

# Development and Change

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# **Acquisition of Foreign Technology: A Case Study of Modern Brewing in Nigeria**

**Edet B. Akpakpan**

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Nigeria, like most other less developed countries (LDCs), is characterized by a low level of technological capability. This generally shows in the country's inability to draw on local resources to meet the technological demands of modern production and in the consequent dependence on the rest of the world for technological requirements. In an effort to develop local technological capability, successive governments have sought to induce the proprietors of different modern technologies to transfer their technologies to the local economy. The hope was that the application of transferred technologies would, over time, enable Nigerians to acquire the relevant technical knowledge and skills.

This article looks at brewing technology, one of the many technologies which have been transferred to Nigeria, and examines the extent to which the beer brewing firms' operations have contributed to developing a local capability in modern brewing. It also considers the country's technological development in general. Section 1 discusses the importance of indigenous technological capability, while section 2 considers the process by which a foreign technology is acquired. Section 3 examines the extent to which imported brewing technology has been acquired by Nigeria. The final section considers the implications of the findings for the debate in the literature and for Nigeria's technological development.

## **1. THE IMPORTANCE OF INDIGENOUS TECHNOLOGICAL CAPABILITY**

From the point of view of development, indigenous capability in technological matters is important for two main reasons: (1) it gives a

country a high degree of control over its own development; and (2) it reduces the costs of development projects and thus helps to conserve resources for implementing a variety of needed projects.

A country's control over its own development means that it is able to determine the types of food its people eat and the types of materials used in producing them, the types of houses in which it shelters its people and the materials used in constructing them, the types of roads it builds and the inputs, including labour, that go into their construction, and a host of other activities affecting its development. Without a high level of technological capability, these will largely be determined from outside and a country in such a situation would be extremely insecure.

The point about reducing the costs of development projects derives from the many reported cases of exorbitant fees, royalties and commissions demanded of LDCs by developed country technology suppliers (evidence of this is provided in Vaitos 1971 and UNCTAD 1975). Such charges have, for the paying LDC economy as a whole, the effect of draining away much needed investment resources. For individual firms using the foreign technologies, the effect is one of increasing production costs, raising the prices of the output and making the products non-competitive in the world market. Together, these effects weaken the economy's long-term capacity for self-propelling development and explain the desire of most LDCs to develop indigenous capability in technology.

## **2. HOW A FOREIGN TECHNOLOGY IS ACQUIRED**

An industrial technology transferred from one country for operations in another is said to have been acquired by the recipient country only after it has been completely anchored. In the context of a single firm, for instance, such anchorage or implantation would mean that indigenous personnel employed in the firm are trained in the critical aspects of operating it, and let in on the secrets of the technology to such an extent that they are able to perform the relevant operations from start to finish without recourse to external assistance.

Anchoring technology is a crucial stage in the process of acquiring foreign technologies in the sense that if it does not occur, the economy concerned cannot be said to have really acquired the technology. Thus it is only when the transferred technology has been anchored that the

local economy can begin to experience improvements in its technical skills, production techniques and technological capability in general.<sup>1</sup>

### *Means of Anchoring Technology*

Since technology is essentially a matter of 'know-how' (which consists of knowledge and information), its transmission to a second party requires that the prospective user be trained by the transferor in the technical aspects of the technology in question. This point is made by Zevin, who argues that 'the transfer of technology and its adaptation to local conditions cannot be successful unless it is accompanied by the training of skilled manpower' (1978: 114). Training local workers is thus the key activity in the process of anchoring an imported technology, and for the LDCs this is particularly important in view of their generally poor system of technical and general education.

Three factors deserve particular attention in the issue of training local personnel for the purpose of anchoring imported technologies: the quality of the personnel selected for training, the extent of training and the content of training. Quality of personnel refers to the capacity of staff to assimilate the knowledge imparted and to be able to benefit from the ideas to which they are to be exposed. This capacity is, to some extent, indicated by the prospective trainees' previous training or education in general. What is meant here is that a prospective trainee who has had some form of technical education, for instance, stands a better chance of understanding and assimilating new technical skills than one who has no such background. Such previous education equips him with some basic 'know-why' in the relevant matters and thus enables him to assimilate the ideas better than someone who has not been so exposed previously. The extent of training refers to the number of persons receiving training. For a typical LDC, this will have to be large enough to compensate for the generally narrow scientific and technological infrastructure in such countries, if the transferred know-how is to produce the desired effect. As far as the content of training is concerned, within the context of this article, it relates to the nature and quality of what is passed on to the trainees — i.e. whether the vital aspects of the know-how are imparted. This is important because as will be seen shortly, the acquisition of an imported technology involves more than merely being able to operate it.

Activities aimed at adapting imported techniques to local conditions can in some way also lead to anchoring the technologies (or aspects of

them) in the local economy. For instance, where the economic conditions of the recipient economy necessitate scaling down imported techniques, the process of doing this could expose some aspects of the technical elements to a second party. Such exposure could lead to anchoring some aspects of the technology, depending on the extent to which qualified indigenous personnel participate in these activities. This means that the process of adapting imported technologies can only lead to anchorage where the economy already has available technically skilled manpower capable of taking part in the relevant activities.

Adaptation of industrial technologies usually takes three forms: the adaptation of products, of equipment and of processes. All these activities, together with the important one of training local personnel, enable an economy to acquire techniques and technologies imported into it. We shall therefore assess the performance of firms in the brewing industry in terms of each of these issues.

### 3. ANCHORING BREWING TECHNOLOGY IN NIGERIA

#### *The Brewing Industry: Some Background Information*

Beer brewing is one of the longest established industries in Nigeria. It was initiated not as part of a planned or conscious effort to develop the economy, but as part of the efforts of some foreign merchant firms to protect and promote their interests in the growing domestic market. This effort was induced by intense competition in the merchandise trade following the successful penetration of the market by new merchant firms (for details see Kilby 1969).

The first firm in the industry was the Nigerian Breweries Ltd (NBL), which was established by a group of merchant firms led by the United Africa Company (UAC) Ltd.<sup>2</sup> NBL operated for about fourteen years, from 1949 to 1963, before a second brewing firm was established. Between 1963 and 1980, however, a space of seventeen years, eleven more firms were established, encouraged mainly by the success of the pioneer firm. All the firms are joint ventures, but in the majority of them (nine out of thirteen) the public sector owns the majority of shares. The reason for this is that most state governments in the country regard local brewing as a top priority development project. Table 1 summarizes information about the industry.

Table 1. Structure of the Brewing Industry of Nigeria, September 1981

Firm	Location	Establishment	Total Labour Force	Product <sup>a</sup>
Nigerian Breweries Ltd (NBL) <sup>b</sup>	1. Lagos	1949		
	2. Aba	1957	2422	Lager (Star, Gulder)
	3. Kaduna	1963		
Guinness (Nig.) Ltd <sup>c</sup>	1. Lagos	1963	900	Stout (Guinness) --
	2. Benin-City	1974		Lager (Harp)
Golden Guinea Breweries Ltd	Umuahia	1963	670	Lager (Golden Guinea)
				Stout (Eagle)
West African Breweries Ltd	1. Abeokuta	1964	980	{ Lager (Top)
	2. Badagry	1979		
North Breweries Ltd	Kano	1974	850	Lager (Double Crown)
Cross River Breweries Ltd	Uyo	1975	600	Lager (Champion)
Premier Breweries Ltd	Onitsha	1976	450	Lager (Premier)
Bendel Breweries Ltd	Benin City	1976	n.a.	Lager (Crystal)
International Breweries Ltd	Ilesha	1978	259	Lager (Trophy)
Kwara Breweries Ltd	Offa	1978	434	Lager (Noble)
Continental Breweries Ltd	Ijebu-Ode	1979	243	Lager (Double Three)
Jos International Breweries Ltd	Jos	1979	600	Lager (Rock)
Superbru Ltd	Agbara	1979	210	Lager (Skol)

<sup>a</sup>Brand names are given in brackets. There is no information about the scale of output because of the requirement that confidentiality be maintained.

<sup>b</sup>NBL also produces Maltina (a non-alcoholic drink) and Green Sands (Shandy).

<sup>c</sup>The figure for the labour force is as from 1979.

Sources: Information supplied by the firms as well as by the Federal Ministry of Industries, *Industrial Directory* (1975, 1980); and by Lawn (ed.) 1979.

### *Components of Brewing Technology*

The set of techniques required for producing beer includes three categories: management techniques, non-proprietary techniques and proprietary techniques. What each of these entails may be described as follows. *Management techniques* entail the techniques required for effectively managing the personnel and materials employed in the enterprise. *Non-proprietary techniques* entail the practical skills and techniques for operating the brewery (i.e. the operative skills). *Proprietary techniques* are the processing techniques, secret formulae, quality control techniques, research and development techniques, and design and engineering techniques. Also included are the techniques for effectively marketing the product. These categories together constitute the beer production technology expected to be anchored in the Nigerian economy by brewing firms.

In a sense, it would appear naïve of the various Nigerian governments (the main promoters of the brewing industry) to expect to have the technology for producing beer (as defined above) anchored in the domestic economy simply by establishing breweries. A firm — foreign or indigenously controlled — may not expose its proprietary techniques to a second party for reasons of self-interest. And without some specific and mutually beneficial arrangement to take care of the self-interest element, such a vital aspect of a technology may never be exposed to a second party.

Perhaps the various Nigerian governments are not as naïve as have been suggested. Perhaps they do not expect that through their approach, such aspects of brewing technology as the knowledge and skills for designing and engineering plant and equipment will be anchored in the economy. It is not clear, however, how else the firms could have contributed to the development of the much needed technological capability if their operations did not result in the anchoring of such vital skills.

Design and engineering skills are crucial factors in economic development. This is emphasized by Baranson, who argues that 'the key to long-term growth and development (the desire of most, if not all LDCs) lies in acquiring the ability to design and engineer industrial systems, which in turn necessitates the development of indigenous capabilities in product design, process engineering, and equipment design and construction' (1981: 1). Such capability takes on extra importance in an industry like brewing, in which the bulk of the core activities have been translated into machine operations. It is assumed,

therefore, that the various Nigerian governments have expected the brewing firms in the country to anchor all aspects of beer production technology in the local economy.

### *Training Indigenous Personnel*

Almost all the brewing firms indicated that they had trained a large number of indigenous employees in the various aspects of their operations. Our investigations showed five different modes of training, as shown in Table 2.<sup>3</sup>

Table 2. *Modes of Training Observed in the Industry*

Mode of Training	No. of Firms
On the job, with their own school	1
On the job, without their own school	10
External, at a technical partner's plant	11
External, through courses given by specialized agencies	11
External, in institutions at home and abroad	6

*Source:* Information supplied by the firms.

It was not possible to get information on the content of the training programmes of most of the firms, but for the one firm that had its own school, it was gathered that the principal objective was to give the employee a systematic introduction to the various aspects of the business. Specifically, courses covered such activities as grain-mashing and wort filtration processes; wort boiling, clarification and cooling processes; and laboratory (quality control) operations like microbiological tests (for dangerous organisms); checking quality and process control (e.g. the purity and colour of the product). With respect to maintenance engineering, the instruction given related mainly to repair services, overhauling of various machines and minor installations.

### *Adaptation of Techniques*

As was indicated earlier, adaptation of imported technologies usually implies modifying the processes, the products and/or the equipment to



suit the particular economy. Each form of adaptation involves a number of activities that are briefly defined below.<sup>4</sup> *Adapting the process* involves modifying the production procedures, taking into account the quality and quantity of local factors. This involves, for example, reducing capital inputs and increasing labour inputs, and reducing inputs of highly skilled labour and increasing inputs of less skilled labour. *Adapting the product* consists of changing standard specifications, usually with respect to quality, and in the beer industry this means modifying such aspects as the strength and bittering, which would result from incorporating any of the known possible local substitutes. *Adapting the equipment* generally implies modifying the equipment to suit the domestic market conditions. In the Nigerian case, this would involve substituting inexpensive locally made tools and materials for the imported equivalents.

### *Evidence*

#### *Adapting the Process*

*Capital-labour substitution in the 'core' process.* There were virtually no cases of this form of adaptation in the industry. The various firms confirmed that their technical partners/advisers made no special modifications in the techniques they chose for the Nigerian 'plants'. The procedures in use in all the firms were the standard ones known to the various technical partners/advisers at the time the local breweries were established and were consistent with the desired product quality and quantity.

*Capital-labour substitution in 'ancillary' processes.* There were a few cases of modifications in techniques in these processes, i.e. the substitution of manual operations for mechanical operations in the activities relating to palletizing and depalletizing materials and products. This modification was observed in four out of the thirteen firms, and it should be pointed out that this adaptation has the effect of reducing the machine intensity of the techniques but has none of the kinds of effects this article is concerned with, i.e. that of improving local technical skills and anchoring technology. Each firm explained its choice in terms of the need for fast and efficient operation.

#### *Adapting the Product*

*Changes in quality specifications.* In all the firms, the strength of beer, its colour and the other quality specifications were determined following European standards. The reason for this is that all the firms relied

on European firms as technical partners or advisers. Throughout the industry, the emphasis was on producing beer of high quality to meet the taste demands established by the now displaced imported beer, and the fear was commonly expressed of a possible adverse effect of quality changes. When *adjustments are made for new (local) materials*, the core materials include malt, hops and sugar, while the ancillary materials include all the packaging materials (bottles, corks, labels and cartons).

*Changes in 'core' materials.* Apart from water, the indispensable input, malt and hops have been the principal core materials in beer production in Nigeria since local production began in 1949. In 1981, these were still the principal materials. Furthermore, all the malt and hops and a large proportion of the sugar used in the industry were still procured from external sources.

In 1979, one of the newer firms in the industry introduced the use of maize as an adjunct to malt. This change produces beer of comparable quality to the beer from other breweries in the country, but most of the other firms were sceptical about the innovation.<sup>5</sup> The use of maize, it should be mentioned, was not a modification to incorporate local materials; rather it was a technique which technical partners of the particular firm already had.

*Changes in ancillary materials.* Significant changes were observed in this respect, but mainly in terms of the sources of the materials. This kind of modification has more implications for linkages than for anchoring technology.

### *Adapting Equipment*

*Substitution of locally made tools and materials.* There was no evidence of this in the industry. It was gathered that the facilities installed in the various firms were parts of 'turn-key' contracts.

*Adjustments made to equipment.* Three firms indicated that they had adjusted parts of their equipment. Of the three only one was able to give details of the adjustments made. One adjustment made was the replacement of fermenting tanks. The old tanks were open and were replaced due to a number of technical problems which rendered them inefficient. The new tanks are 'closed-vertical'. Another adjustment made was the installment of the new tanks by a foreign brewery construction firm in collaboration with the firm's local engineering staff. Such participation by local staff has the effect of letting them in on the secrets of some aspects of the brewing business, though in a rather limited area.

These findings show that activities aimed at adapting the techniques imported for beer production in Nigeria have been limited, and they imply that technical adaptation has not been a significant means of imparting technology to Nigerians.

### *The Extent of Anchoring the Technology*

This section aims to assess the extent to which the training activities reported in section 3 (the third part) have anchored brewing technology in Nigeria. To do this, evidence was sought of anchoring each of the three components of that technology as outlined in section 3 (the second part).

#### *Anchoring Management Techniques*

To study this, evidence was sought of the training of indigenous managerial personnel, of the emergence of capable indigenous personnel, of a decline in the number of foreign managerial personnel and of key decision-making responsibilities being assumed by indigenous personnel.

The firms were found not to have performed at the same level in terms of anchoring management techniques. In the two largest firms, anchoring management techniques has reached the third stage and in some aspects the fourth. Both firms depended on foreign managerial manpower when they started operations, but through their various training programmes they have now developed an indigenous managerial capability, manifested in the decline in the number of foreign managerial personnel that they now engage. In one of them, for instance, indigenous managerial personnel grew from thirty-one persons (36.5 per cent) in 1965 to 133 (90.5 per cent) in 1979, whereas foreign managerial personnel declined from fifty-four (63.5 per cent) in 1965 to fourteen (9.5 per cent) in 1979. In such aspects of the business as personnel, marketing and public relations management, the fourth stage of the anchoring process has been reached. In general, however, technological control, engineering and technical matters are still in the hands of expatriate personnel.

#### *Anchoring Non-Proprietary Techniques*

To study this, evidence was sought of the effective transmission to local personnel of the non-proprietary skills and techniques required for producing beer in installed breweries and for servicing plant and

equipment. These skills include the practical skills of such workers as machine operators, mechanics, fitters, plumbers, electricians and other technical personnel — i.e. the workers termed 'operatives' — and together they constitute the 'operative technology'. It was found that the non-proprietary component of the brewing technology is the most effectively anchored of all the components. As in the case of the managerial component, the contributions of the individual firms have differed according to their age and size.

The older two firms, which are also the largest, have reached a very advanced stage in the anchoring process, and the effectiveness of their contribution is manifested in the competence of the indigenous operatives. In both firms, local operatives are able to perform their tasks with a minimum of supervision. Indigenous maintenance staff, for instance, carry out routine checks and servicing and also do minor repairs.

In the younger firms, indigenous operatives are also quickly acquiring needed skills and have mastered the skills involved in crushing and mixing malt as well as mashing, lautering and boiling wort.<sup>6</sup> Considerable progress has also been made in training indigenous maintenance workers in the skills necessary for servicing some machines and equipment.

The anchorage of operative brewing technology is, however, not adequate to enable Nigerians to adapt and improve existing breweries and design and fabricate new ones. The skills needed for these critical activities belong to the area of proprietary techniques.

#### *Anchoring Proprietary Production Techniques*

Proprietary production techniques are usually kept secret. This is necessary because they are critical to the competitive advantage of the proprietor.

Like the other components of the technology, the proprietary production techniques are essentially knowledge and information, and like the others, they are anchored in the economy of the host country by training indigenous employees and passing on the relevant knowledge and information to them. But the training required for this has to be specialist, because of the sophisticated nature of the knowledge and information to be transmitted.

To assess the extent to which the brewing firms have anchored these techniques in the local economy, evidence was sought of the training and emergence of indigenous personnel in such operations as process control, quality control, research and development (R & D),

installing plant and design and engineering of plant and equipment, without which the local economy cannot be said to have acquired the technology. The findings showed that this aspect of brewing technology was the least anchored of the three components. The firms that performed best were, once again, the large and long-established ones; in them, indigenous capability had emerged in the process and quality control activities. However, the industry as a whole had yet to make significant progress in the more critical activities, namely R & D and design and engineering.

None of the firms had a specific department for R & D. In some of them there was a 'technology department', but the work done there was essentially quality control. Throughout the industry, the emphasis was on meeting desired output targets for the established products and by the established procedures. Attention had not yet been turned to finding new procedures and/or new materials for producing the product. Activities relating to manufacturing engineering, and design and engineering of product, plant and equipment were not undertaken.

#### 4. ANALYSIS OF THE FINDINGS

Modern beer brewing technology has not been completely anchored in the Nigerian economy. Indigenous capability has been developed in activities in the production process, but not in R & D and design and engineering activities. This means that Nigeria still depends on foreign expertise to build a brewery. And with improvements in techniques (particularly the increasing mechanization of procedures), Nigeria's dependence on foreign suppliers of brewing technology has tended to increase.

However, the situation in the brewing industry is not exactly as argued in much of the literature. The fact that not all the components of the technology are anchored stems not so much from secrecy and other restrictive practices of the proprietors of the technology (although some evidence of this exists), but mainly from the attitude of the host government towards technological issues in the industry.

All the breweries that exist now in Nigeria were built as turn-key projects by foreign brewery construction firms. A number of these are wholly indigenously owned, and the foreign technical advisers have not always insisted on shareholding. This would seem to suggest that in such cases, the indigenous promoters of the projects have bought, as it were, the entire brewing technology and are free to operate it as they

wish. The low level of anchoring technology, however, stems in part from this very approach — the turn-key approach to acquiring foreign technology.

Turn-key arrangements generally have the advantage of ensuring that projects are completed on time, because they are usually handled by experienced and tested foreign engineering firms. When projects are completed on time, this approach avoids capital cost increases which often result from delays, waste and inefficiencies that characterize projects handled by inexperienced local engineers and/or engineering firms, though there are serious disadvantages as well.

The greatest disadvantage of the turn-key arrangement — particularly in circumstances such as exist in an LDC — is that it offers little opportunity for indigenous personnel to participate in the various stages of implementing the project. It thus denies this personnel the opportunity to learn by doing, which is important in acquiring new skills. This has been the case in the Nigerian brewing industry.

By December 1980, there were seventeen breweries in Nigeria that had been built over a period of thirty years. Because of turn-key arrangements, however, their establishment has had little positive effect on developing indigenous capability in the crucial design and engineering activities involved in brewery construction.

The fact that the Nigerian state governments still favour turn-key arrangements for the new breweries being built and being planned shows a haphazard approach to technological development. It also shows that either the governments — the major promoters of these 'development' projects — do not understand the processes by which foreign technologies are acquired, or that they are not really interested in acquiring the particular technology.

The lack of interest in research and the general absence of R & D facilities in the industry can also be attributed to some extent to government's attitude towards the industry. Let us illustrate this point with a particular case.

For a long time now, some Nigerian scientists have argued that local materials like sorghum, maize and cassava could replace imported malt as the main raw material used for making beer.<sup>7</sup> These scientists maintain that substituting any of these materials would save substantial foreign exchange and would increase the positive impact of the industry on other subsectors of the economy. In response to this, the brewing firms argue that such a change in their material inputs would produce beers totally different from those with which the market is

familiar, and that it would adversely affect their commercial interests. They have therefore not taken the suggested innovation seriously.

The validity of the firms' argument cannot be denied: beer produced using, say, sorghum, is likely to taste different to a consumer who is used to the taste of beer made from malt. It would in fact be a new product and would therefore face the problems of market penetration generally faced by new products. In addition, it would encounter a serious problem of psychological acceptance in the Nigerian market environment, in which most things local are regarded with suspicion.

Two firms have responded to the pressure to use local materials but not in the way suggested. They are experimenting with cultivating barley in Nigeria (malt is made from barley) but not with using any of the suggested local substitutes. Informed sources say the results obtained so far are not encouraging, the climate being the main problem.

By 1981, a research institute owned by the Federal Government — the Federal Institute of Industrial Research (FIIR) at Oshodi — was experimenting with producing beer made from local materials. The Institute was optimistic about putting the product on the domestic market soon, but fears were already being expressed about the commercial success of the project, as the brewing firms were not showing interest. In view of the important part which the firms can play in the success of such an experiment, one would think that the government would seek to encourage them to cooperate with the Institute. However, there has been no such effort: instead, the firms are merely being urged to 'use local materials'.

In order to encourage R & D activities in the industry in general, the government has urged the firms to provide the necessary facilities. So far, the firms have not responded in the way required, and it does not seem likely that they will do so, since the reason for this hesitation is that from their own point of view, they are already well served by their technical partners/advisers overseas. The ease with which they can draw on the technological resources of their partner/advisers to solve their technological problems minimizes the need to set up facilities to develop the capability to deal with such problems.

Another reason why the firms are not likely to respond positively to the kind of pressure being put on them on the issue of R & D facilities relates to the nature of research activities in the industry. In a study of the brewing industry of the United Kingdom, Vaizey (1960) found that research was aimed mainly at controlling product quality

and not so much at developing new methods or processes. He observed that 'Laboratories, whether at breweries, in consulting firms, or in the Institute of Brewing, are concerned chiefly with the analysis of the problems arising in production due to the biochemical properties of yeast or to infection, or to other organic causes' (1960: 152). The evolution of new products in the industry, Vaizey pointed out, was not primarily a matter of research but one of 'brewing new flavours and consistencies by existing means...variations on well-known themes' (1960: 153).

However, Vaizey's observation should not be interpreted as implying that the Nigerian government need not worry about R and D facilities in the local industry, because the type of research activity observed in the UK industry is not even being undertaken to a significant extent in the Nigerian industry. The leading Nigerian firm, for instance, still has its production checked regularly at the European laboratories of its technical advisers. The other firms have similar arrangements with their technical advisers overseas.

This sort of dependence would be reduced if the firms established R & D facilities to develop the relevant skills in their own breweries. In addition, local R & D facilities would enable the Nigerian firms or their agents to undertake long-term fundamental studies of raw materials and brewing processes which cannot be undertaken in the existing laboratories, which are designed mainly for the needs of short-term production. For the economy as a whole, R & D activities in the brewing industry would have spill-overs that would contribute to improving local scientific skills. The relevant facilities can be established in Nigeria, but doing this will require more planning efforts on the part of the various governments than have been seen so far.

It would therefore appear that in this industry, it is possible to anchor the technology in the host economy. The limited anchoring of brewing technology in the Nigerian case is due not so much to the restrictive practices of the proprietors, but largely to the host government's haphazard approach to the technological aspect of the brewing industry.

It is recognized that the lack of a modern capital goods industry has contributed to the limited anchorage of brewing technology in Nigeria. The effect of this has been that brewing machines and equipment cannot be fabricated locally, and consequently local engineers cannot acquire the relevant skills. However, since anchoring such technological aspects as the skills for designing and building breweries and



installing machines and equipment does not necessarily depend on whether a local capital goods sector exists, it would seem that the failure of the firms to do so is due mainly to the lack of appropriate government policies.

### *Policy Implications*

The main policy implication of this study is that if the brewing industry is to contribute more significantly to the technological development of the economy than it has so far, the government's attitude to this sub-sector will have to be reviewed. This will generally involve greater government concern with the industry's operations. It should be pointed out, however, that while the establishment of brewing firms in the local economy can be used to develop skills in designing and building breweries and installing machines and equipment, it cannot be used to develop skills and capability in *designing* and *fabricating* the many brewing machines and the equipment.

To use the establishment of brewing firms to develop local skills in designing and building breweries, the national development planners could adopt two related measures. The first would be to arrange for the planned breweries to be constructed jointly by experienced foreign firms and indigenous engineering firms. In such cases the objective of the arrangement — acquisition of relevant skills — should be made known to both parties and explicitly stated. The second measure is to plan for sequential rather than simultaneous implementation of brewing projects in the country. Taking this approach, the first built breweries would provide the training ground for local brewery engineering manpower, whereas implementing the later ones would provide important opportunities to test and consolidate skills.<sup>8</sup>

• In order to develop local skills in designing and fabricating brewing machines and equipment, the local economy will have to have, as a precondition, a well-developed capital goods sector. This applies equally to developing similar skills in other lines of activity. Production of capital goods in the local economy provides opportunities, at least potentially, for local labour to learn specific technical skills as well as non-specific fabricating skills. With conscious and deliberate efforts on the part of national development planners, and with active public sector involvement, such potential opportunities could be turned into real opportunities for developing and building up the vital technical skills needed for upgrading production skills, for acquiring modern technologies and for adapting existing technologies and developing more appropriate ones. A significant capital goods sector is therefore

needed in the Nigerian economy to lay the foundation for the much needed technological transformation.

With respect to R & D in the industry, this study suggests the adoption of a policy similar to that of the brewing industry of the United Kingdom, in which all the firms jointly established and finance a research institute, the Brewing Research Foundation in Nuffield. The resources and research of this institute's findings are made available to all contributing firms, whatever their size, which has the advantage of minimizing research costs.<sup>9</sup>

#### NOTES

1. Throughout this article the term 'skills' refers to practical knowledge — such as skills in crafts — which requires mainly dexterity of the hands and eyes. The term 'techniques' refers to particular combinations of persons and tools used for turning out a product — i.e. ways of performing particular operations. The term 'technology' refers to a set of techniques for producing a particular product and is therefore regarded as a package of technical know-how needed to transform things. See Green and Morphet 1977; Stewart 1977; UNIDO 1979.

2. The other merchant firms were Great Britain Ollivant (GBO), John Holt and Co. (Liverpool) Ltd, Compagnie Française de l'Afrique Occidentale (CFAO), Société Commerciale de L'Ouest Africain (SCOA), Paterson Zochonis (PZ) Ltd and the Union Trading Company (UTC).

3. One of the agencies specialized in training employees of beer firms (see the fourth mode of training in Table 2) is the Industrial Training Fund (ITF). An agency of the Federal Government, it was established to encourage and coordinate the training of industrial and commercial manpower in the country. It pools financial contributions (1.0 per cent of the payroll) from firms employing twenty-five or more people and uses a large proportion of these funds to finance industrial training activities. Another is the Centre for Management Development (CMD), an agency of the Nigerian Council for Management Education and Training, which is charged with the specific responsibility of training managerial manpower. Courses often offered by these agencies are, for example, general management, financial, marketing and sales, and production management.

4. For a detailed discussion of the issues involved in adapting industrial techniques to LDC conditions, see United Nations 1963.

5. A number of firms said there was no point in considering substituting maize for malt, since maize too would have to be imported. In general, the firms fear that incorporating any new (local) material might lower the quality of their products and so damage their commercial interest.

6. A production manager in one of the firms pointed out that the operations involved in the various stages of beer production 'are largely press-button operations'. He said that for this reason, it did not take his workers a long time to master their tasks. This statement is particularly significant, because it shows the extent to which beer brewing activities have been taken over by machines and

underlines the importance of developing the capability to design and engineer brewing equipment as part of the programme of acquiring brewing technology.

7. This information was supplied by the Federal Ministry of Industries. See also a survey of the Nigerian brewing industry in *Africa Now* (1983).

8. The recent survey of the brewing industry published in *Africa Now* (see note 7) reports that Nigeria is likely to have about 61 breweries by 1985. Some of these are currently under construction, but over thirty of them have yet to be operationalized and would provide opportunities for indigenous engineers to learn the relevant skills if set up in the way suggested in this study.

9. This information was supplied by the Brewing Research Foundation in Nuffield.

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