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Policy-Induced Local Sourcing of Raw Materials and Technology Development in Nigerian Industry

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Chapter One

Introduction

Manufacturing technology and raw materials are intricately intertwined in a modern economy. But there does not appear to exist either a rigorously articulate theoretical basis for a robust empirical validation of the relationships between industrial capacity utilization, local sourcing of raw materials and technology development. It is in an attempt to provide a plausible conceptual and empirical for these linkages that this study has its primary justification.

The near-misses in policy responses that have characterized the development experience of many African countries may find explanation, at least partly, in the absence of adequate understanding of these relationships. Thus, in this chapter, the research problem is situated in the context of the policy initiatives and performance responses of Nigeria's manufacturing sector over the past three decades.

The Research Problem

The Nigerian manufacturing industry grew quite rapidly during the 1974-80 period that coincided with the country's oil boom. During this period, manufacturing value added recorded an annual average growth rate of about 12 percent. At the end of the oil boom, however, the sharp fall in domestic demand (resulting from a sharp decline in aggregate income) and drastic reduction in the country's import capacity had a direct and significant impact on the manufacturing sector. One indicator of this effect is the rapid decline of capacity utilization of the manufacturing sector from a peak of 73 percent in 1981 to under 35 percent in 1995. In addition, the share of manuacturing in the economy's aggregate output and in exports remains stuck at the very low levels of eight percent and four percent respectively.

The combination of sharply reduced export earnings and high external debt servicing obligations translated into a relatively low import capacity during the 1980s and 1990s compared to the 1970s. The low import capacity was in turn, held largely responsible for the the observed low capacity utilization rates that have characterized Nigeria's manufacturing industry over the past one and a half decades.

Policy response aimed at dealing with this problem has taken several forms. In all cases, however, the underlying reasoning appears to trace the following logical chain. Given currently installed

industrial capacity, and given that the import capacity level of the 1970s is not likely to be restored, the quickest and most effective way of raising industrial capacity utilization is to promote increased reliance upon, and use of local raw materials. In addition, the expected increased use of local raw materials will be made possible primarily through greater technological adaptation and innovation directed at production, process modification, product improvement and design of new products. In effect, this perception of the problem would allow for policy intervention in terms not only of measures to create incentives for encouraging the use of local raw materials (and/or disincentives against the use of imported raw materials), but also initiatives that are more directly targeted at the promotion of technological accumulation at the firm level. The research problem identified for the project, therefore, requires a systematic and comprehensive analysis of the interface between technology development (particularly at the firm level) and local sourcing of industrial raw materials.

Study Objectives and Justification

The specific objectives of this research project revolve around the problem identified above. In particular, this study seeks to:

- identify and appraise the major policies that have been used to induce local sourcing of industrial raw material;
- evaluate whether and the extent to which policy-induced local sourcing of industrial raw materials has been made possible by technology accumulation;
- identify the broad types of technology accumulation associated with local sourcing of industrial raw materials; and
- evaluate the role of local sourcing of industrial raw materials as a factor influencing industrial capacity utilization.

Given this broad set of research objectives, the project proceeds by implementing a corresponding set of associated tasks. Firstly, at the analytical level, the study offers a review of policies targeted at promoting the use of local industrial raw materials, and an exploration of how, and the extent to which policy-induced use of local raw materials could, in principle, be expected to motivate firms to embark on various types of technology development and accumulation activities. Secondly, in the empirical sphere, the study provides an analysis of three important issues. One examines the extent of policy-induced local sourcing of raw materials. This aims at isolating the main factors that explain the extent of local sourcing of industrial raw materials, and demonstrating how the pattern of local sourcing of raw materials is related to the degree of policy-inducement. Another issue examined concerns the broad types of technology development consequent upon or required to facilitate local sourcing of raw materials. In this context, the study identifies the main factors explaining the extent of technology development and, in the process, demonstrates how the pattern of local sourcing is related to that of technology development. In other words, it identifies the broad types of technology development that have been promoted by local sourcing of raw materials. Finally, a significant issue analysed at the empirical level is the relationship between local sourcing of raw materials and industrial capacity utilization. This analysis provides a basis for assessing the role and significance of the local sourcing of raw materials in boosting industrial capacity utilization.

The specific objectives articulated above for this research project underpin its justification. Various studies of Nigerian industry are available. Some of these have focused on the structure, growth and performance of the manufacturing sector (e.g. Sokilsi 1965, Vielrose 1970, Kilby 1969, and Schatz 1973). Several of them have examined questions relating to the components and determinants of the structure of the incentive system, how, and the extent to which the system has influenced the growth and structure of the manufacturing sector (e.g Asioudu 1967, Phillips1976, Oyelabi 1972, Oyejide 1973, Robertson 1981, and Teriba and Kayode 1981). Others still have explored issues relating to technology policy per se and in terms of its contributions to the process of industrialization (e.g. Adeboye 1981, Abulifa 1988, Oyeyinka and Adeboye 1988, 1991, and Oyeyinka 1991). A more recent effort (Adeboye, Kayode, et al, 1991 examines technology supply and accumulation against the background of Nigeria's structural adjustment programmes. Similarly, in a recent assessment of the structural adjustment programme and its impact in Nigeria, the World Bank (1994) has offered some significant insights regarding the relationship between import dependence, local sourcing of raw materials and growth in Nigeria's manufacturing sector. Thus, the uniqueness of (and hence main justification for) this research project lies in the fact that it provides the first systematic and comprehensive analysis of the local sourcing of raw materials technology development capacity utilization nexus, and how policy incentives affect it. The issues involved in this nexus and the role that specific policies may play constitute major areas of contemporary policy concern in Nigeria. A better understanding of these questions could prove useful for improving policy-making and implementation, not only in Nigeria, but also in other developing countries that may be expected to learn from the Nigerian experience.

Chapter Two

Background

Performance of the Manufacturing Sector

In reaction partly to the belief that colonial policy frowned upon the promotion of agro-allied processing and manufacturing activities in Nigeria and probably also in accordance with the general direction of development economics literature at the time, the country's post-independence government expected the manufacturing sector to assume the role of a "leading sector" around which rapid overall economic growth would be built. Yet, the country started out, in 1960, with an unusually small modern manufacturing sector. At this time, the sector contributed less than three percent of the country's gross domestic product (GDP). As expected, however, the sector's share of GDP increased overtime, more or less doubling during the 1970s but ending up at still less than 12 percent of GDP in the early 1990s.

This increase in share of GDP over time reflects the sector's growth experience relative to the rest of the economy. The manufacturing sector recorded an average annual growth rate of almost 15 percent during the 1965-80 (compared with 6.9 percent for total GDP). But this growth performance worsened at the end of Nigeria's oil boom; the sector's growth declined to almost two percent per annum during 1980-86 before recovering somewhat to grow at an average annual rate of approximately five percent during the 1986-94 period.

In value terms, manufacturing value-added in Nigeria increased from just over US$ 0.5 billion in 1970 through approximately $10 billion in 1985 to about $15 billion in 1994. Thus, Nigeria has one of the largest manufacturing sectors in Africa. However, its degree of industrialization remains far behind those of Asian and Latin American countries with broadly similar population and natural resource base.

The sector's structure has also changed over time. Between the 1960s and the early 1990s, the share of consumer goods declined from about 80 percent to approximately 60 percent; that of immediate goods increased from less than 10 to almost 15 percent, while the share capital goods has risen to about 20 percent. In terms of recent growth performance, the most important subsectors of Nigeria's manufacturing industries include synthetic fabrics, soft drinks, sugar and confectionery, soap and detergents, and cotton textiles. Other subsectors, particularly those which are heavily dependent on imported raw materials, such as radio and television, vehicle

assembly, and roofing sheets, have declined substantially.
The domestic-market oriented nature of Nigeria's manufacturing sector is sharply revealed by the fact that the sector accounts for less than four percent of the country's total (recorded) merchandise export, although the existence of large scale smuggling across the borders leads to an underestimation of the sector's contribution to actual exports.

Industrialization Strategy and Policies

Nigeria enthusiastically embraced an import-substitution-industrialization strategy in the early 1960s. In pursuit of this chosen path to industrial development, a progressively more protective import regime, based on a system of high and escalating tariffs, import licensing and prohibitions, was used to insulate most of the domestic import-competing manufacturing activities from foreign competition. This phase of Nigeria's industrialization experience coincides broadly with the period during which the manufacturing and processing activities in the consumer goods sub-sector grew rapidly.

From the mid-1970s, a second phase emerged. As the Nigerian economy experienced a large oil export boom, the country altered its industrialization strategy. An attempt was initiated to utilize part of the abundantly available oil revenue to finance an ambitious resource-based industrialization programme. In the process, public sector investment in manufacturing activities rose sharply as a vigorous push was made into more capital-intensive areas of intermediate and capital goods as a means of capturing the "commanding heights" of the economy. The basic policy instrument during this phase was public sector industrial investment which was generously used to increase the share of the manufacturing sector owned by the public sector by approximately three-fold the 1970-80 period.

The industrialization push of the 1970s was founded on large oil export and government revenues. The collapse of the world oil market from 1981 led to serious balance-of-payment and difficult debt-servicing problems which in turn brought about drastic declines in import capacity. This amounted to a fatal blow for the predominantly import-dependent industrialization programmes promoted by the first two types of strategies described above.

The end of the oil boom was, apparently, not immediately recognized in 1981. Hence, an ultimately futile attempt was made to keep existing industrialization programmes on track by simply resorting to increased import restrictions through administrative controls and foreign exchange rationing. Thus, between 1982 and 1985, the intensity and coverage of the import control regime increased substantially and, as a result, imports were compressed from US$18 billion in 1981 to $8.3 billion in 1985.

Eventually, the prevailing control regime was replaced by one that combined "austerity with structural adjustment" in 1986. The new regime shifted the overall strategy of industrial development from maintaining public-sector-dominated, large scale capital-intensive industries to that of providing

the macroeconomic environment and other incentives for the private sector to assume the lead role in promoting manufacturing activities. Key elements of the structural adjustment programme (SAP) include the adoption of a market-based and realistic exchange rate policy, rationalization, restructuring and reduction of import tariffs, and enhanced trade and payments liberalization.

The most important effect of the SAP regime for the manufacturing sector has been generated by the alignment of relative prices induced by devaluation and traded liberalization. In effect, SAP has favoured those branches of manufacturing with high domestic value-added over assembly-type activities. Thus, those segments of the manufacturing sector that are heavily dependent on imports have been squeezed by both higher import costs and depressed domestic demand while others have been stimulated in the direction of using more local inputs. Capacity utilization, depressed in the first instance by the drastic import compression of 1982-85, has not fully recovered, but the differences in sub-sectoral capacity utilization rates across manufacturing activities clearly reflect the industrial restructuring that SAP policies were designed to accomplish.

The current structure and growth prospects of Nigeria's manufacturing sector are obviously part of the legacies of the past, dictated largely by the industrialization strategies and policies adopted over time. The structural deficiencies and problems of the sector can therefore be traced to these initiatives. An outstanding issue, in this context, is the unusually high import-dependence of the sector. The original import-substitution-industrialization strategy concentrated on final products and hence, local manufacturers could not effectively tap the potentials of domestic component and input suppliers. The push into large-scale and complex activities that followed in the next phase was meant to achieve the required deepening but it failed. Public ownership combined with inadequate technological and managerial capabilities rendered the attempted industrial deepening largely unviable. Limited skill and technological capabilities precluded the achievement of efficiency levels needed to attain international competitiveness. Yet, the in-built capabilities for Nigeria's petro-chemical, iron and steel projects, as well as those of similar large scale intermediate and capital goods producing facilities are simply too large to be based entirely on local demand.

Local Sourcing Strategy

In the light of the emerging deficiencies of Nigeria's manufacturing sector discussed above, emphasis of industrial development strategy shifted towards the promotion of the use of locally available industrial raw materials. This shift was meant to tackle the problem of falling industrial capacity utilization, given the binding constraint imposed by the prevailing low import capacity. The first in the series of the steps needed for creating the necessary policy package for implementing the local sourcing strategy was taken in 1985 when the government announced a set of minimum targets for the local sourcing of raw materials for Nigerian industries with the added stipulation that these targets should be met within a five year compliance period. The following are the industrial sub-sectors and the minimum local sourcing targets established for them:

Soft drinks and breweries	:	100 %
Agro-food industries	:	80%
Agricultural processing industries	:	70%
Chemicals	:	60%
Petrochemicals and machine tools	:	50%

Having established these quantitative targets, government tried to ensure their achievement by moving in two complementary directions. Firstly, government's own research and development (R&D) activities and its assistance for such activities by various research institutes are mainly directed at obtaining suitable local raw materials and promoting their use by industry. More specially, the Raw Materials Research and Development Council (RMRDC) was created in 1988, under the Ministry of Science and Technology, and charged with the responsibility of allocating resources for research and development activities aimed at identifying local raw materials for industrial use. In addition, government finances many (over 20) research institutes and funds various research projects aimed at the same purpose.

Secondly, government has established special incentives for encouraging domestic industries to engage in research and development activities for the improvement of their products and production processes. Included in these incentives are the following:

- tax relief of up to 120 percent of expenses on research and development, provided that such research and development activities are carried out in Nigeria and are connected with a business from which income or profit is derived;
- tax relief of up to 140 percent of expenses on research and development on local raw materials; and
- the abolition, in 1991, of excess profit tax for companies with the expectation that all firms which used to pay this tax would channel the amount into the development and use of local raw materials.

As expressed in a recent analysis by GATT (1991, p.38):

> ...increasing the local content of Nigerian industrial output through increased use of local raw materials is given a high priority in Nigerian trade policies. An increase in the level of local sourcing of raw materials is considered by the government to be vital for rising capacity utilization of Nigerian industries. The government has also been encouraging research and development of identified raw material substitutes or alternatives through the Raw Material Research and Development Council.

The local sourcing strategy, especially as it applies to the brewing industry, has received further support from two more specific trade policy measures. Firstly, import of beer was banned in 1978; and secondly, a similar import prohibition was applied to malted barley (the key raw material), in 1988.

The Brewing Industry

As shown above, the local sourcing strategy established, in 1985, a minimum local sourcing target of 100 percent for the brewing industry, and specified that this target should be met within a five-year compliance period. This makes the brewing industry the ideal case-study candidate for this research project.

Commercial production of beer in Nigeria started in 1949 when the Nigerian Breweries Ltd. established its first (of four) brewing plant at Iganmu in Lagos. Local competition did not arrive until the early 1960s with the emergence of Golden Guinea (1962), Guinness (1963), West African Breweries (1964) and the North Breweries (1970).

A phenomenal growth in the number of breweries occurred in the second half of the 1970s; this was induced partly by government's decision to ban the importation of beer into Nigeria in 1978. Starting, in 1972 with only four breweries producing a total of 1.65 million hectolitres per annum, there was a dramatic growth in the following decade to 22 brewing plants, in 1982, with total installed capacity of 11.5 million hectolitres per annum. By 1990, a total of 33 brewing plants existed with total installed capacity of approximately 20 million hectolitres. But while installed capacity grew up to the early 1990s, many of the breweries had ceased to be operational. Thus, by 1994, only about eleven breweries remained in operation; capacity utilization had fallen substantially in many cases and several of the plants had been taken over by the industry leaders.

In terms of structure, the brewing industry in Nigeria was always concentrated. This concentration was reduced somewhat and only briefly in the mid-1970s with the explosion in the number of new breweries. However, the exit of many breweries over the past ten years or so has returned the industry to its earlier degree of concentration, a development not totally unconnected with the effect of local raw material sourcing policy. Thus, by the early 1990s, the two industry leaders i.e. Nigerian Breweries and Guinness, accounted for 33 percent of the installed brewing capacity in Nigeria, while the Nigerian Breweries Ltd. claims 48 percent of actual beer production in 1994.

In the context of the emerging oligopolistic structure in the brewing industry, there exists considerable product competition especially between the two industry leaders. Initially, Guinness controlled the Stout market until the introduction into the market of Legend Extra Stout by Nigerian Breweries. In the beer market, Nigerian Breweries' Star competes with Guinness' Harp. More recently, Guinness has also introduced Satzenbrau into the market to provide competition for Nigerian Breweries' Gulder. In addition Rex and Merit lagers, which have been withdrawn, were introduced in the same year (1986) by Nigerian Breweries and Guinness respectively. In the malt drink market, Malta Guinness was introduced to compete with Nigerian Breweries' Maltina, and the latter company has responded by launching its own Amstel Malta, due to the loss of substantial share of the market to Malta Guinness.

More detailed analysis of the responses of the brewery industry to government policy interventions (i.e. the local sourcing strategy and associated import bans) must await the results of this study's survey. It may be pointed out, at this stage, that important aspects of this analysis will include the consequences of these interventions and responses to them in terms of the industry's market structure, performance of the leading firms, as well as the results of their innovative activities.

Chapter Three

Technology-A Review of Concepts, Issues and Approaches

Introduction

There is a large rapidly growing and wide-ranging literature on technology, technological development and their various features and attributes. Hence, the review which is presented here is, of necessity, selective; this selectivity has been influenced primarily by the focus of this study.

An initial reading of this literature may lead one to a labelling it (similar to the one done on management some years ago) as a'technology jungle'. The conceptual disorder and analytical chaos are palpable. That is probably a harsh indictment.

The apparent disorder represents a variety of viewpoints and approaches for dealing with a complex subject-matter which technology is. In what follows, we ferret out the concepts, issues and approaches which feature prominently in the literature and then articulate the perspectives that are of particular relevance to this study.

Concepts

Increased total factor productivity is predicated usually on technological*development,* technical *change* or technical *improvements* (David, 1992). It is this realization that leads to the widely accepted view that, in all countries, technological change is the engine of growth. Yet, the variable, technology that is changing or developing is often presented in a fluid, if not nebulous manner. This section reviews the concept of technology with a view to operationalizing it in the context of this study.

(a) Technology

Technology, in broad terms, relates to ways of doing things. It involves systematic processes used in achieving a given result (Adeboye et. al, 1994). Technology usually refers to the various elements of productive knowledge which help to transform materials into goods, create new or improved products and generate further knowledge which is more advanced and more potent than hitherto available. In a nutshell, technology may be seen as the study, mastery and a systematic utilization of the knowledge of the industrial and manufacturing methods in practical terms. It aims

at making things work effectively (Stewart, 1977).

A firm's technology can be broken down into four embodiment forms (Technology Atlas Project Team, 1987), comprising object, people, document and institution embodiment forms.

The object aspect of 'technoware' consists of tools, capital goods, land, intermediate goods, products, crops, physical equipment, machinery, physical processes etc. People embodiment or 'humanware' is made up of understanding, capacity for systematic application of knowledge, know-how, human capability, human labour, specialised ideas, skills, problem solving capacity etc. The document aspect or 'infoware' is knowledge about physical relationships, scientific and/or other forms of organised knowledge, R&D, technical information, principles of physical and social phenomena, standards, computer software, specification etc. The last form, institiutional embodiment or 'orgaware' comprises organisational work assignments, organisation of products, processes, tools and devices for use by people, day-to-day operations of production, social arrangements, means for using and controlling factors of production, inter-and-intra-firm networking, linkage with meso institutions, etc.

The disaggregation of technology into different embodiments that technology is not all machines. It is the knowledge partly embodied in machines, and otherwise embodied in organizational structures, and processes (Ernst et.al, 1994). Technology is an interplay of machines, skills and processes through which organizations adapt means to ends. Thus, division of labour and specialization underline the complex organization of machines, processes, materials, peoples and products by which goods and services are created in modern societies. The nature of the production system, whether manual, automatic or computerized, determines to a large extent the flexibility, efficiency and effectiveness of the configuration. The types of predominant materials used for machines and as raw materials determine the quality, the cost of goods and the extent of production. Whether a product is mass produced or not depends on some features of the products, processes and materials. The "impressive degree of technological dynamism which has been a constant source of economic development" (Wright, 1995) has its origins in the possible permutations of physical and human combinations in the production process.

The concept of technology has different implications for various organizational levels and perspectives. Within the entity viewpoint, the firm is a "depository of experiential, and tacit knowledge" (Wright 1995, p.20). This view reinforces the conception (Penrose, 1959, p.46) "that the firm is a collective entrepreneurship", having individuals who have had to experience working together and challenged by the environment to match the performances of other firms by seeking to continually reduce its costs by creating new products and processes, and by continually improving the dimensions of its products. The notion that the firm produces both products, processes and knowledge justifies a "learning theory of the firm". The learning is obviously done by individual humans.

Technological acquisition at the firm level requires interactions among various departments and units of a firm. According to (Ernst et. al., 1994), such interactions take place:

- between marketing and production (feedback from consumer complaints and suggestions leading to product improvement)
- between production and design (continuous interactions between production engineers leading to a bottom-up approach to design where the focus is on manufacturability); and
- between research and development, marketing and production (joint development teams, consisting research and development, marketing and production people who are responsible for the product throughout all stages of its development cycle, right up to the final manufacturing, which has led to a substantial acceleration of "speed to market").

Any technology acquired by a firm as a result of these processes remains largely confined to the firm because the personnel and organizational structures facilitating such acquisition belong to the firm. In other words, the technology is localised within the firm, and can only filter out to other firms with the active or tacit cooperation of affected firm or its accredited representatives. Moreover, it is the existence of such interactions within a firm that effectively differentiates the firm from another in terms of its production process, effective and efficient utilization of resources, technological capabilities, and indeed, its ability to weather the storm of economic downturns and unfavourable government policies.

It is clear that the technology at the firm level is a composition, not only of the requisite physical capital, but also its depository of practical and tacit knowledge as well as the subsisting interactions among its various component parts.

Technology at the inter-firm level necessarily involves linkages between productive units as a conception of inter-industry transaction mediated by both pecuniary and non-pecuniary externalities, specifically, technological externalities. Linkage, in its broad sense, is "an inducement to activity on the part of one enterprise created by the action of another" (Weiss,1987). In a narrow technical sense, it refers to the network of relationships of productive units, within a framework of inter-industry externalities. Hirchman (1958) identified two broad categories of linkages namely, the backward and forward linkages. Backward linkages refers to the interdependence of an industry on its supply sources while forward linkages refer to the relationship between industry and its users.

Thus, at the inter-firm level, certain production requirements are provided including the transferable skills of labour, high technologically-intensive skills, and an enhanced knowledge of production processes. Specialized joint production exists therefore between and among small specialized firms which involve frequent transfers of an unfinished product between numerous specialized firms and industries on the one hand, and between the firms and industries on the one hand, and between the firms and their customers on the other. Thus, firms interact among themselves with a view to enjoying commonly produced facilities e.g. in large industrial concerns.

Firms in the same industry may also cooperate with each other in order to avail themselves of opportunities arising from government policies and/or programmes. It is not uncommon for

domestic and foreign firms to enter into ventures which are of mutual benefit to themselves whether in terms of seeking collaboration for research and development, staff training or updating plant and machinery.

Thus, Ernst et. al. (1994, p.20-21) see interactions among firms in terms of linkages which "encompass such diverse activities as the procurement of materials, parts and components and services and the related exchange information with suppliers, the sharing of marketing and distribution activities and the sharing and joint development of product design and production technology and of related scientific knowledge". Within this context, it is easier to interpret technical change as a "collective enterprises" within an organized market. Thus, enterprise-level linkages enhance technological learning (Mytelka 1991, p.13). Small-technology-based firms (STBF) need access to external formal technology or technological externality. And as Mytelka (1993) argues, such firms now find it is "cooperation not competition that can enhance modernization". In the same vein, a firm's boundary no longer contains its size; on the contrary, the size is determined largely by its knowledge-base (Wright, 1995, p. 27).

The knowledge-base should be immediately linked to the existence of a developed domestic supply base. Materials technology, materials and components supply and cost are quite important for performance and quality of individual firm's production.

(b) Technological Capability

Ernst et. al. (1994) define technological capability as the great variety of knowledge and skills which firms need to "acquire, use, adapt, change and create technology".

It transcends engineering and technical know-how to include organizational know-how knowledge of behavioural patterns of workers, suppliers and customers. This knowledge and skills derived from "iterative trial-and-error, cumulative learning by doing, by using and by interacting" within the firm (between marketing and production, between production and design and between research and development, marketing and production) and between the firm and its customers, and suppliers. To Bell and Pavitt (1993), technological capability constitutes a change-resource "needed to generate and manage technical change including skills, knowledge and experience and institutional structures and linkages".

Once we move away from the basic concept of technological capability and its broad definition, opinion diverges, sometimes quite widely, regarding what the component parts of technological capability are, how firms acquire them as well as the factors that may promote their acquisition and accumulation.

Thus, in terms of the component parts, Lall (1993) recognizes three, i.e. investment capability, production capability and linkage capability. The first describes the firm's ability to identify and prepare projects, procure equipment, design, construct, and install a production facility. The

second deals with actual operation, quality control, plant maintenance, product innovation, etc; while the third capability deals with technical relationships with suppliers and customers.

In comparison, Ernst et. al. (1994) identified six different technological capabilities, three of which are similar to or are essentially the same as those articulated by Lall. Thus, in addition to investment, production and linkage capabilities, Ernst et. al. added such new capability concepts as minor change, major change and strategic marketing capabilities.

Whatever may be the differences in the specific categorization of technological capabilities, it seems to be generally agreed that the acquisition of these capabilities involves a learning process particularly at the firm level and that the process is impinged upon by national level technological capabilities, the prevailing macroeconomics environment the incentive system and competitive pressures (Lall, 1993).

(c) Technological Development

The firm has been posited as being in the best position to enhance innovation through knowledge and learning (Chandler, Shapiro, 1991). The firm acts as an organization for storing knowledge (including tacit knowledge), is an enduring institution which can reproduce that knowledge and inculcate it in new entrants or share it with other firms and it acts as a social agent which can establish trust and cooperation (Wright, 1995). The firm thus represents a continuum of relations that develop over time through productive experience. Given experience-based nature of technological capabilities attained from learning-by-doing, firms must draw on their internal capabilities and capacity in order to produce and develop new products. Thus the firm, large or small, provides the vehicle for technological development and innovations by discussing, purifying and codifying necessary changes, adaptations to work routines, processes and products. It is obvious why dearth of technical skills will be a constraint to technological development.

Technological development of technical change provides a linkage between technological capability and increase productivity as a stage where better ways of transformation of components and materials to final products are developed through either the adaptation of imitative technological innovations or experience-based learning. It is the manifestation of the evolution over time of cumulative deeper forms of technological capabilities.

Technical change generates large productivity increases and ultimately, economic growth. As Branscob (1992) points out, any society's economic prospects are likely to be strongly influenced by its capacity for sustained technological development.

One of the major issues in the analysis of technical change is the capacity of and speed with which developing countries can absorb and adapt new technological innovations as against possessing the capability of creating new technological innovations of their own. It is suggested that the absorption and application of these new ideas would more probably sooner launch developing

countries on the "threshold of technological competition" than the attempt to "re-invent the wheel" (Weiss Jr., 1993). It is through the cumulation of a myriad of small technical improvements and incremental modifications of the production process (David, 1992) that the technology adopting firm generates increases in total factor productivity in the long-term. Any enterprise involved in this variety of technological development is regarded as the primary agent of technological change.

Existing and varying market conditions, and the macro-economic policy environment, to a large extent, influence the efforts to modify, adapt and improve production processes. Market conditions on the one hand facilitate the need to efficiently produce and adapt innovative ideas in the production process, thus leading to improved quality of products. On the other hand, macro-economic policy environment in conjuction with adequate and appropriate technological infrastructure, including the requisite political will of the government to put in place regulatory framework of the right, act as inducements to the firm in its choice of cheaper alternatives for the productive process, modification and adaptation of its existing technology.

Issues and Approaches

How do firms and countries acquire technological capabilities and use these to further enhance their levels of technological development? Does this process respond best to market-based incentive systems or does it require broad or specific government interventions? This is an issue that has for long dominated the debate in the literature, particularly in relation to ability of developing countries to "catch-up" with the more developed world in the area of technology.

As literature reveals, thinking has evolved over time with regard to the role of market versus that of government in general economic development as well as with specific reference to technology development. An earlier, neo-classical, perspective treated technology as an exogenous economic development under the idealistic assumptions of perfect competition, constant returns to scale and absence of externalities. This perspective required no active involvement of government in firm-level decisions; the useful role of government was limited to eliminating distortions and providing a stable macro-economic environment and a reliable legal framework (Justman and Tenbal, 1991) within which firms could operate.

Given its underlying assumptions, the view of the relative roles of government and the market in the promotion of technological development implied by this perspective could not endure once one admits that, in the real world, competition is not necessarily perfect, that there can be non-constant returns to scale, and that significant externalities may exist. Hence, a new perspective crept in to replace it. This new perspective has been referred to as the "market-friendly approach" (Singh, 1995). Under this approach, the role of the government in economic development is regarded as important, although it is best limited to providing the social, legal and economic infrastructure, creating a suitable climate for private enterprise, and ensuring a high level and appropriate composition of human capital formation.

The role assigned to the state in the market-friendly approach is larger than that provided for in the neo-classical perspective but is regarded as too limited by those who regard the acquisition of technological capabilities and the development of technology (whether through adaptation or innovation or both) as an incremental and long-term process that of necessity, requires concerted national effort. In the context of this view of technological progress, it is argued that the government must play an active, leading, direct and crucial co-ordinating role (Singh, 1995).

Towards a New Focus

The debate in the literature has apparently established a consensus on several issues. For instance, learning, in its various forms, is recognized at the basis for the acquisition of technological capability which enables firms not only to access existing technologies but also to expand the frontiers of technological knowledge. In addition, the development of technological capabilities is dynamic as its stages are influenced by changing industrial and firm-level strategies as well as national level government policies. More specifically, the macro-economic environment, domestic market competitiveness, and international competitiveness as moderated by national-level trade policies are important factors affecting the acquisition and accumulation of technological capabilities at the firm level.

Given these areas of consensus, the focus of research on technology development need to shift away from the debate as to whether one should have a market-based technology development paradigm or a state-led technology development paradigm. It seems clear that important elements of both paradigms are involved and the real issue should be how to manage the interface between them. In other words, once it is recognized (a) that government policy interventions are required in certain respects to assist in guiding and co-ordinating enterprise-level efforts in the acquisition of desirable technological capabilities and (b) that firm-level responses to those policy interventions will be affected by a number of factors (including their organizational structures and ownership pattern, as well as market structures and incentives), then it is important to pay attention to the process through which policy interventions are expected to bring about particular firm level responses. More specifically, appropriately managing that process of change becomes crucial to the success of the entire effort.

The management of change thus constitutes an important aspect of the technological development. A movement from one technological development phase to another would necessarily involve so many parties: individuals and firms on the private sector side of the public sector. Unprogrammed, these individuals, firms and groups would arrive at some technological development point which may or may not be optimal and the national perspective. We hasten to suggest that the various individuals and groups in the private and public sector can be consciously programmed for a more desirable result. Our focus on change management derives its rationale from this reasoning. In other words, isolated policy articulation and injection may achieve the desired objectives. But a set of policies articulated on the basis of the various interests (at times conflicting); on the basis of information disseminated to promote overall benefits; and taking into account the psychological

and economic calculus of operating participants is more likely to result in very beneficial outputs. This analytical framework, while taking cognisance of the conscious sustained efforts of government and individual enterprises in technological development, views change management and individual enterprises in technological development, views change management as an important factor for smoothening the process of change and ensuring improved policy effectiveness. In this perspective, the issue of technological development goes beyond the role of government and the firm and thus should focus on how technological change ought to be conceived and managed.

The response of the firm to government policies for inducing technological development cannot be treated in isolation. Firm's responses depend partly on their organizational and ownership structures. A firm's ownership structure will influence the enthusiasm with which it embraces the technological development effort. The firm which is foreign-owned may frown at locally-based research and development and be favourably disposed towards foreign-based research and development efforts, thus the interests within the firm must be consciously weighed. The attitude of the management towards change will also be influenced by the level of understanding of the process of technological change as well as the exposure to information on the available incentives. This perspective, which assigns an important role to change management and focuses on the interface between government policies and the response of private sector firms in the process of technological development, forms the basis of the conceptual framework articulated for this study. It is more fully described in the next chapter.

Chapter Four

The Conceptual Framework and Methodology

Introduction

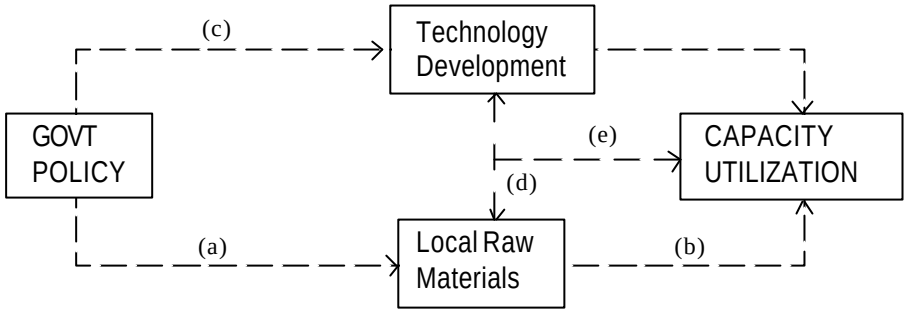
This section provides a theoretical framework for understanding and validating the relationships between government policy on one hand and technology development and capacity utilization on the other. It proceeds by first providing a narrative version of the main links embedded in the nexus of technology development, raw materials policy and industrial capacity utilization. We next attempt to trace how other important variables impinge upon the interface which constitute the primary focus of our research.

Narrative Version of the Framework

As observed earlier, persistent low capacity utilization in the manufacturing sector triggered the need for a policy response. Thus, ultimate target of policy was seen as the boosting of capacity utilization. This was expected to be achieved explicitly by increasing the use of local raw materials, given the fact that binding foreign exchange constraints sharply restricted import capacity and thus made the traditional reliance on imported raw materials no longer viable or even feasible. An important component of this chain argument, which was largely left implicit, was that the technology development required to make the use of local raw materials both feasible and efficient either already existed or could be easily established.

In principle, therefore, a simple narration of the linkages to be researched should explicitly recognize an ultimate target of policy, i.e. industrial capacity utilization, as well as two immediate targets, i.e. technology development and local sourcing of raw materials. *Figure 4.1* offers a linear presentation of these linkages. More specifically, the figure shows that appropriate and specific policy initiatives could be directed to influence local sourcing of raw materials through linkages (a); this would, in turn, lead to a boosting of capacity utilization via linkage (b). In addition, the figure provides explicit recognition for a second channel of policy impact. In this case, specific policy measures would target technology development through linkages (c), which would in turn enhance the efficiency with which local raw materials could be used (linkage (d)) and ultimately boost capacity utilization via linkages (e).

Figure 4.1: Linking Policy to Intermediate and Ultimate Targets



Other Elements of the Model

We have highlighted three variables – capacity utilization (the problem variable), raw materials policy, and technology development. There are other variables which are important and may appear necessary to be highlighted. These other variables are grouped into two, namely, those that will be further clarified but not incorporated into our model and those to be incorporated and thus extend the linear model.

(a) Concepts of Technology

Technology, technological capability and technology development will be further clarified but will not be treated separately in the expanded model. Like the linear model, the expanded model will contain only the variable technology development. It is clear from our discussion in sub-section 3, that we believe that the three concepts are different, even though there may be some over-lap and inter-relationship. It is, however, sufficient for this study to clarify some of the confusion, but not complicate our model unnecessarily by treating them separately in the expanded model. For now, we summarize the essence of the three concepts, highlighting the same of the distinctions thereof.

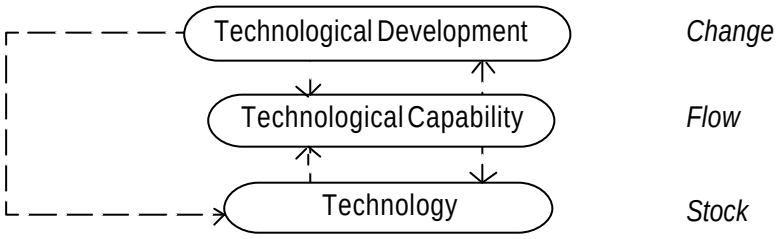
The distinguishing feature of technology is that it refers to*stock.* With this feature, some of the earlier definitions will read thus:

- the stock of the ways of doing things
- the stock of the knowledge partly embodied in machines, organizational structures and processes.
- the stock of physical capital, depository of practical and tacit knowledge.

With technological capability, the emphasis is on access to and/or ability to use ability to use available technology, it is a flow concept. There is some overlap between technology broadly defined and technological capability. For example, the four embodiment forms of technology earlier highlighted, namely, technoware, humanware, inforware and orgaware appear to us to overlap with technological capability especially in the last three embodiment forms. As the definition of technology becomes more robust, the overlap with technological capability becomes greater.

Technological development is concerned with *change* often times expected to be of substantial magnitude and/or rapid: at times, it may be of less magnitude. It can be limited to technology alone, but invariably would involve technological capability. *Figure 4.2* summarizes the relationships among the concepts.

Figure 4.2: Technology, Technological Capability and Technology Development – A Relationship Schema



(b) Change and Change Management

Change is a variable that is further clarified and incorporated into the model. Though simple, *Figure 4.1,* by bringing out the key components and the various linkages, reveals the process feature of the relationships. Being a process, change is implicitly involved. Surprisingly, because of the implicit feature, change is not usually identified and treated as an element in the policy response model. The need to treat change and an element in the policy response model which places emphasis on technical/technology *improvement, development and change.* The three involve some departure from, or modification to the existing state of doing things, either of which involves change.

If change is accepted as crucial, the management of change is even more crucial. How change is managed is a major determinant of the effectiveness and efficiency of the linkages in *Figure 4.1*. Change management is therefore a major determinant of, and indeed, the key to the effectiveness of policy response. There are numerous reasons why change management is crucial to the success of policy response and in particular to technology development. Some of these are due to the general nature of change, some derive from the involvement of people and others are

technology related. Earlier in subsection three, we highlighted the various interests that are involved in the policy of local sourcing of raw materials as well as those involved in the technological development associated with it. Our concern here is the effect of change and change management on policy response.

To fully appreciate the relationship between change management and policy response, it becomes critical to understand change generally. Change involves altering or modifying an existing situation which invariably tends to encounter opposition or resistance. One of the common illustrations by the psychologists of the effect of changes on its environment is the effect of a pressed finger on an air-filled balloon — the contour of the balloon visibly changes at the point of contact and not always obvious is the stretched effect on the entire balloon. The message from the balloon illustration is clear and valid for technology development, namely, changes may lead to pressures, conflicts and resistance to change.

Most changes are initiated by people. The responses to change by people are well illustrated by the Hawthorne experiments performed by Roethlisberger and his associates. This was an experiment in employees' attitude to produce response that is conditioned by *feelings* towards change - in the specific case of the Hawthorne experiment, it was testing the effect to changes in illumination on worker productivity. The feelings of the workers about the experiment itself became an important variable.

Feelings are not a matter of logic. As rightly put, "logic alone is an ineffective means of trying to modify feelings because it does not get at them directly" (K. Davis and J. W. Newstrom p. 285). Yet the feelings determine to a large extent the resistance to change. The resistance to change consists of any employee behaviour designed to discredit, delay or prevent the implementation of a proposed changed. According to Davis and Newstrom (p. 290).

> Employees resist change because it threatens their needs for security, social interaction, status or self-esteem. The perceived threat stemming from a change may be real or imagined, intended or unintended, large or small. Regardless of its nature, employees will try to protect themselves from the effects of change. Their actions may range from complaints, foot-dragging, and passive resistance up to absenteeism, sabotage and work slowdowns.

Change management becomes critical in minimizing resistance to change. The management starts with the type of change. This is important because not all changes are resisted. How and when the change is introduced, who introduces the change and how much dialogue is involved in the change are other dimensions of change management to be properly and frankly addressed. For example, it is generally true that pseudo participation may not enlist positive response. Thus change management (or implementation of change) is crucial in minimizing resistance and obtaining positive response.

The discussion so far is on change generally. It is important to emphasize that the issues raised

are applicable also to technological development (change). At the heart of this change are people. With the recognition of "man", the effectiveness with which the policy change is managed becomes crucial.

(c) Firm Characteristics

There are numerous dimensions of a firm that may enlist positive or negative response-most of these are double-edged swords. The most critical of these are size, ownership structure, source of technology, management structure and general outlook-inward or externally outside the country. Our objective is to collect information of these and other characteristics and attempt to use them to assess the response to local sourcing strategy as well as any resulting technology development. We show in *Figure 4.3* some of the variables used to measure each of these dimensions.

Table 4.3: Selected Firm Characteristics and their Measures

Dimensions and Measures

Type ownership structure	Firm size	Source of technological capabiligy	Management structure	Linkage behaviour & tendency	Performance
Private majority owned foreign subsidiary (PFS)	Asset base	Fully depend on foreign	Composition of board & management	Fully outward (weak internal)	Profitability
Private minority owned foreign participation (PMS)	Manpower size	Partial dependence	Composition of technical groups	Paritial linkage	Liquidiity
Independent endogenous private (IEP)	Physical output hectolitre	Endogenously driven technology effort	Composition of skilled workforce	Significance linkage	Reserves
State-owned (SON) majority Nigerian	Turnover	___	___	__	__

NOTE: Reading is vertical, no meaningful horizontal inferences are expected.

(d) The Economic Environment

The concern here is the environment that is external to a firm. A few observations are worth highlighting here.
The first is that the general policies and strategies of government are designed to create an enabling environment. It will, therefore, not be necessary for us to treat these policies and strategies separately in our model. It is pertinent to note a recent assessment of the importance of the enabling environment in Africa [*Global Coalition for Africa* (1994, p. 12)] which states that:

Creating an enabling environment for private investment has lagged behind other economic and structural reforms in many African countries. Potential investors continue to be deterred by excessive bureaucratic procedures, the unavailability of medium or long-term financing, a lack of confidence in the judicial system and complex, rigid labour laws.

The second point to highlight is that the environment contains several sub-components apart from the economic aspect mentioned. The political, technical and institutions dimensions are also important. Our concern in the environment, except where quantifiable dimensions are possible, would learn more on the assessment of the actors in the breweries and their responses to the local sourcing strategy.

(e) Encumbrances

Most, if not all of the breweries rely on external technical input, obviously in varying degree. There is, therefore, foreign interest in most of the breweries, even when the ownership is 100 percent Nigerian. It is important to note the stakes in the breweries and the conflicts of interests which may arise with local sourcing and the attendant reluctance to promote technology development.

It is best to regard some of these interests not only as *conflicting,* but *constraining* and in most cases *hidden*. The problems inherent in managing these interests are likely to be lost if they are regarded as constraints the way economists would normally treat them. They are likely to be similarly down-played if they are lumped with the enabling environment. We believe these interests must be highlighted and addressed up-front if meaningful policy response is desired. We have labelled these types of interests as encumbrances, borrowing from the legal profession. The choice of the concept is dictated by the property transfer implied by the change to be effected. The legal concept consequently has the greatest appeal.

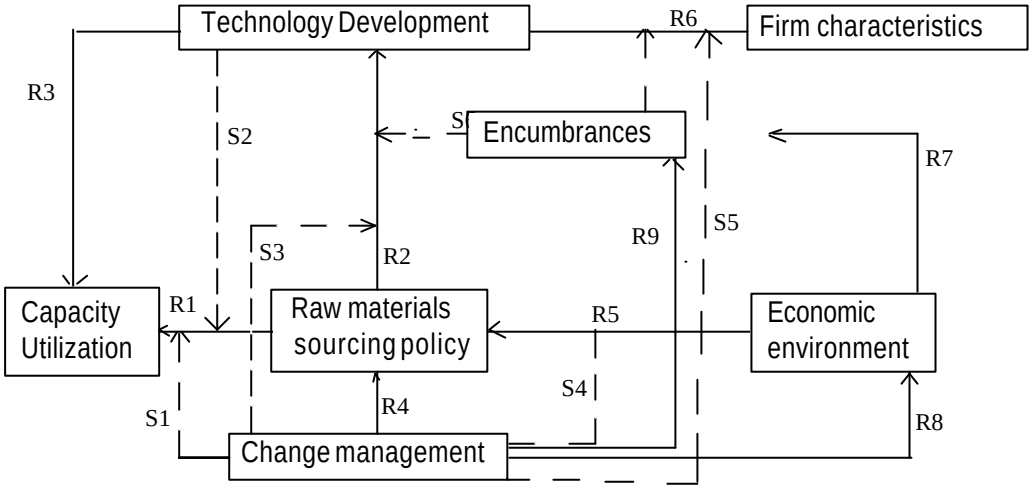
The Model

We summarize in *Figure 4.4* some of the critical relationships among the elements highlighted above. The model enables us to see at a glance:

- those elements that affect the raw materials policy
- those elements that affect the strength of the relationship between two elements, and
- those elements that the materials policy affect

As shown in the figure, and as we expect, the raw materials policy affect capacity utilization and technology development. Thus, both in linear model and the expanded model*(Figure 4.4)* show two routes through which the material policy is expected to impact on capacity utilization. For ease of reference, the various relationships are labelled as follows:

Figure 4.4: A Model of Raw Materials Sourcing Policy



R_1 - materials policy and capacity utilization
R_2 - materials policy and technology development
R_3 - technology development and capacity utilization
R_4 - change management and materials policy
R_5 - external environment and materials policy
R_6 - technology development and firm characteristics
R_7 - encumbrances and external environment
R_8 - change management and external environment
R_9 - change management and external encumbrances

The above labels are used for the relationships between two components of the model. As shown in *figure 4.4*, there are more relationships than those listed above. There are relationships between

a component and some of those already highlighted. Such relationships are shown in broken lines. These broken lines tend to weaken or strengthen the relationships they are linked to. For ease of reference we labelled them differently as follows:

S_1 - R_1 - and change management
S_2 - R_1 - and technology development
S_3 - R_2 - and change management
S_4 - R_5 - and change management
S_5 - R_6 - and change management
S_6 - R_2 - and encumbrances

The S—lines can be regarded as boosting or weakening the R-relationship. The figure shows that change management, technology development and encumbrances are the sources of these boosters or weakening forces. In terms of the number of R-relationships affected, the change management would appear to be the most important of the three sources. Indeed, this assertion is further reinforced by R_9 which shows a relationship between change management and encumbrances. Further assessment of the relative importance of these sources might be possible from the field results. We discuss below other relationships, and the postulates thereof, that we hope to test based on the field result:

- the more successful the material substitution, the higher the level of capacity utilization (R_1)
- material sourcing should promote technology development (the field result will reveal the magnitude of such development/change) (R_2)
- the greater the resulting technology development, the higher the level of capacity utilization (R_3)
- the more effective the change resulting from material sourcing in terms of participation, education etc., greater would be the success of materials sourcing policy (R_4)
- the more favourable the external environment, the more successful the materials policy (R_5)
- firm characteristics will greatly influence technology development (R_6)
- the external environment determines to a large extent existence and retardative effects of encumbrances (R_7)
- effective change management can produce favourable external environment generally but particularly for a given policy (R_8)
- effective change management will minimize and can, indeed, eliminate the negative effect of encumbrances.

The above are broad hypotheses in that some of them incorporate other sub-hypotheses. For example for R_6 selected firm characteristics will each be tested for the effect on technology development. The same is true of R_5 for which selected components of the external environment will each be used for testing the hypothesis therein. Where quantification poses a problem for hypothesis testing, we may for this study, simply *classify* firms on the basis of kind of response such as positive, negative, none, for such components as technology development. Other variables may be scored in terms of high, low or medium for the classification exercise.

Methodology

(a) Objectives and Tasks

The research methods derive from the primary objectives of the study and the major tasks for achieving these objectives. The data gathering methods flow logically from the tasks. The major objectives include the following:

- identify and appraise the policies that have been used to induce local sourcing of raw materials by the manufacturing sector;
- determine the impact of such policies on the industrial sector;
- evaluate whether, and the extent to which, policy-induced local sources of raw materials has been made possible by technology accumulation;
- identify the different types of technology accumulation associated with local sourcing of raw materials; and
- evaluate the role of local sourcing of raw materials as a factor influencing capacity utilization in Nigerian industries.

The above objectives have a number of sub-objectives that are derivable from them including:

- assisting in answering questions related to the appropriateness, usefulness and effectiveness of policy response;
- isolating the major factors explaining the extent of local sourcing of raw materials;
- identification of the main lessons for policy-making and implementation; and
- determining the role and significance of local sourcing of raw materials in boosting capacity utilization.

(b) Data Gathering Methods

Given the variety of the major tasks, a number of data gathering methods were employed including:

- desk study
- brain-storming sessions
- field work to cover:
  - professional associations within the brewing industry;
  - selected brewing firms;
  - relevant government ministries;
  - selected research institutes;
  - RMRDC.

The desk research involved a thorough search for relevant documents and information. Through this, we were able to identify sources of data and information relating to the history and development of the brewery industry in Nigeria, highlighting the various changes that had taken places. It was also possible to identify the sources of information on the effect of both government and company policies on the substitution of local raw materials. Similarly, we were able to identify sources of

information on the implication of these policies on the performance of various companies within the industry and the survival strategies of the companies. For the field work, three methods were employed:

- visit to elicit positive response
- preliminary visit to selected breweries
- survey of:
  * breweries
  * government ministries and agencies
  * research institutes

Visits were made to elicit positive response to our questionnaires and further indepth interviews were conducted at the secretariat of the brewery sub-group of the Manufacturers Association of Nigeria (MAN). The visit also made it possible to access the list of members in the industry. This provided an insight into the evolution of the industry over the last decade, bringing out members that are still surviving and those who have either been merged or acquired by bigger companies. Visits were made to selected breweries to have a broad overview of their operations and collect preliminary data and information on their activities.

For the full survey of selected breweries, research institutes and government ministries and agencies, three types of structured questionnaires were designed and were administered.
The questionnaire for government ministries focused on the management of policy. The following four government ministries were selected for interview:

- The Federal Ministry of Industries
- The Federal Ministry of National Planning
- The Federal Ministry of Science and Technology
- The Federal Ministry of Finance

The research institutes were selected for information on technology development. The following three institutes were selected:

- Federal Institute of Industrial Research, Oshodi (FIIRO)
- Project Development Institute (PRODA)
- Institute of Agriculture Research (Zaria or Ibadan)

Two levels of interviews were planned for the breweries. At the first level, all the functioning breweries were to be interviewed. The plan was to distribute the questionnaires during one of the meetings of the sub-group. At the second level, we intended to have more indepth interview with a small number of the breweries selected after the analysis of the questionnaires. We intended to select at least a brewery from the following categories:

- the leaders in the industry - Nigeria Breweries Plc and/or Guinness Plc
- the moderately sized breweries such as International Brewery Ltd., Ilesa and/or Premier Brewery, Onitsha
- those not performing well, e.g. Standard Brewery, Ibadan or Associated Brewery.

Research Constraints

Three sets of questionnaires were prepared for the breweries as individual firms and government agencies, ministries and three research institutes.

While the research institutes were generally well disposed to answering the questions, this was not the case with the breweries. Initially the research team did approach the Manufacturers Association of Nigeria (MAN) and had fruitful discussion with the Director-General. The Director-General introduced the researchers to the Breweries Manufacturing sub-group. It turned out that the rivalrous relationship between the firms would make cooperation concerning this research almost impossible. Our initial proposition to treat the questionnaire jointly, was accepted but later rejected. In the end, we had to revert to the option of individual company visits, an exacting and difficult exercise. We had to employ extant goodwill and all manner of clandestine means to obtain information.

As for the government ministries and agencies, only a few of these on our initial list were directly or remotely concerned with the substitution exercise. The National Planning Commission, Federal Ministry of Finance, claimed not to have had input into the exercise. All the listed agencies were visited but to our surprise, only the Federal Ministry of Science and Technology and some of its agencies, were involved. In short, the real actions that brought about the substitution was at the level of the companies and government agencies.

Chapter Five

Analysis of Firm Responses

The empirical component of this study explores the relationships hypothesized in the conceptual framework presented earlier. Before the main findings are analyzed, however, it is useful to describe the data and summarize the main questions that guided their collection.

The sources of data used in the study are primary and secondary. Questionnaires were distributed to 12 firms, to obtain data relating to issues of interest in the brewing industry from six - two market leaders, two moderately-sized breweries and those not performing well. Secondary source of data was used primarily to complement primary sources especially in areas where there were insufficient primary data. The primary data were cross-sectional, covering the six breweries. Annual reports and statement of accounts of relevant firms were used as secondary sources to obtain data on impact receiving variables. Data were collected and analyzed in respect of Nigerian Breweries Plc, Guinness Nigeria Plc, Sona Breweries Plc, Consolidated Breweries Plc, Vitamalt Plc and Standard Breweries Plc. For the purpose of confidentiality, these companies have been represented by A, B to F, with the alphabetical order not corresponding to the arrangement of company names. Questions that were asked in the questionnaire related to pre-policy state of affairs of relevant firms. For instance, ownership structure, pre- and post-policy sources of most important materials, foreign relationship of firms as well as questions bothering on the performance of firms are addressed in the questionnaire. Also, government agencies and local research institutions were covered in the attempt to address some issues relating to policy formulation and implementation.

Analysis of Firm Responses

The local sourcing of raw materials policy induced different responses, according to empirical findings. These responses are examined within expectations of the conceptual framework for this study.

(a) Materials Policy and Capacity Utilization

To start with, a re-statement of relevant hypothesis is in order. First, we hypothesized a linkage between materials policy and capacity utilization. More specifically, the more successful the material substitution, the higher the level of capacity utilization (R_1). Data available show that materials substitution policy has been successful as 100 percent substitution levels have been achieved for sorghum and maize by virtually all sample firms. While firms A, B and E achieved 100

percent substitution in sorghum earlier (1986, 1987 and 1987 respectively), firms C and F achieved it in 1990. For maize, all firms achieved 100 percent substitution level in the late 1980s, except firm C, which lagged behind, achieving the level in 1990 (*Table 5.2*). Also, data available on *Table 5.1* show that all sample firms source 100 percent of sorghum and maize locally. 50 percent of firms source sugar locally while the remaining 50 percent obtained the material from foreign sources. In addition, only Firm C has achieved some measure of local sourcing for hops (30 percent). The remaining 75 percent of firms still utilise hops from wholly foreign sources. These findings show that relying on domestic sources of local raw materials was imperatively brought about by the policy stance of the discontinuation of imported barley for brewing purposes, hence the resort to local supply base and the enhancement of local value added.

Data obtained on the capacity utilization of firms A and E show that capacity utilization has been on the decline. For instance, with an installed capacity of one million hectolitres for Firm A, only 45 percent and 30 percent level were achieved respectively in 1991, 1992 and 1993. For Firm E which has 750,000 hectolitres as installed capacity, capacity utilization fell from 500,000 hectolitres in 1989 to 350,000 and 180,000 hectolitres in 1993 and 1994 *(Table 5.3)*. Therefore, empirical findings have rejected the R_1-relationship. The implication here is that another R-relationship, R_5, is proven to be true.

(b) External Environment and Materials Policy

R_5 postulates that the more favourable the external or economic environment, the more successful the materials policy. Given the acute economic depression in Nigeria, and with the adverse impacts of deregulation, devaluation, liberalization and privatization going on in the economy, the harsh economic environment brought about by these factors account more for the failure materials policy to transform into higher level of capacity utilization.

Table 5.1 Percentage (%) Sources of Raw Materials

Materials	Sorghum		Maize		Sugar		Hops	
	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign
A	100	-	100	-	100*	-	-	100
B	n.a	n.a	n.a	n.a	n.a	n.a	-	-
C	100	-	100	-	100	-	30	70
D	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
E	100	-	100	-	-	100	-	100
F	100	-	100	-	10	90	-	100
% of company in local sourcing	100	-	100	-	50	-	25	-
% of company in foreign sourcing	-	-	-	-	-	50	-	75

* Utilize yeast instead of sugar

n.a Did not provide percent source of materials

Source: Field survey

Table 5.2 Level of Subtitutions Achieved (%)

Company	Sorghum (%)	Year of subst.	Maize (%)	Year of subst.	Sugar (%	Year of subst.	Hops (%)	Year of subst.	Yeast %)	Year of subst.
A	100	1986	100	1986	-	-	-	-	-	-
B	100	1987	100	1987	n.a	n.a	n.a	n.a	-	-
C	100	1990	100	1990	100	no change	30	n.a	-	-
D	100	n.a	100	n.a	n.a	n.a	n.a	n.a	n.a	n.a
E	100	1987	100	1987	-	-	10	no subst.	-	no subst.
F	100	1990	100	1986	10	n.a	10	no subst.	-	-

Source: Field survey

(c) Materials Policy and Technology Development

A priori expectation established a strong linkage between materials policy and technology development. Materials policy should promote technology development (R_2). *Table 5.3* provides data on production line changes and modification induced by materials policy. While some firms established new production lines, some did not, preferring only substantial modification to existing production lines. 33.3 percent of sample firms established new production lines, while majority of them, 66.7 percent modified existing lines. Companies which establish new lines as well as modified existing ones constitute 33.3percent. Two firms, (E and F) established new lines and modified existing ones. Firms C and D only carried out modification on their existing production lines while Firms A and B neither established nor modified existing plants. Newly established lines by Firms E and F include malting sorghum lines and fermentation, sorghum supplementary unit, kettle filter and heater. Modified production lines include filter mesh, malt plant, brewing kettle, barley malt line and kettle filter among others.

Apart from production process changes proxied by production lines changes, other characteristics also signify different firm level responses to local sourcing of raw materials policy. These include the establishment of own agricultural farms, the use of contract farmers, establishment of hitherto non-existent departments (e.g. R&D) as well as new skills acquisition. These are depicted in *Tables 5.4* and *5.5*. From *Table 5.4*, source(s) of most important materials are indicated. Three of sample firms (i.e Firms B, C and D) obtain their materials from the open market only. One firm, Firm A, utilises own farm and open market while another, Firm F, makes use of own farm, contract farmers. Firm E alone obtains its materials from the three indicated sources i.e own farm, contract farmers and open market sources. Neither of them uses contract farmers alone nor own farm source alone. Moreover, none of the firms obtained its materials from a combination of open market and contract farmers alone.

Table 5.3: Production Process Changes

Company	Established New Production Lines	Modified Existing Production Line
A	None	None
B	None	None
C	None	Filtration machinery
D	None	The grist case
E	Sorghum supplementary units, kettle filter and heater	Barley malt line and kettle filter
F	Malting sorghum lines and fermentation	Filter mesh, malt plant and brewing kettle
% change of firms which established new line or modify	33.3%	66.7%
	66.7%	33.3%

Source: Field survey

Table 5.4: Source(s) of Most Important Materials

Source(s) Company	Own farm	Contract farmers	Open market
A	1	0	1
B	0	0	1
C	0	0	1
D	0	0	1
E	1	1	1
F	1	1	0

Key: 1 = Yes 0 = No
Source: Field survey

From *Table 5.5*, 50 percent of firms created new departments to cope with materials policy change. These are Firms D, E and F. All the firms retained existing departments. In a related issue, 66.7 percent of firms employed new skills to cope with policy change. These include C, D, E and F. Nearly all, 83.33 percent provided training (in-house and/or overseas) for existing skills in their respective firms.

Table 5.5 Creation of New Departments and Employment of Newskills

Measures company	Create new departments	Close existing departments	Employ new skills	Training of existing skills
A	0	0	0	1
B	0	0	0	n.a
C	0	0	1	1
D	1	0	1	1
E	1	0	1	1
F	1	0	1	1
Create new department %	50	-	-	-
Retained existing department %	-	100	-	-
Employ new skills%	-	-	66.7	-
Train existing skills %	-	-	-	83.33

Key: 1 = Yes 0 = No
Source: Field survey

As a result of production process changes and use of local raw materials, information was obtained to evaluate the changes in quality, taste, colour and prices of beer produced and sold. According to data on *Table 5.6*, 50percent of customers like the quality of beer produced from local materials, 33.3percent of them do not like the quality while only 16.7 percent are indifferent to pre- and post-local materials use quality. Also, half of customers provided information that the beer taste is alright and a third are indifferent. Only 16.7percent think that the tastes are not so good as when wholly imported materials were used. Majority of customers, 83.3percent still think that beer colour and prices are in order.

Table 5.6: Consumer Information Feedback

Company	Beer quality	Beer taste	Beer colour	Beer prices	Problem area for company
A	_	0	+	+	Quality
B*	+	+	+	+	None
C	0	+	+	+	None
D	+	_	+	+	Taste
E	+	+	_	n.a	Colour
F	_	0	+	+	Quality
%like very much	50	50	83.3	83.3	_
% do not like	33.3	16.7	16.7	_	_
% indifference	16.7	33.3	_	_	_

Key: (+) = like very much; (-) = do not like; (0) = indifferent; (*) = Quality, Taste, Colour and Price of Malt Drink

Source: Field survey

In view of the responses of firms relating to materials policy change through the establishment of new or modified production processes, creation of new departments and acquisition of new skills, the conclusion can be drawn that the effect of materials policy change was strong on technology development and technological capability.

Thus, materials policy, according to empirical evidence, has brought about substantial technology development to the brewing industry.

(d) Technology Development and Capacity Utilization

The greater the resulting technology development, the higher the level of capacity utilization (R_3). The impact of local sourcing of raw materials policy, though having induced considerable technology accumulation, did not seem to have been brought out in the industrial sector, as capacity utilization has successively fallen *(Table 5.3 and 5.7)*. Though data showed substantial new production lines

establishment and old lines modification, capacity utilization fell consecutively from 45 percent level in 1991 to 35 percent and 30 percent levels respectively in 1992 and 1993 for Firm A. In addition, Firm E experienced fall in capacity utilization from 500,000 hectolitres in 1989 to 350,000 hectolitres in 1993 and 180,000 hectolitres in 1994. Therefore, the role of local sourcing of raw materials policy in engendering technology development was not carried through to increased capacity utilization. Empirically then, technology development did not induce increased capacity utilization. The reason for the absence of this linkage was enumerated in the R_5 relationship, as the unfavourable economic climate existing in the overall economy adversely impacted on firm level capacity to utilize effectively and optimally the resources available to it.

Table 5.7: Capacity Utilization for Selected Years in Hectolitres

Year	Firm A	Firm E
Installed capacity	1,000,000	750,000
1982	n.a	750,000
1989	n.a	500,000
1991	450,000	n.a
1992	350,000	n.a
1993	300,000	350,000
1994	n.a	180,000

Source: Field survey

(e) Change Management and Materials Policy

The hypothesis linking these variables states that the more effective the change resulting from materials sourcing in terms of participation, education etc., greater would be the success of materials sourcing policy, R_4.

The concept expressed in this linkage derives from the effect which participation, education, etc. should have on the success of materials policy. In effect, the expectation consists, in the high level, efforts to persuade firm level interests to appreciate the long run benefits of local sourcing of materials, as against unavoidable short run costs. Ordinarily, given the uncertainty and instability of economic expectations vis-a-viz actualization by firm level interests, and the resulting inertia to change emanating therefrom, firm level interests tended to heavily discount future long run benefits, and to this extent, perceived disparencies exist regarding short run cost and long benefits. Rationality pre-supposes that properly weighed, maximization of short run benefits is the optimal option for firms.

Available data did not indicate any attempt to fully involve private sector interests in the implementation of the materials policy. Data also showed the involvement of few government agencies (e.g.

National Planning Commission and Nigeria Standard Organization) in the policy management, limiting efforts to media promotion and campaigns, and coercive economic measures (e.g ban on importation, etc.) rather that persuasion, education, participation, etc., of relevant interests. To the extent that effective change management was absent at the implementation stage, the materials policy recorded partial success. This result however has not diminished the potency of the hypothesis, only that empirically, proper change management has tended to be weak, and thus has adversely affected the success of the policy.

(f) Technology Development and Firm Characteristics

The expectation here is that firm characteristics will greately influence technology development (R_6). The evidence from the study is that both variables tend to move in opposite direction in some cases, and directly in others, and thus is inconclusive.

Tables 5.8, 5.9a-5.9d, and *5.10* show firm characteristics of ownership pattern, foreign assistance, type of foreign relationship, type of foreign technical support, foreign technical staff assistance, and relationship with local research and development institutions. Firm E and F have all the requisite foreign administrative and technical support, including that of local research and development institutions, and thus have very strong foreign technical relationship. They also possess an ownership structure that is more foreign than say, Firm C, which also has very strong foreign technical relationship. Therefore, on the one hand, we have a strong foreign technical relationship with strong foreign ownership (Firm E and F), and on the other, a strong foreign technical relationship with weak foreign ownership (Firm C).

After policy change, Firm E and F established new production lines as well as modified existing ones while Firm C only modified its existing production lines. Furthermore, Firms C and F achieved 100 percent subsitution level in sorghum in the same year (1990) while Firm E had done the same in 1987 *(Table 5.1).* Similarly, Firms E and F achieved 100 percent maize substitution respectively in 1987 and 1986 while Firm C achieved the level in 1990. Therefore, a situation exists where more 'foreignness' which is perceived to create encumbrances to policy and hence detrimental to the speed of technology development is not borne out by facts. Another situation also exists where more 'Nigerianness' which is perceived to posess less encumbrances to policy implementation and hasten the pace of technology development is not also borne out by available facts. Thus, though firm characteristics is perceived to influence technology development, the establishment of direction of causality is inconclusive in this study.

Table 5.8: Ownership Pattern (%)

Company	Nigerian shareholding	Foreign shareholding
A	n.a	n.a
B	n.a	n.a
C	78	22
D	60	40
E	60	40
F	60	40

Source: Field survey

Table 5.9a: Foreign Assisstance

Company	Technical partner	Type of relationship	Type of Tech. assistance
A	None	None	None
B	Formerly XYZ.Now none	Use of brand names	None
C	Y Ltd, Europe	Equity participation Brand names Technical support	* Spares and components * R&D for new processes and production * Plant refurbishment * Major annual maintenance * Raw materials
D	X of D, Europe	Use of brand names	* Spares and components * Plant refurbishment * Provision of yeast
E	IB ofB, Europe	Equity participation Brand names Technical support	* Spares and components * R&D for new proceses and production * Plant refurbishment * Major annual maintenance * Raw materials
F	HH, Europe	Equity participation	* Spares and components * R&D for new proceses and production * Plant refurbishment * Major annual maintenance * Raw materials

Source: Field survey

N.B. Real Names of technical partners have been coded to maintain confidentiality

Table 5.9b: Type of Relationship

Company	Equity participation	Use of brand names	Technical support	Total
A	0	0	0	0
B	0	1	0	1
C	1	1	1	3
D	0	1	1	2
E	1	1	1	3
F	1	0	1	2

Key:1 = Yes; 0 = No; Total column: 0 = Very weak; 1 = weak; 2: = Strong; 3 = Very strong
Source: Field survey

Table 5.9c: Type of Technical Assistance

Company	Spare parts and components	R&D for new process and production	Plant refurbishment	Major annual maintenance	Raw materials	Total
A	0	0	0	0	0	0
B	0	0	0	0	0	0
C	1	1	1	1	1	5
D	1	0	1	0	0	2
E	1	1	1	1	1	5
F	1	1	1	1	1	5

Key:1 = Yes; 0 = No; Classification onTotal column: 0 = Very weak; 1 = weak; 2: = Strong; 5 = Very strong

Table 5.9d: Foreign Technical Staff Assistance

Company	Type of assistance	Number of staff
A	None	None
B	None	None
C	Engineers	6
D	Engineers and technicians	5
E	Technical & production manager	5
F	Product developers	3

Source: Field survey

Table 5.10: Relationship with Local Research and Development Institutions

Company	R&D institutions	Nature of linkage	Incentive behind linkage
A	None	None	None
B	None	None	None
C	None	None	None
D	None	None	None
E	Ministryof Science and Technology	Policy negotiation, pilot scale	
		New product development	None
F	Federal institute of industrial research	New product development	New product development

Source: Field survey

Impact of Local Sourcing of Raw Materials

In this section, analyses of the effect of materials policy change on product range, production costs, turnover, value added and capital employed are provided. Owing to the concentration which has occurred in the brewing industry, two firms, Firms E and F, will be used in the analyses concerning turnover, value added and capital employed. The rest of the analyses will bother on all sample firms.

(a) Turnover, Value Added and Capital Employed

These variables are used as proxies for capacity utilization, owing to incomprehensive data provided by respondent regarding capacity utilization.

The nominal and real values of turnover, value added and capital employed are provided in *Table 5.11 to 5.16* for both companies, the nominal values having been deflated by the composite consumer price index to obtain their real values. 1988 is the base year in the analyses as it corresponds to the year of total import restriction of raw materials for the brewing industry. The period of analyses is 1986 to 1994.

Firm F experienced an unstable growth trend in its turnover over the years *(Table 5.11)*. It grew by 33 percent in 1987, fell by three percent in 1988 and rose moderately by five percent in 1989. It reached a peak in 1994 at 57 percent growth rate. Between 1990 and 1992 however, growth was stable around an average of 36 percent. On the average, growth rate was approximately 19 years over eight year period (i.e. 1986-1994). The average growth rate since the outright ban (1988) on imported materials was 18 percent. The slight difference (one percent) in the average growth rate

could be the result of the raw materials stocking policy of the firm which largely derived from the expectation of the ban, and hence has stored substantial imported materials to even out the adverse effect of total import restriction on production and sales.

Table 5.11: Turnover of Firm F

Year	N Mn nominal value	N Mn real value	Index of real value 1988 = 100	Cummulative growth rate (%)	(%) yearly growth
1986	205	195	69	-31	
1987	341	294	103	3	33
1988	515	284	100	0	-3
1989	811	297	105	5	5
1990	1180	403	111	41	36
1991	1709	517	182	82	41
1992	2899	606	213	113	31
1993	4992	604	213	113	0
1994	7143	767	270	170	57

Source: Computed from annual reports and financial statement of Firm F

The data on value added on *Table 5.12* present similar unstable yearly growth. It grew by 15 percent, one percent and 17 percent respectively in 1987, 1988 and 1989. The year 1990, 1991 and 1992 also witnessed some relatively stable growth, 31 percent, 47 percent and 30 percent respectively, after which it fell to 16 percent 1993 and peaked at 58 percent the following year.

Table 5.12: Value added of Firm F

Year	N Mn nominal value	NMn real value	Index of real value 1988 = 100	Cummulative growth rate (%)	(%) yearly growth
1986	146	139	84	-16	15
1987	191	164	99	-1	1
1988	299	165	100	0	17
1989	526	193	117	17	17
1990	716	244	148	48	31
1991	1061	321	195	95	47
1992	1777	372	225	125	30
1993	3285	397	241	141	16
1994	4585	493	299	191	58

Source: Computed from annual reports and financial statement of Firm F.

Capital employed is a measure of the total investment in a company. From *Table 5.13,* the growth rate of capital employed reached a peak in 1990 at 108 percent and was at its lowest in 1988 at -45 percent. The growth was relatively not too divergent between 1989 and 1991 when the growth rates were 76 percent, 108 percent and 48 percent respectively in 1989, 1990 and 1991. One striking feature common to the three variables i.e. turnover, value added and capital employed, is that between 1989 and 1992 they exhibited relative stability, probably denoting the adjustment effects of change in materials policy of 1988. The relative stability would therefore indicate an adjustment tendency to the shock of policy shift.

Table 5.13: Capital employed of Firm F

Year	N Mn nominal value	NMn real value	Index of real value 1988 = 100	Cummulative growth rate (%)	(%) yearly growth
1986	173	164	144	44	
1987	192	165	145	45	1
1988	208	114	100	0	-45
1989	548	201	176	76	76
1990	952	324	284	184	108
1991	1249	378	332	232	48
1992	1839	384	337	237	5
1993	2817	341	299	199	-38
1994	3501	376	330	230	31

Source: Computed from annual reports and financial statement of Firm F

The growth rate of the real value of turnover of Firm E exhibited successive increases in the three years following the change in raw materials policy *(Table 5.14).* Though Firm E has achieved 100 percent substitution for maize and sorghum in 1987, the effect did not manifest until 1989 when turnover grew moderately by five percent, then increased phenomenally by 25 percent in 1990 and peaked in 1991 at 43 percent. Considering all the years together, the growth trend was unstable, reaching negative values in 1988 and 1992 respectively.

Value added also showed increases in the four years following the year of imported materials ban *(Table 5.15).* It reached its peak in 1992 at 166 percent and its trough in 1993 at - 160 percent. In between these extreme rates , average growth rates range between 10 percent and 31 percent.

Table 5.14: Turnover of Firm E

Year	N Mn nominal value	NMn real value	Index of real value 1988 = 100	Cumulative growth rate (%)	(%) yearly growth
1986	268	254	97	-13	
1987	308	265	101	1	14
1988	474	262	100	0	-1
1989	751	275	105	5	5
1990	1005	343	131	31	26
1991	1510	456	174	74	43
1992	2155	451	172	72	-2
1993	3921	474	181	81	9
1994	5202	559	213	113	32

Source: Computed from annual reports and financial statement of Firm E

Table 5.15: Value added of Firm E

Year	N Mn Nominal Value	N Mn Real Value	Index of Real Value 1988=100	Cummulative Growth rate(%)	(%) Yearly growth
1986	190	180	138	38	
1987	156	134	103	3	-35
1988	236	130	100	0	-3
1989	389	143	110	10	10
1990	535	183	141	41	31
1991	730	221	170	70	29
1992	1042	438	336	236	166
1993	1891	229	176	76	-160
1994	2390	257	198	98	22

Source: Computed from annual reports and financial statement of Firm E

The growth pattern of capital employed by Firm E is similar to the previous two: unstable and fairly divergent, osciallating between more negative and positive rates *(Table 5.16).* It reached the highest growth rate of 154 percent in 1993 and lowest of - 38 percent in 1988. It exhibited positive growth rates in the two years immediately following the material policy shift, suggesting increased requirement of capital to implement firm level policy response.

Differential impacts of individual company's dividend policy would confuse any meaningful interpretation of the effect which materials policy would have on capital employed. Ideally, capital employed should grow in the years following materials policy change (i.e. if unexpected) and taper off, ceteris paribus, in later years when liberal dividend policy would be undertaken. The behaviour of capital employed growth in Firm E seems to confirm this hypothesis but because the firm achieved 100 percent substitution prior to policy (i.e. policy is not unexpected), no meangful conclusion can be made in this respect.

As a concluding remark, both companies' growths of turnover, value added and capital employed appear to grow at relatively stable increases within three to four years (i.e. 1989 - 1992) of the local sourcing of raw material policy.

Table 5.16: Capital employed of Firm E

Year	N Mn Nominal Value	N Mn Real Value	Index of Real Value 1988=100	Cummulative Growth rate(%)	(%) Yearly growth
1986	194	184	142	42	
1987	208	179	138	38	-4
1988	237	130	100	0	-38
1989	546	200	154	54	54
1990	617	210	162	62	8
1991	687	208	160	60	-2
1992	913	191	147	47	-13
1993	3232	391	301	201	154
1994	3535	380	292	192	-9

Source: Computed from annual reports and financial statement of Firm E

(b) Product Range

The changes in the range of products of sample brewing firms are shown in*Table 5.17.*Nigerian Breweries and Guinness have added two new products each to their range. These are Rex Lager beer and Amstel Malta in the case of Nigerian Breweries, and Satzenbrau Lager beer and Malta Guinness. Consolidated and Standard Breweries maintained their pre-materials policy product range. Sona Breweries and Vitamalt have respectively lost one and two lager beer after policy change.

Table 5.17: Range of products

Company	Before policy	After policy	Difference
Nigerian Breweries Plc	Star lager Gulder lager Maltina	Star lager Gulder lager Rex lager Maltina Amstel Malta	Rex lager Amstel Malta (+2)
Guiness Nigeria Plc	Stout Harper lager Merit lager	Star lager Harp lager Satzenbrau Malta Guiness Merit lager	Satzenbrau Malta Guiness (+2)
Sona Breweries Plc	Gold lager Tusk lager Wilfork Dark Ale Maltonic	Tusk lager Wilfort Maltonic	Gold lager (-1)
Consolidated Breweries Plc	"33" lager beer Hi -malt	"33" lager Hi - malt	(0)
Vitamalt Breweries Plc	Top lager Baron lager Vitamalt	Vitamalt	Top lager Baron lager (-2)
Standard Breweries Plc	Club lager Club Malter	Club lager Club lager	(0)

Source: Field survey

(c) Costs of Production

Table 5.18 depicts the production cost effect of change in production processes induced by materials policy change. 66.7 percent of firms currently experience higher costs of production as a result of the substitution exercise, 40 percent of which carry 20 percent - 30 percent additional cost. Only one firm, Firm A reported a lowering of production costs, with the reduction being less than 10 percent. Given that production process change required the establishment of new facilities such as new departments, own farms, new production lines, employment of new skills as well as retraining of existing skills, the higher production costs are explained by these factors.

Table 5.18: Production costs

Company	Production cost changes	Percentage change (%)
A	Lower	Less than 10
B	n.a	n.a
C	Higher	30
D	Higher	20 - 30
E	Higher	20 -30
F	Higher	10 -20

Source: Field survey

Some Policy Implications

This study has attempted to evaluate the responses of the Nigerian Brewing Industry to the policy of local sourcing of raw materials. It has also examined the way the policy was managed and the impact of policy on the brewing industry. Finally, in the process, it has uncovered variables or factors which confound the direct relationship between policy and responses and between policy and performance. There are important policy implications that are pertinent in each of these areas.

The policy to promote local sourcing of key raw materials in the brewing industry was accomplished through the banning of the importation of these inputs. Evidence presented in this study revealed that the policy succeeded broadly in achieving its primary objectives. The wholesale adoption and acceptance of the policy was predicated on the number of favourable features and characteristics of policy itself. In other words, the firms found it largely in their own interest to adopt the policy because of the cost, convenience and foreign exchange savings arising from it. Also, the policy provided sufficient lead-time for many of the firms to reorganize many of their production processes in accordance with the requirement of the use of the locally sourced materials. In short, the consonance between government's and firms' objectives assured the success of the materials policy. The main lesson here is that the policy which takes explicit account of the interests of those it affects is more likely to elicit the expected range of responses.

The policy itself resulted from a careful determination of what is feasible technologically. Research studies, production using raw materials in a pilot scheme, planting of grains (e.g. wheat, etc.), all were done to confirm the feasibility of the local sourcing of raw materials years before the imposition of the ban and hence of the local sourcing of raw materials policy. The logical planning and design of this policy as well as the consultation between government and the affected sectors of the private promoted a fuller understanding of the limit of technical feasibility, the implications for technology acquisition, the availability of local substitute and the financial implications of the policy prior to its implementation. In any case the thorough understanding of the technical and conceptual process on the government side made it difficult for government to succumb to pressure for a reversal of that policy. In all, it seems clear that the process of designing and

managing this policy exhibited a number of strong features that enhanced its success.

This policy was implemented at a very difficult time of the Nigerian economy. Although, the firms upon which this policy directly impacted responded eagerly and in the appropriate direction the generally depressed condition of the Nigerian economy led to a number of unexpected results. For instance, a 'shake-out' occurred in the industry: the number of breweries fell drastically from around 50 to less than 20 while capacity utilization among the surviving breweries also declined. Perhaps, it is conjectural to suggest that the survivors remaining is because of the policy. In other words, it would be incorrect to ascribe this undesirable result to the policy itself. We do know that the share prices of these companies are doing well on the stock market indicating that the companies are individually liquid and profitable. For instance, the share prices of one of the firms rose from 380 kobo in January 1992 to 497 kobo in January 1994, while for another, the share prices rose from 578 kobo in January 1992 to 890 kobo in 1994. An important policy lesson may be that major policy changes are more likely to achieve their objectives without some initial negative effects if they were implemented in more accommodating and political environment.

Chapter Six

Raw Materials Sourcing Policy and Change Management

Introduction

This is a preliminary assessment of RMRDC on its local raw materials sourcing and technological efforts, an appraisal based on certain fundamental data derived largely from secondary sources. Against this background, it is also necessary to place the objectives, strategies and performance of the RMRDC in proper perspective using our model developed in*Figure 4.4*. In doing this, we hasten to add that all the problem variables less the firm-level characteristics are deemed relevant, that is, raw materials sourcing policy, technological development, capacity utilization, encumbrances, change management and economic environment. It is recognized that encumbrances embody hidden actors whose differing interests and objectives may be at variance with those of the policy initiators and implementors. In the same context, the economic environment in existence relates to the availability of the macro- and micro-level incentives and the totality of the accommodating environment. The component of the model which is thought most relevant to RMRDC and in which it is perceived as the most critical single agent of change concerns the change management variable. In this case, therefore, RMRDC is conceived as the prime agent of transformational leadership and a change manager whose basic objective functions should involve activities spanning the domain of social engineering, inclusive of the techno-economic function.

The natural point of departure is the presentation of the mandates, action programmes and activities of the RMRDC.

Mandates

Raw Materials Research and Development Council (RMRDC) is a Nigerian parastatal created under Decree 39 of 1987. Its mandates are nine in number, namely, to:

- draw up policy guidelines and action programmes on raw materials acquisition, explotation and development;
- review from time to time raw materials resources availability and utilization, with a view to advising the Federal Military Government on the strategic implications of depletion, conservation or stock-piling of such resources;
- advise on adaptation of machinery and processes for raw materials utilization;
- encourage publicity of research findings and other information relevant to local sourcing of

industries;
- encourage growth of in-plant research and development capabilities;
- advise on and devise awards or systems for industries that achieve any breakthrough or make innovations and inventions;
- organize workshops, symposia and seminars designed to enlighten people on new developments and solutions discovered from time to time;
- consider and advise on special research grants for specific objectives, and;
- consider and advise on any other issue capable of enhancing the objectives of the council.

From the mandates enunciated above, it can be deduced that the Nigerian government views the persistently low local raw materials utilization by industries as the national problem to be tackled. Ignoring the overlap in Mandates four and seven, the catch-all Mandate nine allows RMRDC some latitude to seek and gain government support along new lines as it gets increasingly to have the feel for issues involved in the problem variable.

Programmes

With the mandate constantly in view, the following policy initiatives, action programmes and projects have been derived (from techno-economic surveys carried out by some ten or so multi-disciplinary task forces commissioned by RMRDC) and are in various stages of actualization:

(a) stock-taking of available raw materials and determining scale and scope of their use by the manufacturing sector;
(b) enumerating present industries' raw material and technology needs where they are sourced and the extent to which they can be improved upon, copied or modified cheaply and efficaciously;
(c) inducting new machines, methods and commercialisable products that will tap local raw materials;
(d) inaugurating catalytic model factory projects and pilot plants possessing demonstrative value in various parts of the country-these model factories are for raw materials processing and have the virtue of being largely designed and fabricated by local engineering and technological talents;
(e) providing venture capital for turning endogenous processes and prototype technologies into pecuniary and gainful enterprises that rely increasingly on local content and value added manufacturing and;
(f) evolving inter-organizational and multilateral collaborative alliances and planetary networking agreements for transfer, elaboration and advancement of technology as well as for carrying out consultancy services, including plant installation, trouble shooting, etc.

Activities

In assessing the role of RMRDC in the fostering of endogenous know-how related to the methods and techniques of transforming locally-obtained mineral and agro-based raw materials into industrial inputs and finished products, one has got to see and think through its activities to date.

On the mineral side, for example, RMRDC has audited equipment fabricators and identified a number of machinery items like hammer mills for size minification, mixers for liquid blending, blenders for solid mixing, tanks of various forms and shapes and varieties, dryers and ovens and kilns for drying and callacination, furnaces for melting of non-ferrous metals and for cast iron, silos for bulk storage, extruders, semi automatic weighing and packaging equipment, mechanical and hydraulic press for dewatering, cyclones and hydrocyclones for wet and dry classification.

The snag in most of all this is that local manufacture of complete plants for processing mineral raw materials is found to be in prototype stages only. This is because equipment fabricators are constrained by:

- Scarcity of appropriate materials of construction, and
- Low level of commercialization of most of the locally fabricated machinery and equipment items resulting from their short service life, unreliability, lack of standardization, poor engineering design, inappropriate materials in terms of efficiency and output capacity compared to their imported machinery counterparts.

So, while the potential ability for configuring complete mineral plants exists among some known equipment fabricators, what obtains in the majority of cases and in reality for now is specialized production of specific items of equipment.

As for the side of agro-based raw materials, the story is not much different. Again, most of the manufacturing activities are concentrated on simple single items such as mills, grinding machines, manually operated press for dewatering and oil extraction, crackers, grater and shelter. In other words, a preponderance of the total equipment in use is imported - distillation equipment, heat exchanges, mills, to name just a few.

Outcropping from the various techno-economic surveys already referred to is the adoption of a number of research and development programmes and catalytic projects in the quest for endogenous technology in identifiable priority areas such as the production of refractor bricks, sweeteners, high grade titanium dioxide, enzymes, foundary crucibles, kenaf pulping for paper making and extraction of oleo resin from ginger. Other strategic projects of research and development interest to RMRDC are starch derivatives, lead and zinc smelting, seed multiplication, agro-minerals fertilizers, and poultry feed formulations. But the high financial outlays required for setting up these projects have allegedly limited the success ratio.

Nevertheless, as far back as 1983, RMRDC had begun to engage in joint venture projects, to host investment fora, to set up a risk fund scheme as well as a mineral development fund to finance local resource-based long-gestation-period investments. For example, the Nigeria (brick) Refractories Limited is a joint venture company between Ajaokuta Steel Company Limited, Trad Stamps Limited and RMRDC.

There are at least five model factories currently being financed by RMRDC aimed at catalyzing the establishment of such factories in Nigeria by prospective entrepreneurs, viz: soda ash processing, talc processing, phosphate beneficiation, pharmaceutical grade kaolin, and cocoa processing. Also pilot plants being supported by RMRDC include production of amylase enzyme, castor oil, dye stuff, sorghum malt, science and laboratory chemicals and reagents, ginger processing.
Besides, it tries to give a fillip to local design and fabriacation of critical process equipment and their components as a way of promoting local engineering capability. Such fabrications include coal briquetting machine, full fat soya extruder, ginger slicing machine, imported hammer and ball mills.

Be it remembered that RMRDC also concerns itself with current level of activities and developments taking place in the utilization of new and advanced materials in the country and beyond, particularly the threats and opportunities embedded in their emergence. For instance, engineering ceramics and plastics are feared to be capable of rendering obsolete or reducing the importance of conventional materials like iron and steel in equipment manufacturing industry. In this wise, RMRDC tries to explore areas of complementarity where conventional materials may serve as feedstock for new and advanced materials.

Assessment

In making a critique of the RMRDC, two approaches were adopted: appraising RMRDC programmes and activities against its mandates is one; the second consists of assessing its programmes and activities vis-a-vis the theoretical model developed in*Figure 4.4.* The first level of assessment is based on *Figure 6.1.* Among its action programmes, there exists the preponderance of the development of new machines and process designs that will tap local raw materials. There also exists a large coverage in the area of making raw materials available for use and the determination of the scale and scope of use by the manufacturing sector. To a lesser extent, its activities cover enumeration of materials and technological requirements for industries; finance and inauguration of catalytic model factories; provision of venture capital; and collaboration for technological transfer and advancement. Support services are provided through consultancy, plant installation, trouble shooting and joint ventures. In effect most of the mandates have been covered leading to the ostensible conclusion that RMRDC has fared well in carrying out its statutorily assigned roles.

Table 6.1: RMRDC Mandates and Action Programmes

Programmes/ activities mandate	Stock-taking and scale of materials use	Enumera-tion of materials and tech. requirment	Develop-ment of new machines and process designs	Finance inaugura-tion of catytic model fatories	Venture capital provision	Collabo-ration for techno-logy transfer, advance ment	Consultancy services, plant installation, trouble shooting	Engage-ment in joint venture projects
Raw material acquisition, expolitation and development	X							
Raw materials availability and utilization	X	X						
Technical Adaptation			X	X				
Publicity of R&D				X				
In-house R&D encourage-ment			X					
Incentives					X			
Research grants			X					
Catch-all	X	X	X	X	X	X	X	X

Table 6.2: RMRDC Mandates and Problem Variables

Variable mandate	Raw materials sourcing	Technology development	Capacity utilization	Encumbrances	Economic Environment	Change management
Raw material acquisition, expolitation and development	X					
Raw materials availability and utilization	X		X			
Technical Adaptation		X				
Publicity of R&D						X
In-house R&D encourage-ment	X	X				
Incentives				X		
Research grants	X	X				
Catch-all	X	X	X	X		X

However, the width and depth of such activities reveal a different story altogether especially when cognisance is taken of the model with which an ideal relationship is posited. This is the second level of assessment mentioned earlier and is shown in *Figures 6.2* and *6.3.*

Table 6.3: RMRDC Programmes and Problem Variables

Variable mandate	Raw materials sourcing	Technology development	Capacity utilization	Encumbrances	Economic enviornment	Change
Stock taking and scale material use		X				
Enumeration of materials and technology requirement	X	X				
Developement of new machines and processes designs, etc.		X				
Finance and inauguration of catalytic model factories		X		X		
Venture capital provision				X		
Collaboration for technology trans fer advancement			X			
Consultancy services plant installation trouble shooting		X				
Engagement in venture projects				X		

Figure 6.2 It is clear that RMRDC's mandates cover all areas addressed by the problem variables except the economic environment, this probably being due to the exogeneity characteristic it possesses. It is also obvious that, given its primary area of jurisdiction that is, local raw materials sourcing, the Council is also mandated to play major and vital roles in engendering technology development and the breaking down of barriers induced by unwilling interests through incentives. The former is reflected in its function to advise on machinery adaptation possibilities and raw materials utilization enhancement, encouragement of in-house research and development and other issues which positively impact on the Council's objectives. In fact, this "catch-all" mandate is treated as being relevant to all the problem variables, since the possibility of overlap exists. The latter, that is, breaking down barriers to change, is expected to be achieved principally by its mandate on provision of incentives through devising awards for innovating and inventing firms. Only the requirement to regularly review raw materials availability and its utilization explicitly recognizes the need for industrial capacity utilization expansion. It is noteworthy here that the change management variable can only be related to the publicity of research and development mandate given to RMRDC. It may be embedded in the 'catch-all' mandate in which case an articulate and directional programme or activity towards the variable will be impossible, and of course will render its objective assessment a herculian task. Thus conspicuously, while raw materials sourcing and technology development are fully recognized by the core mandates, other problem variables i.e. capacity utilization, encumbrances and change management are presumed to possess less importance.

Against this backdrop, *Figure 6.3* attempts to relate various programmes and activities of the Council to date, to how it has fared in strengthening the variables. As expected, programmes and activities are skewed in the direction of materials sourcing and technological development, at least prima facie. Also revealed in the figure is the fact that none of the other variables has been expressly captured by the RMRDC's activities. What obtains is a tacit or hidden expectation, or at best an assumption that capacity utilization enhancement, alleviation of encumbrances, effective change management are being met by activities such as provision of venture capital, consultancy and plant installation services.

In effect, RMRDC's conduct has not been substantially in consonance with the relationships and linkages depicted in the model. From a critical review of its actions and programmes, some factors that are responsible for the non-consonance are identified as follows:

- objectives not properly defined to seek harmony amongst conflicting sub-objectives; e.g import substitution, self-reliance promotion, in raw materials area; and low cost locally developed and nurtured technology against high cost technology transffer, adaptation and advancement;
- too broad areas of activities;
- inadequate recognition of the country's stage of development;
- lack of sequential, result-based implementation of programmes.

These factors have separately and severally impacted negatively on the achievements of RMRDC, with the implication that most areas of its operations are yet to be completed. This is not to suggest that RMRDC has insurmountable shortcomings. What is being stressed is the need to rejuvenate its activities in the most desired direction for the most impact.

From these conclusions, it follows we must properly address the issue of change management. The most critical factor that needs recognition here is an articulate definition of the objective of change, at least prior to its effective management. In addition, recognition needs to be accorded to the existence of many stakeholders, some constraining, others strengthening, in the process of generating change. This implies, as well, that different layers or types of interests exists which will unavoidably lead to different individual objective which in turn mitigate the pacing of the change. Another dimension is that, temporally, the benefit-cost ratio of change is unequal among the stakeholders. This benefit-cost ratio may be very high in the long-term, depending on effective management, while may be for the short term, ambiguous, also depending on change management efforts.

Therefore, the change manager is the key to effectiveness and efficiency of policy response; as such he is the minimizer of resistance to change with respect to the various conflicting interests all in an effort to ensure that the short-term costs involved in the technological change associated with local sourcing policy is least. RMRDC, in this connection, is expected to be a change manager, to identify the hidden factors, initiate or create enabling environment for stakeholders and their participation. What was discovered is that the 'scientific' nature of RMRDC's organization limits its ability to conduct itself effectively as a change implementation management agent. More specifically, beyond the support services of Audit, Budget Administration, the essential focus was on agro-based, mineral-based, raw materials, and technology development. This make-up closely mirrors the Civil Service Ministry's pattern, clearly providing little modification regarding the special role of RMRDC as a major change agent. Quite often, structure determines strategy and process. Put equivalently, just as strategy should shape structure, so structure-organization, information systems, personnel systems and overall work environment-should shape strategy. RMRDC has not totally provided the social engineering component needed for raw materials policy impact. The use of seminars, workshops, and publicity helps if, and only if, the contents and themes constantly emphasize the need for change, how to cope with change-induced dislocations, the temporal benefits and cost ratios to the individual and the society, and also the intergenerational and environmental benefits of change. These are not possible if there is no organizational unit in charge.

Options

Undoubtedly, RMRDC has achieved a lot regarding its mandates. But this achievement can be improved upon especially in impact-yielding areas. For most impact, it must divest its interests in some of the demonstrative projects. It is suboptimal to be present in all activities e.g. venture capital, research grants, joint venture and simultaneously fulfil its pivotal mandates. Therefore, it should:

- concentrate on policies that will enhance its impact among the citizens e.g. in costs of production reduction, and lowering prices of locally produced goods, etc.
- consider credit guarantee schemes for pioneer entrepreneurs
- limit its joint-ventures to within a very short time-frame
- sequence its programmes and activities no matter how narrow such may appear
- consider the country's stage of development in technology issues. It is most rational to commence technology development at rudimentary level and seek further improvements later, rather than try to catch up overnight with the technologically advanced countries.
- reflect the need for social education and social engineering in a more fundamental sense.

Chapter Seven

Emerging Issues

Thus far, we have attempted to examine critically the various issues stimulated by local raw materials sourcing policy. Such issues include the presumption that local sourcing policy would on the one hand enhance capacity utilization and, on the other, stimulate technological development. As for technology, the conceptual disarray was streamlined to suit the scope of this study leading to the suggestion that the relationship existing among technology, technological capability and technological development can best be described in terms of stock, flow and change. These and many more factors highlighted in the course of this study have thrown up serious questions and issues requiring answers and more clarifications:

- What is the degree of success in the understanding and management of the interface between the two technological development paradigms i.e. state-led and market based? Have government and its agencies paid due attention to the dynamic processes through which policy changes affect firms such that negative responses are minimised and positive impact appropriately enhanced?
- How has the technological challenge posed by policy been handled? Aggressively? Lukewarm? or How?
- Has proper evaluation been made regarding effective control over market, strength and pattern of effective demand in the areas affected by policy? For instance, a large home market would be supportive and accommodating to policy change responses. Foreign-based market may be constraining to policy success.
- What factors are responsible for the choice of projects to be researched on or even embarked upon: What are the primary considerations in fashioning a relationship with ongoing or completed projects and indeed new project ideas?

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