is lacking in Nigeria.

Evidence was sought regarding the extent of import substitution production by input-supply firms in Nigeria. Our investigation reveals insignificant results in this regard. The few domestic substitutes available are reported to lack refinement and standardization or to suffer from irregularity of supply. Examples: local lime, which substitutes for the famous *limbus* lime (imported) is reported to be 'destroying hides and skins during processing'; the local emulsions or vegetable oil, which substitute for imported fatliquor, are edible and are therefore in competitive demand from the domestic food firms; and *bagaruwa*, which is a domestic substitute for imported *nimosa* and *myrobalan*, is neither standardized nor refined.

The main products of Nigerian tanneries were found to be three types of leather: wet-blue, crust, and finished. Wet-blue leathers constitute the dominant product for the export-based firms, accounting for an average of 60 percent of total output in the survey firms. In some of such firms upwards of 80 percent of total leather output is taken up by wet-blue leather. The non-exporting firms, in contrast, produce finished leather for use by domestic leather goods firms.

The export-based tanneries explained the predominance of semi-processed leathers in their product-mix as stemming iron market demand overseas where importing firms (of Nigerian leather) prefer semi-processed leather. Production of semi-processed leather by Nigerian firms was said to be beneficial both to Nigerian exporters and foreign importers. It enables Nigerian firms to penetrate foreign markets since semi-finished leathers attract lower tariffs than finished ones. On the part of importers, it reduces their burden on environmental pollution and the resultant strict sanctions in Western countries. This is so because the wet part of the processing which contains the bulk of the effluents, has been undertaken in Nigeria. Beside, the purchase of semi-finished leathers enables foreign importers to finish the processing to suit the tastes of their domestic consumers.

Although the production of semi-processed leathers by Nigerian tanneries is reported (by the tanneries themselves) to enable them penetrate export markets, it should be noted that semi-processed leathers offer only marginal price advantage over raw hides and skins. According to price data relating to the 1970s but which may still be relevant to the conditions in the 1990s, the difference between wet-blue leather and finished leather ranged as high as 41 percent; between vegetable-tanned crust and finished, as much as 28 percent.

### *Wastage Control*

Almost all the tanneries surveyed indicated that they took steps to keep wastage to a minimum; this was perceived as a strategy to minimize costs. The most widely reported steps taken to achieve this objective are summarized as follows:

i. Careful calculation and weighing of chemicals for process;
ii. Trial tests of recipes to ensure that desired type of leather is produced since it will amount to a huge loss if an untried recipe went to be used to process a whole batch of hides and skins only to discover later that the recipe was inappropriate;
iii. Proper processing and quality control;
iv. Proper buying of raw materials to ensure that good quality raw materials are purchased (since low quality hides and skins, for instance, can never produce good quality leather);
v. Treatment of low materials while in storage to avoid putrefaction and attack by rodent and insects;
vi Enhancement of workers' skills to enable them handle the various processes at required technical standards;

The uses to which the residuals from tanning are put are summarized in *Table 7.3*.

**Table 7.3 Uses of Residuals from Nigerian Tanneries**

| **Residuals** | **Use** |
|---|---|
| Fleshings | Glue production |
| Trimmings from hides and skins | Meat |
| Shavings | Particle board production |
| Rejects | Local leather production |
| Lime droplets | Local leather production |
| Bagaruwa waste | Animal feed |
| Finished leather trims | Mattress and pillow fibres |
| Condensed effluent | Fertilizer |

Source: Survey information, 1996

### *Wastage management and the environment*

Leather production generates toxic wastes such as chromium, sulphide, ammonium residues as well as atmospheric emissions in the form of particulates and ashes. Leather tanning waste management requires a separate study in view of its importance. For now, suffice it to say that leather tanning waste disposal could negatively impact on the environment. Since the bulk of effluent wastes are produced at the wet-blue and crust stages on which Nigerian tanneries specialise, waste treatment is very important in order to minimise its negative effects on the environment. Indeed, importers prefer semi-processed leather partly to avoid environmental problems associated with processing raw leather.

The Federal Environment Protection Agency (FEPA), a statutory body mandated to protect and maintain environmental standards in Nigeria, monitors the activities of all firms, whose operations are likely to negatively impact on the environment, and advises or imposes sanctions when the occasion warrants it.

## Investment Capability

As already noted, investment capability incorporates the information and skills utilized in the identification, preparation, design, setting up and commissioning of new plants, or in their modernization. Thus, it requires knowledge on the types of raw material, technical inputs, personnel, etc. to hire either to maintain existing production or set a new line of production.

The study investigated four types of investment decision: (i) maintenance of existing production capacities (ii) building of a new production line (iii) extending existing production lines and (iv) diversification and production of completely new products. In all cases, little project evaluation skills are available; neither do firms engage the services of competent local or foreign consultants.

Asked to indicate factors that influence their investment decisions, most firms (90 percent) answered 'market demand,' 40 percent government policies; 30 percent availability of finance; and 10 percent availability of in-house manpower and technical personnel.

Among the sample, most investment decisions centre on maintaining existing production capacities; little interest seems to exist in opening new production lines. The firms producing for the export market said decisions on what to supply to foreign clients were influenced by specifications given by the latter. As indicated earlier, Nigerian tanneries export only semi-processed leathers (wet-blue and crust).

However, it was discovered that the firms possess some 'in-house capabilities' in installing new plants and equipment. In doing this, however, technical experts from domestic engineering firms, including civil engineering firms, are contracted to work with firm technicians. One firm said they often retained the services of a civil engineering firm (roads) to do most of their civil engineering work as well as install new equipment.

The dearth of well-trained engineers and experienced management cadres in the survey firms seem to be responsible for their lack of investment capability. Though the firms cultivate contact with local firms to help in installing pieces of equipment it was not clear to what extent such contact improved technological learning in the tanneries.

## Minor Change Capability

Minor change capability involves knowledge in the so-called adaptive engineering and organizational restructuring required to effect upgrading of products (design and mix) as well as processes.

Although all the tanneries indicated that they maintain engineering workshops, it was found that in reality what existed in most tanneries are repair and maintenance workshops. In a majority of such workshops neither the technical personnel nor physical equipment for repair and maintenance operations actually exist.

Of the 11 tanneries surveyed, not more than two (18 percent) have well qualified engineers to man their engineering units. In a majority of the firms, only tannery mechanics, who undertake routine repair work, are available. It was observed that these mechanics have not taken any specialist courses on tannery machines and equipment but depend on the general knowledge and experience gathered over the years.

A good number of tanneries do not hire or retain 'own' tannery mechanics. Such tanneries indicated that they usually contracted out their engineering jobs to outsiders (mainly other

tanneries with better equipped engineering departments).

With regard to acquisition of spare parts, all tanneries reported heavy dependence on imports to the tune of 80 percent. Even where local sources were available it was found that over 60 percent of the so-called domestically obtained spares actually came through local suppliers who retail imported inputs. Our survey showed, however, that some tanneries posses in-house facilities to fabricate peripheral tools such as knife handles and fleshing boards.

On adaptation of equipment, no firm indicated having the capacity to adapt imported equipment, implying that the leather tanning industry has little opportunities for 'learning-by-doing' and minor change engineering capabilities.

Minor change capability has been cited in literature as one of the distinguishing characteristics of technological capability among the NICs. Such capability has enabled NIC firms to use adopted (imported) technologies to create new processes and organizational structures suited to local conditions. However, acquisition of minor change capability by NIC firms has depended on, *inter alia*, possession of adaptative research and development capability.

It was found that research and development efforts and facilities are glaringly absent in the commercial tanneries. The firms seem complacent in depending on imported inputs and on external contractors. All the tanneries indicated that they did not make any special budgetary provision for research and development; neither do they contribute to the research and development effort in leather in either the universities or in formal research institutions like NARICT (National Research Institute for Chemical Technology) located in Zaria. The mode of the Nigerian tanneries is to use what they are more familiar with in their production processes rather than experiment with untried processes and inputs – a situation which explains the slow rate of technical change in the industry.

## Strategic Marketing Capability

This involves knowledge and skills for exploring new output markets. The technology of marketing in vogue depends on the type of commodity involved and the scale of production and the types of consumers served. In this section, the indices that will be used are: the type of product, the product market, distribution channels used, and sales promotion techniques, market information gathering techniques, etc.

Nigerian leathers as earlier indicated fall into two broad categories: semi processed (wet-blue and crust), and (ii) finished. Category (i) is destined for the export market, and category (ii) for domestic leather-goods firms. Nigerian semi-processed leathers are in high demand in foreign markets, for reasons already indicated. The firms concentrate on expanding their capacities to satisfy these types of leather, in most instances to the tune of 65-80 percent of their total leather output. It should be pointed that the top-grade leathers are usually reserved for processing to the finished stage for sale in the domestic market.

For the present analysis we focus more on capability in export marketing without, of course, neglecting completely the domestic market. There are problems connected with export marketing of leather, which should be noted.

Leather market is complicated by the very nature of the raw material (hides and skins); the heterogeneous nature of the natural product makes it almost impossible to sell solely according to specification, which suggests, therefore, that there must exist a close association between potential exporters and importers. But this serves a dual purpose: first, it allows the exporter

to know what products he can offer; and, second the importer can advise the exporter on how to adjust production to suit current market demands.

The exporter then must, if he must obtain orders, satisfy the importer that he can deliver the right product at the right time and at a fair price. LDC leather exporters are known to experience lots of problems in these respects; few have the required linkages to maintain close touch with importers usually located in the industrial countries. But there is a lack of correct market information; distance makes it difficult to meet orders in time; using airfreight, except in top-grade leather, could be exceptionally uneconomical. Besides, the small-size LDC firms generally undermine economies of scale, apart from the fact that they cannot produce top-quality leathers in sufficient bulk owing to their size and low-level mechanization.

Firms were asked to indicate their main strategy used to maintain market shares. Fifty-five percent mentioned 'constant contact with customers', 33 percent answered 'production of high quality leathers', and 1 percent answered 'through high level of output'. As to the dominant means of contacting consumers, 'personal contact' and telephone were found to be dominant. More modern means of communication, namely, fax and e-mail seemed absent among communications facilities available to the firms.

Are firms capable of responding to changes in market demand? The majority of the firms (85 percent) claimed that they posses capability to respond quickly to market demand changes. When pressed to confirm whether or not they can produce finished leathers to the standards obtaining in foreign markets, the firms qualified their answers to mean 'changes in demand in the Nigerian market.' The types of market change the firms seem capable of responding to quickly are those which do not require changes in technology e.g. increase in demand for wet-blue or crust leathers, which may need only expansion in existing production capabilities. Changes requiring new lines of production e.g. sole leather, finished leather for exports etc are completely outside the competence of Nigerian firms.

Investigations were made regarding the mode of distribution of output. Sales to overseas markets are done mostly upon receipt of orders from customers. Such orders would normally specify the type of leather, its characteristics (such as tensile strength), the quality and product grade, the time and place of shipment. Tan samples are usually mailed to potential importers overseas to ensure that the products meet the specifications.

Some firms indicated that their export sales are transacted through marketing representatives and warehouses located overseas. All exports are made free on board (fob). On the other hand, domestic sales are made direct to customers and firms who must have placed order well in advance - and with cash deposits. Given that in the Nigerian market the demand for leather far outstrips supply, the tanneries usually ration the available suppliers to customers. Indeed the market for finished leathers from the tanneries to the customers is a seller's market. Sales are done on cash basis. Only in a few cases where customers are trusted are cheques accepted (Ihuoma 1992:323)

Like most other manufactured goods markets in Nigerian, the leather-tanning firms operate in a typical oligopolistic market structure: few firms supplying an expanding demand. Ihuoma (1992: 319–20) reports that "the five largest firms account for about 65 percent of the total sales in the domestic market." While the majority of the firms, and the largest ones at that, are located in Kano, Sokoto, and Borno zones – all in the livestock-producing Sudanic savannah - the market for finished leather is located in the southern cities (Lagos, Aba, Onitsha, etc), where

formal-sector and myriads of informal sector artisanal firms produce assorted leather goods for the Nigerian and sub-regional markets.

## Linkage Capability

This, as earlier noted, refers to knowledge and skills enabling the production firm to interact with its external economic environment including its various technological sub-system. It incorporates, besides, intra-firm networks to mange information sharing between and among the units and divisions of the firm such as research and development, design, marketing, finance and administration. For the present study, however we focus on inter-firm linkages which are expected to facilitate inward technology transfer as a strategy for technological learning.

The production firm does note operate in a vacuum. Managers organise and improve their firms' production systems assisted or constrained by the understanding and technological capabilities of their engineering and shop-floor operatives. At the same time theses key decision-makers are responding to what can be termed 'threats' and 'opportunities' in their immediate economic environment (see Nelson and Winter 1982; Metcalfe 1995), which materialize in various forms: cost of inputs, emergence of competitors, new input and output markets, new regulatory legislations, etc. The firm develops new products or processes as a major aspect of this response to "threats" and 'opportunities' originating in the economic environment.

Firms learn both from their own experience gained in the course of investment and production as well as from a wide variety of external sources at home and abroad their customers, suppliers of inputs contractor, competitors and an array of organizations and institutions such as university faculties, research and development institutes, banks and consulting firms. The characteristics of the networks also do vary with the type of technology and innovation (process, product, organization), with the sector of industry and with the national system of innovation (Freeman 1995; Foray 1991; Enos 1991; Fine 1992).

Collinson (1993), in a Kenya study, found eight constraints imposed by the economic environment, which may be common to SSA countries including Nigeria:

i. Shortage of local equipment supplies;
ii. Restricted access to overseas markets and suppliers;
iii. High cost/low quality of locally supplies spares and components;
iv. Shortage of competent, technically experienced managers, engineers, etc.;
v. Various market instabilities;
vi. Unstable and problematic financial arrangements underlying supplier payments;
vii. Extra effort and investment required to deal with government regulatory organizations; and
viii. Poor national research and development and science and technology system

The above framework explicitly recognizes that technical change is a complex process involving interactions, in a dynamic sense, between the technological capabilities of the firm and those of the national economy as a whole. The macro environment influences the strategic technological decisions of the firm: types of labour hired, skill training programmes undertaken, foreign partners sought after, maintenance of machinery and equipment, whether to modify products or processes, invest in research and development, contract out research to universities,

or use imports or local substitutes (Adeboye, Bagachwa and Bamiro 1995).

The study shows that linkage capacity is conspicuously week in the Nigerian tanneries. There is no organizational capacity for inter-firm technology transfer. There is also no linkage between the firms and the domestic science, engineering and technology infrastructure. Most of the firms acknowledge having known about the only research institute, National Research Institute for Chemical Technology (NARICT), whose mandate embraces leather and chemical technology but further inquiry revealed minimum contact between the tanneries and the research institute in terms of research and technology transfer. None of the tanning firms surveyed acknowledged having known about the existence of the National Office for Technology Acquisition and promotion – a national scientific institution charged with the responsibility of assisting firms and entrepreneurs negotiate for, acquire and transfer new technology. Similarly, firms do not have any linkage with the responsibility of fabricating scientific equipment for industry and schools. Also links do not exist between the tanneries and the numerous agricultural research institutes, particularly those charged with the production of animals and related drugs for improvement of animal health. Such a link between the tanning firms and animal production and related research institutes would have ensured improved animal husbandry whose effect would have been felt in the hides and skins sub-sector for the production of high quality leather.

The survey reveals gaps between research organizations and tanning firms. NARICT, for instance, has made a breakthrough in fatliquor, a sulphated vegetable oil, which could be used by the tanneries. However, lack of organizational set-up for mutual interaction has made it difficult for the tanneries to avail themselves of the opportunities of the breakthrough. Our survey also reveals cases where particular products have emerged from the institutes such as NARICT hydrated lime and NARICT Bate-G, but tanneries have not shown interest in the indigenous products rooted in indigenous technology.

## Major Change Ability

Tanneries were surveyed to find he extent to which they possess the capacity to create new technology trajectories. It is common knowledge that the skills to do so are function of research and development and engineering capacities.

To ascertain the extent to existence of these skills questions were fielded to investigate the research and development efforts of the tanning firms. It was observed that research and development efforts were glaringly absent. They did not regard such efforts as necessary for their production activities. The tanning firms surveyed indicated that they did not make any special budgetary provision for research and development, neither do they contribute to the research and development efforts of any research establishments. The tanneries generally seem to prefer using what they are more familiar with in their production process rather than experiment with untried inputs.

Laboratory facilities that exist in a few tanneries are scanty and only meant to ascertain the qualities of each batch of leather produced. Such facilities are, in other words, used for routine production activities. They were not for any form of research work.

It was observed that chrome liquor used was discharged without recycling to recover the chrome and make the recipient environment healthier. Some tanneries indicated that there was no method of recovering chrome, thus revealing the total lack of interest in research and

development because modern technology makes it practicable to recycle chrome for further use in leather processing. Such recycling reduced the pollutant effect of chrome on the soil or river to which the effluent is discharged.

An important component of major change capability of a firm is the engineering technology. The relevant variables considered are the existence of engineering departments in the tanneries, the calibre of personnel manning them, adaptation of spare parts, maintenance of machines and other facilities, adaptation equipment, the capacity to design, produce and install machines, and links with external technology sources.

Evidence was sought of the existence of engineering departments in the tanneries. Although most of the firms surveyed indicated that they have such departments, it was found that in reality what existed in these tanneries were maintenance workshops some of which were not sufficiently equipped. It was also found out that only a few firms retained the services of qualified engineers. Majority of the firms only had tannery mechanics who undertake routine maintenance of machinery. These mechanics have not taken any specialist courses on the machinery they service but depend on experience acquired on the job over time.

On fabrication of spare parts, our study reveals that all the tanneries imported parts. Even for those who claimed to have purchased their parts locally, closer observation revealed that the parts were imported. A few tanneries indicated that some fabrication was undertaken in their workshops but that such fabrication was limited to very simple tools such as knife handles and fleshing boards and horses.

With regard to equipment adaptation, no firm indicated possessing the capacity to adapt its equipment, implying that the leather tanning industry has not provided the ground for 'learning-by-doing' as far as engineering skills are concerned. Related to this is the indication by all the tanneries surveyed that they did not possess the capacity to design or produce equipment. Three tanneries however indicated having the capacity to install machinery with some assistance from outside. All the tanneries surveyed indicated that they did not have any links with external technology sources beyond importing machines and chemicals from overseas' vendors. According to these tanneries, such vendors may come over and assist in installation at an agreed fee. Thus, they are essentially import-dependant in their technology acquisition.

# Chapter Eight

## Export Promotion Problems in Leather Tanning

One major problem here is the constraint posed by scarcity of raw hides and skins to feed the domestic tanneries, a problem which has arisen partly from human consumption of raw hides and skins as protein supplements. From the field surveys conducted for other studies (LERIN 1986 – 1987 unpublished data) it is estimated that at least 60 percent of Nigerian hides and skins and 40 percent of available skins are consumed by human beings, a point already noted.

The other problems of export promotion in the industry are more or less potential (Ihuoma and Dike 1992). The ideal policy thrust in the industry should be one favouring production of finished leathers and leather goods. But there are certain potential obstacles to the production of these goods.

The first problem relates to quality: this is not as high as demanded on foreign markets. For example, topcoats of some of the finished leathers either gradually peel off or change their original colours after some time. Similarly, soles of some of Nigerian domestically-made footwear separate from the uppers after a little encounter with water. Therefore, if Nigerian producers of finished leathers and leather goods are to penetrate foreign markets, they should produce internationally competitive products.

From our earlier analyses, it would appear that the inferior quality of some of Nigerian leathers is a reflection of low technological capability. This then suggests that promotion of export capability cannot be separated from promotion of technological capability.

The tariff polices of the industrial countries, which tend to discriminate against manufactured products from LDCs is another potential constraint on export development in the industry. This is even more so as industrial countries tend to mount tariffs on simple labour-intensive manufactures than on complex ones (Murray 1985).

In the leather industry some industrial countries and NICs place higher tariffs on such manufactured products as finished leathers and leather goods than on raw or semi-processed goods such as hides and skins. Canada, for instance, while allowing hides duty-free, imposes 25 percent duty on footwear. Brazil has a rather stiff duty on hides, leather and footwear (*Table 8.1*)

**Table 8.1: Tariff Rates on Leather and Leather Goods in some Industrial Countries and NICs**

| Country | Hides | Leather | Footwear |
|---|---|---|---|
| Argentina | 10 | 10 | 55 |
| Australia | Free | 0-15 | Free 22.5 |
| Brazil | 120 | 160 | 170 |
| Canada | Free | 7.5 – 12.5 | 25 |
| EEC | Free | 8 | 8 |
| India | Free | 60 | 100 |
| Japan | Free | 20 | 10-30 |
| South Korea | 30 | 40 | 60 |
| Mexico | Free | 10-22 | 10-40 |
| USA | Free | 5 | Free 20 |

Source: Adapted from Ihuoma and Dike (1992, Table 1).

Yet another potential constraint on export development is the relative price uncompetitiveness of Nigerian outputs due to high production costs arising from high cost of local inputs, and inefficiencies in infrastructural supplies and other externalities. For example, the power supply situation in a major leather-producing city like Kano is highly erratic and therefore most unreliable for any meaningful cost effectiveness to be attained. All firms surveyed in this study maintain stand-by generators, private boreholes to guarantee adequate supply of water, etc. Inadequacies in publicly supplied infrastructure do indeed raise costs.

Dependence on imported inputs also raise costs particularly given rapid depreciation of the naira since the mid-1980s. On the other hand, exchange rate depreciation since the 1980s has tended to encourage export production. However, profitable tanning for export depends on the domestic inflation rates. As long as the naira exchange rate is allowed to float to adjust to the difference between the foreign and domestic inflation rates, the tanner's profitability will be determined by the firm's efficiency. With exchange rate liberalization since the 1980s export production has been profitable in spite of continued high rates of inflation.

# Chapter Nine

## Policy Recommendations

We first summarize the constraints on the industry and then suggest policy recommendations based on the findings of the study. A key constraint on the industry is the poor condition of the livestock industry which supplies the hides and skins to the tanneries. Both the quantity and quality of the raw hides and skins are poor. Thus any step taken to improve the quality of hides and skins is *ipso facto* aimed at ensuring the provision of high quality raw material for the leather industry.

To ensure production of high quality hides and skins in Nigeria, a Hides and Skins Ordinance was passed in 1958. The latter provides *inter alia* for the registration of slaughterhouses and abattoirs, methods of curing and preservation, handling, grading, inspection of the product and licensing of export markets. It also provides for approved methods of flaying. But this Ordinance was enforced up until the mid-1970s after which its application was neglected. The non-enforcement of the Ordinance has resulted in the following problems for the industry.

The first is the production of hides and skins that have numerous cuts, scores and gouges. Whereas the hides and skins regulations provide for the use of a special flaying knife with a curved blade and a rounded blunt tip, the prevalent practice currently is the free use of doubled-edged and pointed knives which results in production of raw hides and skins that have numerous cuts and other deformations which generally damage the grain layer of the hides and skins and which render such hides and skins not useful for tanning purposes (Ihuoma 1992).

The second problem relates to poor curing and preservation methods. Contrary to the stipulations of the Ordinance which demands that hides and skins be hung on drying frames to air-dry, the practice in many parts of Nigeria particularly in the villages is to spread the raw hides and skins on the ground to dry. This can enhance the putrefaction of the material. We were informed that hides and skins producers who engage in ground-drying practices do this in order to enable their hides and skins to gain weight since hides and skins are generally sold on weight basis.

The third problem relates to the location of slaughterhouses and abattoirs outside approved or registered markets, which results in adoptions of improper flaying methods apart from

diverting hides and skins human consumption. Field surveys by LERIN between 1983 and 1988 indicate that at least 70 percent of hides and 40 percent of skins produced in Nigeria are consumed by human beings. While the hides may be removed from the carcass, the skins are normally roasted together with the whole animal. This practice is widespread in the southern states of Nigeria.

The difficulties observed in non-enforcement of the Hides and Skins Ordinance arise from the informal system of marketing hides and skins in Nigeria. There is practically no order in the prevailing system. The ordinance provides that only licensed buyers engage in the marketing of hides and skins but this is hardly observed. These licensed buyers may be representatives of commercial tanneries or hides and skins dealers. The channel of marketing should then be the movement of hides and skins from the producers registered abattoirs and slaughterhouses to licensed buyers to the tanneries. Besides, the hides and skins must be graded using conventional criteria whereby each of the four to five grades of hides and skins command a particular price, with the lowest qualities commanding the lowest prices. In Nigeria, this system is hardly enforced: hides and skins are purchased on 'piece rate' and the purchase prices are arrived at after haggling with the producer or seller; purchasers may or may not be licensed agents.

It is also relevant to examine the issue of government sponsored research and development for the leather industry. In this regard, two basic facts are worth mentioning: (a) a low level of private sector research and development exists in Nigeria (as in most SSA countries): none of the tanneries undertakes research and development work; besides national expenditure on research and development, which is less than 0.2 of GDP, is almost wholly financed by the public sector; (b) the linkages between the firms and NARICT (the National Research Institute for Chemical Technology) is rather weak, which undermines technology transfer. Other studies confirm this (Adeboye 1995; Kumuyi and Igwe 1987). Few of the tanneries displayed any awareness of research and development priorities in government policies and relating to the leather industry.

Several studies have identified the many constraints facing research and development in Nigeria which match the findings of this survey: (i) a dearth of financial support and high costs and risks associated with research and development work (ii) unwillingness of high calibre scientific personnel to go into research and development work due to poor financial remuneration (iii) erratic government policies on research and development such as constant changes in the status of the federal Ministry Science and Technology (iv) limited demand for the outputs of research and development by otherwise small-sized firms who prefer to source technology form external sources (v) a dearth of local sources of equipment and high cost of such equipment both locally produced and imported (Oyelaran-Oyeyinka, Laditan and Esubiyi 1995; Dike 1991, pp.231-4; Olayide 1981; Kumuyi and Igwe 1987).

However, a more important problem, which is confirmed from evidence in this study, is that the tanneries (and other Nigerian firms) do not need research and development support so much as basic technical and infrastructural support and trouble-shooting skills to help transfer and absorb available technologies rather than create new ones. The surveyed tanneries suggested that they could have benefited from assistance in:

(a) Facilities import of technology inputs e.g. chemical, equipment, etc through appropriate exchange rate policies, interest rates etc;

(b) Development of import substitution in technological inputs by investing in capital goods needed by the tanneries.

On the other hand, NARICT scientists complain that the few findings they have been able to make find little sponsorship from the commercial tanneries. NARICT has over the past few years produced the following leather tanning technologies, which require commercialisation: (i) NARICT Hydrate Lime (ii) NARICT Bate-G (iii) NARICT Fatliquor, and (iv) NARICT processes for monitoring and treating chemical pollutants. NARICT fatliquor , for instance, is a sulphated vegetable oil used for lubrication of leather and has potential to replace some of the imported fatliquor used in the industry. On the other hand, NARICT Bate-G, made from a blend of enzymes from bovine pancreas and selected species of fungi, is used in the bating process for the manufacture of all types of characteristic grain and soft leather of superior quality. It is an essential auxiliary in the modern leather industry. This product is currently wholly imported.

The problems cited in this study tend to align with those experienced in other SSA countries. Capabilities that have established research and development agendas to boost national technological capabilities have generally experienced considerable difficulty implementing them due to, among others, difficulties in providing private sector impetus and generating adequate funding from public and private resources (Juma 1988). Apart from this, there is little coordination between the universities, the research and development institutes and industry in defining priorities.

This study was motivated by recent development in the literature which posits that technological dynamism is strictly a function of the structure and pace of technological accumulation of technological learning. We investigated the Nigerian leather tanning firms in order to provide insights into the dynamics of technological change. Specifically, we sought to find the technological capability within the firms in six areas: (i) production (ii) investment (iii) minor change (iv) strategic marketing (v) linkage and (vi) major change.

It would appear that technological capabilities are lacking in (iv) through (vi) but the documentation in these three areas is still not comprehensive enough and further research would be required to clearly establish the extent of the deficiencies in these regards. On the hand, technological capabilities have been acquired, relatively though, in (i) and (iii).

The factors influencing technological learning or technological accumulation and, particularly, the sources of technological dynamism (or, otherwise, technological stagnation) represent abroad area of primary interest to development economists and policy makers in SSA and LDCs as a whole. Our study indicates that, for Nigerian leather tanning firms, the observed dearth of technological dynamism originates in a myriad of sources, which can be summarized into two. First, the firms themselves, whereby little attention is accorded to technological learning activities. Although production capabilities have expanded over the postcolonial decades, there has occurred little technological accumulation in terms of, for instance, human resource development, establishment of appropriate linkages to source external technologies, etc. Second, the external environment in Nigeria has not provided the type of externalities known in the literature to encourage technological change. For example, until recently exchange rate policies tended to encourage (passive) technological dependency (heavy import consumption) while at the same time discouraging export development. Perhaps more importantly, the existence of a grossly underdeveloped capital goods sector undermine technology transfer processes within the firms, escalated production costs and thereby

undermined export competitiveness.

Though the industry has experienced long years of foreign participation, it appears that this participation has not gone beyond equity participation. There is, apparently, little foreign direct investment going into the industry. Otherwise, some technological dynamism would have been observed in the industry arising from transfer of management expertise and up-to-date production techniques in the firms.

The low-level technological dynamism in the industry is most easily reflected in the inability of the tanneries to produce finished leathers for the export markets.

One of the most important sources of technological change in industry is research and development capability. This is found to be conspicuously lacking in Nigerian tanning firms. However, the type of research and development capability needed in Nigeria firms should focus on transformation of local inputs for use in the industry and not one directed on basic research to generate 'frontier' technologies. The Nigerian leather industry, as observed here, is relatively old, having developed of an indigenous sector even prior to colonial incorporation. The development of a modern sector in the industry based on application of imported inputs has failed to generate technological dynamism precisely because of low-level technological capability within the modern-sector firms themselves. At the same time, the use of imported inputs in the modern tanneries has tended to obstruct, even abort, exploitation of local alternative sources of inputs.

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