Adaptation of processing technologies in the bakery industry in Kenya

by

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ABSTRACT

This was an investigation of the ways in which firms, in the developing nations during the 1980s, have adapted production technologies in their efforts to expand the production capacities and to contribute towards the nation's capability for self-sustaining industrial operations. The study was undertaken in the bakery industry in Kenya, between 1984 and 1991, in two phases that involved a survey of 82 firms and an in-depth case study of six firms. One of the principal aims of the study was to identify a more promising strategy between the small-scale operations and the Big-Push model. The argument in this study, however, is that these two models of economic growth are subject to limitations that arise essentially from their lack of treatment of the attributes of entrepreneurs as determinant factors.

Examined under the modified versions of these models are the effects of the varied characteristics of the entrepreneurs, the nature of investment and location of the firms on the types and the levels of equipment adopted, capacity utilization, labour requirements and ways for skills development. Results indicate that the modified models, to incorporate entrepreneurs among the casual factors, improve prediction of the nature of investment as well as adaptation of the production technologies. With regard to the relative advantages, it was found that while small-scale operations encouraged adoption of locally manufactured equipment and utilization of considerably higher ratio of skilled labour, they are significantly constrained by limited capabilities for adoption of advanced equipment. In contrast, whereas large-scale operations adopted modern equipment and absorbed substantially greater number of the labour force, they exerted overwhelming negative impact on local technical capabilities and entrepreneurial activities.

In light of these findings it is suggested that medium size operations that offset extreme disadvantages of the two conventional models would be more favourable with respect to adaptation of the production technologies for purposes of achieving self-sustaining industrial operations in the context of the developing countries. In addition, attention should be given to policy measures that enable entrepreneurs to acquire capabilities for undertaking competitive industrial enterprises, particularly adoption and management of technically efficient techniques. One of the potential approaches is promotion of the cooperative industrial endeavour through which recent entrepreneurs can mobilize resources and operation skills.

RESUMÉ

Les méthodes utilisées pas les firms ont étes étudiées afin d'améliorer leur capacité de production et de contribuer à l'auto-suffisance du pays en matière de développement industriel. Le secteur étudié a été celui de la boulangerie au Kenya. L'étude a été réalisée au cours des années 1984 à 1991. Celle-ci était divisée en deux parties comprenant l'inspection et le contrôle de quatre-vingt deux entreprises et une étude en profondeur de six autres entreprises. Le but principal de cette étude était de mettre à jour une stratégie plus prometteuse qui se situerait entre deux modèles différents soit celui d'entreprises à petite échelle et celui connu sous le nom de "Big Push Model". Ces deux modèles de croissance économiques sont souvent remis en question parce qu'ils ne tiennent pas compte des caractéristiques des entrepreneurs, qui est un facteur déterminant. Les caractéristiques suivantes ont donné lieu à des modèles modifiés: la nature de l'investissement, l'emplacement de l'entreprise, le type et le niveau de sophistication de l'equipement adopté, la capacité d'utilisation, les besions de main d'oeuvre et leur perfectionnement.

Les résultats ont démontrés qu'en effet, en considérant les entrepreneurs comme élément primordial de l'entreprise cela aidait à prévoir la nature de l'investissement ainsi que l'adoption de techniques appropriés pour assurer une bonne production. Cependant, lorsque on remarque les avantages relatifs à chaque modèle, on voit qu'au niveau des petites entreprises ils encouragent l'utilisation d'equipement manufacturiers de facbrication locale et utilisent une main d'oeuvre spécialisée parce qu'ils ne peuvent se procurer l'equipement moderne. A l'opposé les grandes entreprises préfèrent l'equipement moderne et une main d'oeuvre plus nombreuses et moins spécialisée. Cependant cela a un impact néfaste sur l'ensemble de développement technique et

sur l'entrepreneur-ship de la region.

Conséquemment, l'entreprise de taille moyenne serait à l'abri des désavantages des deux autres modèles. Celle-ci offrirait de meilleures possibilités d'adaptation des techniques de production visant a l'auto-suffisance industrielle pour les pays en voie de développement. De plus, une attention particulière devrait dorénavant être portée sur les politiques qui permettraient aux entrepreneurs de pouvoir prendre les mesures nécessaires pour diriger des entreprises compétitives et plus particulièrement en adoptant et en gérant des techniques de production efficaces. Une approche qui semble intéressante est celle qui encouragerait l'industrie cooperative par laquelle les entrepreneurs pourraient mobiliser leurs ressources et leur connaissances opérationnelles.

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1 INTRODUCTION

This study examines the types of production technologies in the bakery industry in Kenya and their empirical distribution in that country. Specifically, it is an investigation of the ways in which firms have adapted these technologies in order to expand their production capacities and to achieve self-sustaining operations at the firm level, and thus contribute to overall economic growth. One of the principal aims of the study, then, is to identify those characteristics of entrepreneurs and of firms that have influenced such adaptations of the technologies and expansion of production capacities in this industry, and to generalize the findings to the overall process of economic development in that East African nation.

While technology has been defined with different emphasis by different authors, the definition adopted in this study is a combination of the ones presented by Stewart (1977) and Fransman (1984). Stewart defined technology as consisting of the machinery and processes of production and "all skills, knowledge and procedures" which are used in production (1977:1). It also encompasses, she argued, managerial and marketing techniques. Fransman (1984:9) defined technology as encompassing everything pertaining to the transformation of input into output, and considered technical change as involving change, however minor, in the way in which input is transformed. For purposes of this dissertation, I have adopted these views with modifications. I refer to technology as consisting of components used to transform input (such as wheat flour and other ingredients) into output (bread). Such components fall into three categories: equipment, skill and organization.

I refer to changes that are made in any of the components and to the acquisition of new techniques, undertaken in order to improve either production capacity or the quality of products, as constituting adaptation of the production technologies. In this respect, the present study is concerned with: (1) the type of equipment adopted by firms as well as changes which are introduced; (2) inducement of local technological and entrepreneurial activities and factors that have encouraged such activities, and (3) absorption of labour and development of labour skills.

Previous studies on production technologies in the Third World context have tended to concentrate on the substitution of capital and labour as a consequence of changes in the cost of production technology or optimum combination of the factors of production (Pack 1976, Lecraw 1979, Kaplinsky 1980). However, such studies have tended to ignore the fact that prices in developing countries are distorted to the extent that such mechanisms cannot provide adequate guidance (Nurkse 1953, Hirschman 1958, Stewart 1977, 1984). Further, by concentrating on the price mechanisms these studies have failed to give adequate attention to the ways in which characteristics of entrepreneurs and of the firms influence substantially the adaptation of technologies and the expansion of production capacities. It seems, in my view, that Hirschman (1958:5) recognized the nature of the problem of firms in developing countries. He argued that maximization of output should be the main indicator of successful enterprises and that "development depends not so much on finding optimal combinations for given resources and factors of production as on calling forth and enlisting for development purposes resources and abilities" which are either unused or latent. Added to this is the observation that development should consists of changes that deviate from the tendency towards equilibrium (Schumpeter 1934 and Nurkse 1953). This becomes far more significant when the concern is on progress in innovation.

The situation has, however, been subjected to several studies which, while limited in several important respects, nonetheless provide a background to the present research. Case studies that have considered the characteristics of entrepreneurs and of firms have tended to be selective, which involved essentially use of a limited sample of firms and/or range of entrepreneurs. Kilby (1965) examined the performance of only African entrepreneurs in the bakery industry in Nigeria, while Hart (1970) examined the contribution also of only African entrepreneurs in the service sector to the economic development. Langdon (1984) undertook a case study, in Kenya, of eighteen firms in the textile and wood industries in which two types of entrepreneurs, local Asians and multinational corporations, (MNCs), were considered. Grosh (1986) examined the performance of forty state corporations in Kenya, while Coulson (1979) examined the performance of a single state corporation in Tanzania. In another study, Grosh (1990) examined the performance of the public and private sector enterprises in Kenya using aggregate data, in which she pointed out that the study was not designed to assess the influence of the entrepreneurs and that the size of the data did not permit a statistical test of significance.

Still other studies have concentrated on the multinational corporations as agents in the transfer of technology and as forces that impede development of indigenous technologies. Morley and Smith (1977) examined effects of multinational corporations on the choices of technology in Brazil, while Langdon (1981) and Gershenberg (1983) undertook a similar study in Kenya. Mytelka (1978) examined effects of licensing on technological self-reliance among ninety firms in metalworking and chemical industries in Peru, Ecuador and Colombia.

A problem that has been observed consistently concerns the inability of firms, particularly those owned by local entrepreneurs in developing countries to adapt production technologies that would create new productive capacity or expand utilization of existing capacity (Nurkse 1953, Hirschman 1958, Stewart 1977, Kaplinsky 1984, Bhalla and James 1986, Coughlin 1988, Riddell 1990). Arising from the early theories of economic growth, balanced and unbalanced growth perspectives, two opposite strategies have been pursued. On one hand there is a small-scale orientation and, on the other, is a "Big Push" model. These perspectives postulate different approaches to self-sustaining adaptation of production technologies, expansion of the production capacities, and economic growth in general.

The small-scale model emphasizes inducement in the form of incentives that arise from expanded markets through "complementarity in demand", which can be brought about by promotion of many industries. It is envisaged that development planning should involve simultaneous creation of many industries that would bring about desired complementarity in demand. In addition, such incentives are considered to be strengthened by external economies that arise from improvement of the infrastructural services. According to this perspective, important factors in the adaptation of technologies and the expansion of the production capacity are considered to be the volume of capital investments, the location, and the size of the firms involved.

The "Big Push" model emphasizes inducement, not so much in the form of incentives as defined above, but primarily in terms of pressure which is created through the nature of investments with selected industries. It is envisaged that the strategy of development planning is to select few industries or firms with the largest and/or most promising backward and forward linkages. Such linkages are expected to influence subsequent investment or entrepreneurial activities in the form of initiatives for satellite industries and adaptation of the production technologies. In addition to the nature of investment, the nature of the production process within the firm is expected to influence adaptation of production technologies and utilization of production capacities. In this respect, important determinant factors are considered to be the backward and forward linkages that arise from leading, or selected, industries and the nature of the production process.

However, studies have reported situations in which inducements as defined with the two economic models have existed without subsequent initiatives for new industries or adaptation of the production technologies. Masi (1988) reported lack of subsequent industrialization in the area where a giant steel firm was located in southern Italy. This is interesting given that, historically, steel has been considered to have the largest backward and forward linkages. Masi observed that new technology in steel manufacturing has made linkages much less important in the area in which the geographic firms are based. Kilby (1965) reported stagnation and lack of adaptation of production technologies among bakery firms in Nigeria where not only market opportunities were expanding, but also relatively more accessible technologies were available. Kaplinsky (1980) reported lack of adoption of modern production technologies in the bakery industry in Kenya and existence of inefficient technologies in urban areas where market opportunities and external economies are considered to be relatively more extensive.

Further, Coughlin (1988) reported low utilization of production capacities and lack of adaptation of technologies, in Kenya, in a number of industries where market opportunities and other incentives existed. Such stagnation and lack of adaptation of technologies is one of the interesting questions of which the present study seeks to provide some understanding. Some of the scholars have argued that such stagnation and lack of adaptation of technologies is as a result of the macro-economic policies that have been pursued (Langdon 1984, Kaplinsky 1978, Stewart 1977).

However, a recent study which compared policies that have been pursued in Kenya and Tanzania (James 1990) reported that the choices and adaptation of the technologies were influenced "strongly" by entrepreneurs. It will be recalled that this observation is consistent with the contention by Schumpeter (1934) that industrial advancement in developed countries was achieved largely through the action of entrepreneurs. In this respect, the question that needs to be examined concerns the characteristics of entrepreneurs that have influenced the nature of investment and adaptation of technologies in such ways as to create new production capacities or to expand utilization of the existing capacities.

It will be argued, in the next section, that the two above-noted models of development planning are deficient in respect to the role of entrepreneurs. In the balanced growth model, such a role is taken for granted with only a reference by Nurkse that entrepreneurs can make substantial contribution in "carrying out innovations, putting out new commodities, and devising new combinations of productive factors" (1953:13). In the unbalanced growth model, while inability to invest is considered as a major constraint of equal significance to lack of capital and limited market opportunities, an attempt is made to replace the role of small-scale entrepreneurs with capital-intensive, machine-controlled operations. In making such recommendation, Hirschman argued that entrepreneurs in developing countries are characterized by either individualistic or group orientations, both of which he considered to be "inimical" to sustainable industrial operations and expansions.

It is my contention that the characteristics of entrepreneurs do indeed have considerable influence on the ways of "calling forth and enlisting" resources for adaptation of the technologies and the utilization of existing production capacities. The present study, therefore, is aimed at examining ways in which the characteristics of entrepreneurs, combined with those of their firms, have influenced the adaptation of technologies, the creation of new production capacities and/or the utilization of existing capacities. In short, my expectation is that firms whose entrepreneurs are characterized by prior industrial experience and subsequent group, or co-operative, orientation will have comparatively higher production capacities, be more likely to adapt new technologies and have higher capacity utilization rates. In addition, the effects of the nature of investment, and location of the firms will be examined in order to identify how these factors have influenced, separately and jointly, the nature of investment and the ways in which production technologies have been adapted to the local circumstances.

This present study was undertaken in the Kenyan bakery industry for three reasons. First, this industry is accessible to various categories of entrepreneurs characterized by varied capabilities and strategies for adaptation of technologies and, in addition, it has considerable potential in employment creation (Kilby 1965). Second, as Kaplinsky (1980) noted, it embodies a wide range of processing technologies, as compared to other sectors, which allow assessment of the rate of adoption and the nature of adaptation to local production conditions. Third, the average utilization of existing production capacities for this industry in Kenya has been reported to be as low as 21% (Coughlin 1988), but with rather wide variance.

With an interruption in between, the fieldwork study was undertaken between 1984 and 1991, in which the first phase commenced in April 1984 with an in-depth case study of six firms that were selected with respect to the types of entrepreneurs, the size and the location of the firms. One of the firms is an MNC which dominated the bakery industry in Kenya between 1950 and 1980, producing and distributing about 66% of the total quantities of bread in Kenya (Kaplinsky 1980). Another is equally an old enterprise established in the 1950s but remaining a small-scale operation. Of the other four firms, two are located in semi-urban areas and two in the rural areas. During this study these four firms were expanding their production, which provided opportunity to examine factors and conditions which influenced the nature of investment and the adaptation of the production technologies.

The second phase was undertaken between March 1990 and March 1991, and involved an extensive survey with a sample of 82 firms from which quantitative data were obtained for testing hypotheses and for obtaining statistics that can be generalized for the entire industry. Aspects for which the data were collected in the survey are: levels of production capacities and their actual utilization, type of production equipment that has been adopted, inducement of local technological capability or entrepreneurial activities and absorption of labour, as well as characteristics of entrepreneurs and of the firms. In acquisition of such information, a structured questionnaire was administered in person to the managers or owners of the firms. In addition, aggregate data for the period 1981 to 1989 were obtained in order to examine overall trends in this industry with respect to the number of firms, the nature of investment and their contribution to the growth of the industry.

Presentation of the present dissertation consists of ten chapters. Following this introductory chapter, a review of the literature is presented in chapter two with special emphasis placed on the problems related to adaptation of the production technologies in developing countries. In addition, extensive discussion is undertaken with regard to the two theoretical models of development planning in which it is argued that these theories fail to take into account the influence of entrepreneurs in the adaptation of production technology.

In chapter three, a review is undertaken of the evolution of development policies in Kenya and how such policies have influenced the past trends in investment as well as the expansion and utilization of production capacities. Presentation of specific propositions from the two theories of development planning are provided in chapter four, where the nature of the relationship between independent and dependent variables is outlined, incorporating the type of entrepreneur as one of the important determinant factors.

Production equipment used in the bakery industry are discussed in chapter five, with special reference to those that have been adopted in Kenya. Further, local suppliers of this equipment and the institutions that lend the initial capital are discussed in relation to the ways in which they influence selection of the equipment. In chapter six methodological procedures that were used in the collection of data and in the analyses are discussed, as well as characteristics of the sampled firms. Statistical analyses of the hypotheses are presented in chapter seven, while an assessment of the nature of influence and the relative importance of determinant factors are presented in chapter eight. In order to provide further understanding of the ways in which firms adapt technologies, an illustrative case study is presented in chapter nine, while in chapter ten a summary and conclusions are presented.

2 REVIEW OF LITERATURE

2.1 INTRODUCTION

It is interesting to note that the inability of firms in developing countries to expand their production capacities and to maintain competitive operations was observed as early as the 1950s (Nurkse 1953, Hirschman 1958). There has been little progress in finding solutions to these problems. Indeed, over the years, while these problems have persisted, new ones have emerged. Hirschman (1958) noted that idle capital and trained labour did not exist, except unutilized labour in the agricultural sector. This observation is no longer entirely valid in the present circumstances. Low levels of production and utilization of installed capacities have been reported in a wide range of industries in a variety of Third World contexts. Lecraw (1970) reported utilization of installed capacities in South Korea to be 33% in the rubber industry, 28% in the machinery industry and 63% in metal industries. In the case of Kenya, Coughlin (1988) reported utilization of installed capacities to be as low as 23% in foundries industries and 34% in metal engineering workshops. Levels of capacity utilization in selected industries in Kenya are summarized in table 2.1.1 below.

Table 2.1.1 Level of capacity utilization in selected industries in Kenya, 1985

industry	percent
bakery	21
sugar	67
textile	82
motor vehicle	23
pharmaceutical	21
paper	91
plastic processing	53
glass bottles	48
hand tools	24
steel billets	48
steel pipes	13
steel sheets	61

source: Coughlin 1988:278

Stewart (1977) made similar observations in a study of maize grinding in Kenya. She found that whereas some firms operated on a 24-hour shift, most firms operated on less than 8-hour shifts per day, which is particularly interesting given the demand for maize flour as staple food in East Africa. Indeed, based on data from United Nations Industrial Development Organization (UNIDO), Coughlin (1988) observed that low rates of capacity utilization are typical in most firms in developing countries.

It is even more curious to note that firms in some of the developing countries have experienced stagnation in manufacturing for over two decades despite the fact of a modest industrial expansion that has been realized in other areas. Riddell (1990) reported that while value added of manufacturing has risen in percentage of the Gross Domestic Product (GDP) in all developing countries from 20% in 1965 to 30% in 1986, it has remained stagnant in African countries at 10%. In addition, Riddell reported that while the contribution of value added of manufacturing to the GDP rose during the same period in all developing countries from 20% to 22%, it fell in African countries to 7%.

In the bakery industry, in Africa, similar problems have been reported. Coulson (1979) reported acquisition of machinery with excess capacity at what he referred to as "a grossly disproportionate" amount and inappropriate building structures. Kilby (1965) reported instances of firms that have stagnated for a period between 10 and 30 years; a characteristic that tends to be common in most firms in developing countries. In such firms, Kilby observed, profit was not re-invested even when market opportunities were expanding. Whereas Kilby found that the local bakeries controlled a considerable proportion of the market share in Nigeria, Kaplinsky (1980) reported a highly skewed market structure in Kenya, in which one firm accounted for about 66% of the production and distribution of bread. In addition, Kaplinsky reported that firms in Kenya lagged behind in adoption of modern techniques of production already in use elsewhere and that firms existed which utilized inefficient methods.

2.2 SELECTION OF THE PRODUCTION EQUIPMENT

Experience of stagnation and low levels of capacity utilization call for further inquiry into the nature of the investment process and adaptation of the production technologies by firms in developing countries. In the conventional economic perspective, two investment processes have been identified. One identified by Schumpeter (1934) concerns autonomous investment decisions that arise from new inventions or innovations. Such processes has been considered to be mainly the path taken by firms in the developed countries (Stewart 1977, Fransman 1984). These authors have argued that firms in the developing countries do not necessarily need to undertake such a path. One of the reasons given for this contention is that a stock of technologies exists in the developed countries which firms in the developing countries can acquire, thereby saving time and investment. With this view, it is argued that it is not necessary to re-invent the wheel, particularly given the span of time and amount of financial resources required in such investment process. In this respect, the issue that has been expressed concerns the capability of firms in developing countries to select appropriate technologies which are available in the developed countries and to undertake necessary adaptations (Rosenstein-Rodan 1984, Hirschman 1984, Fransman 1984, Stewart 1984).

Stewart (1977) has argued that production equipment consists of a hierarchical structure of three sets. One is a broader set which comprises all known technologies that have evolved historically and exist in the universe, some of which are obsolete. The second set entails the technologies that are available and that firms could acquire, while the third set are technologies that have actually been adopted by a firm. With these sets of technologies, Stewart argued that, with a few exceptions, technologies known which have arisen through scientific and technical advances are predominantly found in the developed countries. Indeed, she stated that "technological development over the past [170] years have been concentrated in what we describe as the advanced countries. This means that, in addition to traditional techniques, [firms in the] third world countries have little choice but to use techniques developed in advanced countries, and for most part produced there too" (1977:58).

The process of acquiring such technologies, according to Stewart, consists of selection mechanisms, in which available techniques are adopted. Such mechanisms include characteristic of the decision makers and of the firms. In this respect, Stewart stated that "the choice actually made depends on the nature of the decision makers and their objectives, economic circumstances...and characteristics associated with different techniques...in addition, circumstances of the firms also influence the choices as well as the way in which 'the economy as a whole operates'" (1977:22). She considered, however, the scale of operation—specifically, the nature of investment—is often the decisive determinant in the selection of techniques. Furthermore, in her view, the problems in the selection of technologies can arise from incomplete or inaccurate knowledge of the range of available techniques.

One of the problems that has been reported consistently with regard to the technologies in use in developing countries involves the dichotomy of capital-intensive and labour-intensive techniques. The former has been found to be a common tendency in most firms when it should be the reverse given abundant supply of labour and rising unemployment (Coughlin 1988, Stewart 1977, Sen 1979). This tendency has been attributed to distortion of the factor prices, with which firms consider the cost of labour in terms of both the wages and training to be relatively high as compared to utilization of capital (Stewart 1977). Because of such distortion, other studies (Morawetz 1974) have tended to use shadow, rather than actual, prices[1] to determine appropriate choices of technologies or optimum combination of techniques.

While substitution of labour with capital has led to consideration by the mentioned authors, among others, of the technologies that are adopted by the firms in the developing countries to be "inappropriate", other factors which have led to a similar conclusion include: limited markets, demand for large capital, which are scarce to begin with, and limited managerial skills. As a result of such conclusion, efforts have been directed, since the 1970s, to adoption of policies in the developing countries which would promote utilization of appropriate technologies. Whereas other scholars (Kaplinksy 1980, Langdon 1984) have suggested reversion to traditional techniques, others (Stewart 1977, Fransman 1984, Bhalla and James 1986, Tisdell 1988) have argued that such inclination is not possible or desirable for a number of reasons. In one respect, Stewart argued that "because the earlier techniques originated at an earlier time, they have less scientific and technical knowledge to back them up, and therefore tend to be of lower productivity, many of them have become technically inefficient" (1977:27,108). In addition, Bhalla and James and Tisdell argued that the problem with traditional technologies is their inability to meet the needs of the local population. However, Stewart pointed out that there can be appropriate technology in terms of small-scale operations, given the size of markets and the local system of organization.

1 While the actual prices have official endorsement, the shadow prices represent negotiated wages under an unregulated environment.

The tendency of the firms to adopt capital-intensive technologies have been viewed as constituting a conflict with the social goals of the country in which the firms are based. Such conflict has been represented (Stewart 1975, Sen 1980, Kaplinsky 1980) in terms of positive and normative approach with which the former refer to practices undertaken by the firms in pursuit of profitable operations, and the latter refer to policies of the state that are aimed at distribution of income and expansion of employment opportunities, and of local technological capabilities essentially through small-scale operations. While such normative approach has tended to favour operations of the indigenous firms, Bhalla and James (1986) have pointed out that such firms are characterized by inability for competitive operations and expansion of production capacities to levels required to meet the demands of the local population. In this respect, Bhalla and James observed that "a very large number of people in developing countries, especially those living in poverty, are dependent on traditional technologies that are incapable of generating levels of income adequate to meet even the most basic human needs" (1986:135).

An alternative which has been pursued over the years involved reliance on large firms, usually MNCs, not only for large-scale production but also for importing modern equipment and to generate employment. The expectation with regard to import of the production equipment has been that such firms would promote local technical capabilities for necessary and subsequent modifications, and development of the components or new ones. In this respect, Sen (1980:134) observed that "what is, however, remarkable is the way in which investors have been able to use some of the advanced techniques in the [developing economies]... without making any substantial contribution to the [local] technological capability".

One of the normative aspects has been the need for developing countries to achieve self-reliance through enhancement of local technological capability. While absolute self-reliance has been considered as neither possible nor desirable, it has been argued (Stewart 1977, 1984) that it is in the interest of developing countries to reduce dependency on developed countries in order to save on resources toward imported technologies, to improve flexibility in application of technologies and to improve bargaining capability for advance technologies. Ranis (1984) argued that self-reliance is not possible given "the existence of a backlog of accumulated knowledge of how and on what to produce...Thus technological dependence in the broadest sense of the much abused term is an incontrovertible and inescapable fact of life" (1984:96). One area which has been considered to be crucial with regard to enhancement of the local technological capability involves development of skills and knowledge of the adaptation of technologies. In this respect, Ranis argued that "nothing can ever be efficiently transferred to a particular place at a particular time without having to be modified to make it fit the always peculiar local circumstances" (1984:96). In support of this argument, Langdon (1984) reported that the way technologies are adapted depend on accumulation of skills, pointing out that firms tended to acquire technological capability through a sequence that starts with simple tools, then moves to secondhand machinery and finally to adoption of modern equipment. Such a process, according to Langdon

(1984:361), involved "gradual accumulation of technological knowledge as enterprises expanded and entrepreneurial experience deepen".

2.3 INDUCED INVESTMENT MODELS

The second process of investment has been referred to as induced investment, which is considered to arise from increases in past production and savings (Rosenstein-Rodan 1943, Nurkse 1953). While this process is considered to be the path amenable to most firms in developing countries, it has been reported to be characterized by certain constraints. From one perspective, limited capital and small markets have been considered to be the main constraints (Rosenstein-Rodan 1943 and Nurkse 1953). From another perspective, the problem has been postulated as the inability of entrepreneurs to invest, not primarily because of scarce capital and small markets, but because of the lack of appropriate decisions (Hirschman 1958). In this respect, two theoretical perspectives—balanced growth and unbalanced growth—were proposed in an attempt to deal with these problems.

With the balanced growth perspective, since the problem was thought to be small markets and low incomes, the principal concern was not simply the size of the population but rather its level of productivity. In this respect, Nurkse stated that "...for any individual entrepreneur, the use of capital is inhibited, to start with, by the small size of the market" (1953:9). Induced investment was therefore envisaged to require simultaneous creation of industries that would expand the markets through complementarity in supply and demand. In addition, expansion of infrastructural services was considered to be necessary in order to reduce the costs of production. Reduction of such costs was envisaged as constituting external economies which would act as further inducement for investment decisions.

In other words, what was required according to the balanced growth model was a large scale effort with which industries were to be created simultaneously so that they could provide reciprocal supply and demand to one another (Rosenstein-Rodan 1943,1984; Nurkse 1953). Indeed, Nurkse represented this requirement as follows. "The difficulty caused by the small size of the market relates to individual investment incentives in any single line of production taken by itself. At least in principle, the difficulty vanishes in the case of a more or less synchronized application of capital to a wide range of industries" (1953:11). Induced investment, in this respect, would be as a result of reduced investment uncertainties and of increased external economies. The proposition, therefore, with the balanced growth model was that in the conditions of initial stages of development or stagnation in investment, "a wave of capital investment in a number of different industries can economically succeed while any substantial application of capital by an individual entrepreneur...may be discouraged by the limitations of the pre-existing market" (Nurkse 1953:13).

One of the major implications with the balanced growth model was its requirement for an initially large volume of capital investment, since it was envisaged that small investments will result in negligible impact on the sector and the economy as a whole. According to Rosenstein-Rodan, "there is therefore a minimum threshold at which the complementarity of demand manifests itself...to reach the threshold and take advantage of complementarity in demand, a minimum quantum of investment is required...(1984:213). With regard to operations of an individual firm, Rosenstein-Rodan argued that "a high optimum size may be required because of the indivisibilities of inputs, processes, or outputs that give rise to increasing returns" (1984:213). In this respect, prior to the 1970s, the balanced economic growth model recommended planning and undertaking that involve creation of many industries and of large-scale operations.

In the 1970s, however, it was recognized that such a large-scale operation was not possible, largely because of limited capital and skilled labour. With the influence of Schumacher (1973), a shift was made to emphasize small-scale investment, with an argument that such enterprises would operate in small markets of manageable dimensions, use local resources, demand modest capital and limited investment in infrastructure. In essence, small-scale enterprises were considered as demanding "appropriate technologies" in terms of their requirement for low levels of capital investment, intensive in their use of labour, and adaptable to local skills. Recent proponents (Ranis 1990:44) of the balanced growth perspective have argued that "very little attention has been paid to the locational dimensions of development, specifically to the importance of the industrial and service activity as a complement to the sustained growth of agricultural productivity". Ranis argued further that what is crucial is the importance of agriculture and its relation to "dispersed rural industry as a key to both successful domestic growth and the export-oriented performance". As will be seen below, this small-scale, balanced growth perspective has influenced development policies in Kenya over the last decade.

In respect to this revised balanced growth model, three factors, inducement that arises from the policy initiatives, nature of investment and location of the firms became important determinants for subsequent investment and adaptation of production technologies, with which location embodies external economies from existing industries and the level of infrastructural services. In support of their claims proponents of the balanced growth model have provided empirical evidence which suggests that application of such model has been successful in other countries. Ranis (1990) reported that adoption of small-scale planning in Taiwan in the 1970s resulted in the location of 34% of the industries in the cities and 66% in the rural areas. In addition, employment level declined in the cities from 43% to 37%, while it increased in the rural areas from 47% to 52% of the industrial workforce. In another study, Uribe-Echevarria (1990) reported that small-scale enterprises in Colombia accounted for 74-100% of industrial employment in rural areas. However, in a study on adoption of microelectronics by firms in England, (Bhalla, et al. 1984), it was found that the adoption rate was high among large firms as compared to small scale firms. Bhalla and associates attributed their observation to two aspects: economies of scale and economies of scope. In terms of the former they concluded that "larger firms are more likely to have attained the minimum scope (economies of scale) for application necessary to cover the costs" (1984:101). Regarding the economies of scope, which they considered a more significant interpretation, they concluded that larger firms are able to spread overhead costs across different types of products and processes.

With the unbalanced growth perspective in which the constraint concerning induced investment was thought to be lack of appropriate decisions, in addition to scarcity of capital and small markets, emphasis was placed on investment through sequence of selected industries that would have greater impact in terms of backward and forward linkages (Hirschman 1958,1984). It was argued that simultaneous creation of many industries, alongside development of infrastructure, as envisaged in the balanced growth model, was not feasible in the developing countries because of scarce capital and lack of ability to invest (Hirschman 1958). According to Hirschman (1958:36), "development is held back primarily by the difficulties of channelling existing or potentially existing savings into available productive investment opportunities, i.e. by shortage of the ability to make and carry out development decisions".

Hirschman viewed the role of investment as consisting of three components: the generation of income, the expansion of production capacities and the creation of additional investment. He emphasized the importance of the last component with a reasoning that investment in industry A would create pressure for investment in industry B; both of which would create incentives (pressure) for investment in industry C. His contention was that, in such sequence, the subsequent enterprises benefit from the external economies created by previous investments which was referred to as "complementarity of effect of investment" (1958:40). In this respect, Hirschman redefined the conventional induced investment to emphasize not only responses to the expanded market and external economies but also the effects (experience) of the previous investments and adaptation of technologies.

According to Hirschman, such induced investment would be amenable to firms in developing countries, primarily because decisions are made relatively easy by the pressure (demand) created through backward and forward linkages. While backward linkages involved inducement by an enterprise for production of its input by another industry, forward linkages involved inducement by an enterprise for utilization of its output as input in another enterprise. In other words, the former encourages investment in earlier stages of production and the latter encourages investment in the subsequent stage of production. Since backward linkages were considered to be compulsive, in contrast to forward linkages which were considered to be permissive in terms of the demand or pressure that they create, Hirschman recommended that, where necessary, priority should be given to investment strategy that create backward linkages.

In order to bring about self-sustaining economic growth and adaptation of technologies, according to the unbalanced growth model, industries that have the greatest backward and forward linkages would need to be selected. Hirschman identified iron and steel as the industries with the largest combined backward and forward linkages. Investment in such industries would require a large-scale effort—"Big Push"—with respect to capital infusion, modern technology, expansion of infrastructure and enabling policies. Hirschman pointed out that while such induced investment would bring about external economies for subsequent investments, it also embodies external diseconomies, i.e "damage" to existing establishments that are utilizing less competitive methods of production, leading to elimination of either such establishments or their methods of production. In this respect, Hirschman stated that "inasmuch as the external diseconomies of new investments will result in negative investment, this destructive effect is likely to be spread over several years; whereas the external economies leads at once to a demand for total capital requirements of whatever ventures are going to be induced" (1958:72).

In summary, therefore, according to the Big-Push perspective—unbalanced growth model—the determinant factor is considered to be the nature of investment with the lead industries. Specifically, the expectation was that large-scale investment in selected industries would accelerate competitive capability of a nation and stimulate subsequent investment or entrepreneurial activities.

An analysis of this model is provided, among others, by Masi (1988) in a study of a large scaled, integrated, steel industry in Southern Italy. Contrary to the theoretical perspective, Masi reported that the large-scale, capital-intensive industry did not give rise to subsequent industrialization, i.e. emergence of local enterprises, or to the location of other industries in the area. Whereas the proportion of the goods and services supplied locally increased from 22% in 1972 to 62% in 1981 such supplies required low technology. Masi attributed the lack of subsequent industrialization to two aspects. He observed that the industry tended to be self-sufficient or to be vertically integrated with other state corporations, such that among 9,427 subcontracting jobs, 50% were created by other state corporations that had an equally limited link to local enterprises. The other and more interesting one, from the perspective of the present study, was that "local entrepreneurial expertise were not sufficiently flexible and specialized to take advantage of the location of the base industry" (1988:25).

Besides the investment sequence, Hirschman (1958) identified further two types of organization of production sequences—process-centred and product-centred—which he considered as determinants of the level and nature of adaptation of technologies. While process-centred refers to production in which sequences are organized around central activities (or "key technical processes") that are performed at different phases of production, product-centred refers to production in which sequences are diffused and coordinated around the final product. The nature of production in the case of such sequences, according to Hirschman, arise mainly from the characteristics of the industries. He pointed out that organization of production in industries such as smelting, petroleum refining, cement and brewing are characteristically process-centred, while in industries such as construction, metalworking and service operations, tend to be product-centred. He predicted, however, that adoption of capital-intensive technology would subsequently increase the level of centralization, particularly with industries that have process-centred characteristics. In this perspective, it will be recalled that Hirschman suggested adoption of machinery to the entire or at least critical portions (phases) of the production process, so that the machinery can set the pace o. the production activities. In such adaptation Hirschman envisaged reduction of the role of management in co-ordination of the management functions and reduction in participation of labour in critical areas of production. Further, he predicted that the role of labour would involve handling of the peripheral operations and special purpose equipments, which demand low levels of skills.

Besides the nature of investment as a causal factor according to the Big Push model, the other determinant factor is the nature of the production process. One anticipated impact of the nature of the production process concerns the level of production capacities that are installed and their utilization. In a study of maize grinding in Kenya, mentioned above, Stewart (1977) reported that the production capacities of the firms with capital-intensive roller mills were far more fully utilized as compared to those of the firms using less capital-intensive equipment, e.g. hammer mills. She reported that firms which had adopted roller mills operated 24-hour shifts, while the others undertook as low as 8-hour shifts. Since capacity utilization is determined by the balance between the installed capacity and demand for the products, Stewart observed that firms utilizing hammer mills had excess production capacities that arose from a shift in the demand of their products to the products of the firms that had adopted roller mills. In another study of cement block manufacturing in Kenya, Stewart (1977) reported that modern machines tended to set the pace of operations as compared to hand-operated machines. In this respect, she stated that "vibrating machines provided for machine-paced operation as compared with hand machines. The pace of the machine in no case entirely determined the pace of the work as the machines could be slowed down; but the machine did impose a regular rhythm which was lacking in the hand-operated machine" (1977:248).

The second anticipated impact of the nature of the production process concerned utilization of labour. Capital-intensive, process-centred operations were expected to require low utilization of labour, i.e. low rate of labour absorption, in addition to demand for low levels of skills. In the above-mentioned study of an integrated steel works in southern Italy, Masi (1988) reported that a considerably high proportion of employees, over 90%, came from the city in which the plant was located or from surrounding towns. This was attributed, as predicted by the model, to the nature of the demand for relatively specific skills that could only be learned on the job. Masi observed that among a total of 20,616 employees, 78% were unskilled manual workers. Further, out of 12,913 employees (63% of the total) who were involved directly in the production process, 88% were unskilled manual workers. Indeed, the same study indicated that employees who handle personnel matters and those involved in service operations had relatively higher level of skills as compared to those involved in production.

In a case study undertaken in one of the largest sugar firms in Kenya, located in the rural area, Mikkelsen (1987) reported that the organization of production was process-centred with heavy machinery being utilized in both processing and handling. She observed that while the firm employed 6500 workers, 5500 (84%) of them were engaged in peripheral operations including transportation and agricultural extension. A smaller number of 1000 workers (16%) constituted "a stable workforce" engaged in skill-intensive operations. Because of the skill-intensive operations, the firm undertook in-house training programmes and maintained its own training facilities, in addition to recruiting such category workers from technical training institutions.

In another case study undertaken in an engineering firm with product-centred organization, Mikkelsen (1987) reported that the production sequences were characterized by a limited segmentation and requirements for relatively higher skill levels. Of the total 120 employees, only 12 were directly involved in administrative services. Out of those directly involved in the production process, 60% were skilled workers with grade I or II trade test certificates and long experience in handling complex machine operations. These grades are one or two years of industrial skills training followed by testing by the Ministry of Labour, such that Grade I reflects basic operational skills, while Grade II reflects intermediate skills, and Grade III reflects qualified technicians. Besides this contrast with the findings reported by Masi, which in part may be accentuated by the difference between the steel industry and engineering firms, the rest of the observations are complementary. The rate of turnover was found to be low, particularly among unskilled and semi-skilled workers, a tendency that made it possible for recruitment of skilled workers through internal promotion. Acquisition of skill was reported to be mainly through practical experience, learning by doing, supplemented with formal courses of short duration.

In summary, therefore, while both small-scale orientation and the "Big Push" model overlap on emphasis of complementarity in demand and external economies, they also entail fundamentally different approaches to investment and adaptation of technologies at the national planning and, to some extent, to management practices at the firm level. However, difficulties arise in application of the two models to operations at the firm level. I have cited, above, studies which have reported lack of subsequent investment or adaptation of technologies when inducements existed either in the form of expanded market opportunities or the existence of external economies. In the case of the reported stagnation among the bakery firms in Nigeria (Kilby 1965), not only was the market actually expanding, but also the firms were based in urban areas where external economies are more extensive. Furthermore, adoption of inefficient technologies in Kenya was ported (Kaplinksy 1980) among the bakery firms located in urban areas where the level of both demand for bread and infrastructural services is high. Similarly, excess production capacities among milling firms in Kenya (Stewart 1977) occurred not because of the size of the market but because of the shift in the demand for their products. Masi (1988) found that local entrepreneurs failed to take advantage, as the "Big Push" argument would have predicted, of the lead industry. Indeed, Masi (1988:14) concluded that "...this lack of further industrialization indicates that such enterprises do not automatically, nor even necessarily, lead to sustained economic growth...". This problem, as can be recalled, is the primary concern of the present study. The question is, what accounts for such stagnation or inability to adapt production technologies?

2.4 CHARACTERISTICS OF ENTREPRENEURS

Of course, Hirschman had already recognized this as a potential problem and proposed that the solution will have to be found within the firm. Indeed, according to Hirschman (1958:135), "any attempt to solving the difficulties of new ventures in underdeveloped countries entirely through pressures from without must appeal to some progressive influence that is supposed to be already at work in the society where the venture operates" (1958:135). While he discounted the role of entrepreneurs, Hirschman provided a hint. He pointed out that entrepreneurs in the developing countries are characterized by either individual or group orientation.

Hirschman maintained that while entrepreneurs who are characterized by individual orientation appear to have potential for undertaking investment and adaptation of technologies, they are "inimical" to sustainable expansion of production, or "genuine economic development" (1958:23). This is because, he argued, such entrepreneurs seek soft options and fail to apply necessary creative and systematic efforts, in addition to lacking ability to enlist cooperation among various contributing agencies and individuals. In this respect, Hirschman stated that "the shortage of the cooperative component of entrepreneurship in many underdeveloped countries is the more unfortunate as, under present conditions, the need for this component is particularly pronounced" (1958:19).

In the case of entrepreneurs who are characterized by group orientation, Hirschman maintained that they would not undertake operations required for large-scale investment, reasoning that such entrepreneurs will be resistant to fundamental transformation required by industrial operations. In this respect, Hirschman (1958:137) stated that "the difficulties in cooperative decision-making which derive from an exclusively ego-focused image of change...do of course affect the day-to-day administration of existing firms and ventures as much as, if not more than, their actual promotion" (1958:137). Indeed, Hirschman contented that such entrepreneurs do not have the "growth mentality" necessary for adaptation of technologies and expansion of industrial operations.

In support of his contention, Hirschman (1958:139) pointed out that resistance arising from entrepreneurs characterized by group image is manifested by the lack of adequate maintenance of machinery and equipment and "for the inadequate efforts to train and retain skilled mechanics... and even neglect of the nontechnical aspects of production". He envisaged further with regard to industrial firms in developing countries that "at a certain stage of their growth, the ability to promote new ventures may outstrip the ability to run them efficiently" (1958:139). It is interesting to note that Kilby (1965) made a similar observation with respect to instances of stagnation in the bakery industry in Nigeria, with which he concluded that such entrepreneurs "lacked desire" to expand and/or "competitive mentality".

Having concluded that entrepreneurs characterized by individual and group orientation were not amenable to competitive industrial operations, Hirschman proposed the adoption of machine-controlled operations which would predetermine the tasks to be performed, thereby creating pressure to the entrepreneurs, management and the workers. In addition, he argued, the "rated" capacities of production in such machine-controlled operations and expansion of market opportunities would bring about pressure on entrepreneurs and managers to expand production and to undertake adaptation of necessary technologies. Precisely for this reason, Hirschman stated that "the rated capacity of the plant provides managers with a performance goal and an objective criterion of failure or success, provided demand is adequate. This is a very valuable mechanism in underdeveloped countries where...competition is often not a sufficiently strong spur to good performance" (1958:148).

In summary, it is clear that Hirschman provided a circular reasoning whereby entrepreneurs characterized by individual orientation would need to be controlled by group mechanisms, while those characterized by group orientation would undertake practices that "impede the more dynamic patterns of change" (1985:13:23). Such conclusion failed to appreciate the fact that the opposite of such resistance could be impetus for change, or specifically for self-sustaining industrial operations.

Other scholars have pointed out the fact that, with the exception of Schumpeter, economic models have tended to minimize the potential impact of entrepreneurs on the nature of investment and adaptation of the production technologies (Cole 1968, Baumol 1968, Leibenstein 1968, Kilby 1971). In the view of these authors, such deficiency in economic model—for failing to incorporate the influence of entrepreneurs—has been sustained partly by continued emphasis on the optimum model for allocation of resources and the tendency to rely exclusively on the market mechanisms. While Hirschman discussed the important role of the entrepreneurs, he assigned the role of causality to external pressure and machine operations.

It is suggested in the present study that characteristics of entrepreneurs constitute an important causal variable which influence, alongside other factors, the nature of investment and adaptation of the production technologies. Further, it is the contention of the present study that entrepreneurs who are characterized by group or cooperative orientation have greater potential for undertaking self-sustaining industrial investment and for adaptation of the production technologies. While he noted the need for a cooperative component, Hirschman (1958) failed to recognize that such a component can exist in the form of group orientation in undertaking of industrial operations. In fact, the group orientation in pursuit of industrial operations bring about an internal complementarity, first and foremost, of human resources in which scarce capital and technical skills can be harnessed. In addition, investment and production risks that were indivisible can be spread to various collaborating individuals.

The importance of entrepreneurship as an explanatory variable in economic development has been discussed by Leibenstein (1968:81) who recognized the potential greater impact of the entrepreneurs who are characterized by group orientation. He pointed out that entrepreneurial capabilities depend, in part, on the kinship relations in which there is a higher degree of trust "and through which one can draw more diverse capabilities". Young (1971:143) provided evidence which suggested that group solidarity is important with respect to effective entrepreneurial performance. Indeed, Young argued that group solidarity provides individual entrepreneurs with the necessary support, particularly pertaining to initial capital, technical advice and even initial market.

In fact, group orientation and its importance reported in the operations of the firms that are based in the developed countries. Cochran (1971) reported that group orientation and the cooperative component were crucial aspects in successful adaptation of technologies by entrepreneurs in the United States and by their firms in developing countries. In a number of countries and for a long time, formal cooperative societies have existed. It will be noted, however, that formal cooperative societies have not undertaken active participation in the industrial sector, except in a few countries such as Israel. Indeed, the operations of Moshav in Israel is a good example of the group image with the attendant cooperative component and remarkable achievements.

Among communities, group or cooperative orientation in undertaking a wide range of human tasks is not new. The dimension which is new consists of such characteristic in industrial entrepreneurship. Group or cooperative orientation in industrial entrepreneurship has been reported to arise from the experience of the required operations (Cole 1968, Kilby 1971 and King 1975). Such experience coalesces from the transfer of roles which existed in the previous, often traditional, occupations that are similar or can readily be adapted to those in the modern industrial operations (Kilby 1971). Consequently, Kilby noted that communities whose previous occupation was trade were characterized by higher performance in entrepreneurial activities. In addition, the acquired experience is passed to successive generations through the process of succession (Cole 1968, King 1975). Indeed, King reported that the performance of the Asian community, in Kenya, in local manufacturing of industrial components has had greater impact as compared to Africans because of experience and skills that have been accumulated through succession. The authors mentioned pointed out, correctly, that these processes, succession and role transference, provide transmission of skills, attitudes and conditioning for effective entrepreneurial performance.

With respect to characteristics of entrepreneurs in Africa, Kilby (1965) observed that expansion of the local bakery firms in Nigeria was aided by associations that were not only negotiating on behalf of the firms but that were also providing ways in which knowledge of the production techniques was shared. Such observation is in contrast with those made by King (1975) on the study of African artisans. King reported remarkable technological capabilities, among the African artisans, for a wide range of household utilities. However, production remained below economical level of operations, in such a way that not only did production remain stagnant, but also the prices were persistently forced downward. King observed that this was as a result of exclusively "individualistic competition", which lacked a co-operative approach. In addition, the study mentioned above in textiles and wood industries, Langdon (1982, 1984) observed that firms that had acquired technological capability were family owned by Asian entrepreneurs. It will be shown later that these entrepreneurs have played a substantial role in the Kenyan's industrial sector, especially with regard to adaptation of the production technologies.

3 DEVELOPMENT POLICIES IN KENYA

Before proceeding to the theoretical model and hypotheses to be tested in this study, it is necessary to review the evolution of the development policies in Kenya and the ways in which such policies and accompanying institutional arrangements have influenced the nature of investment, utilization of production capacities and adaptation of the production technologies for that country's industries.

3.1 BACKGROUND

The historical development of Kenya is characterized by 70 years as a British colony which culminated in the country's attainment of independence in 1963. Geographical layout and the concentration of industries are presented in Appendix 1. It borders Ethiopia and Sudan in the North, Uganda in the West, Tanzania in the South West, Somali and the Indian Ocean in the East. Its land mass is 582,646 sq. km. and is characterized by seven agro-ecological zones—from highly arable to semi-arid and arid areas. With these zones, one-third of the land is arable and supports, besides livestock farming, crop farming especially maize, wheat, tea and coffee. The former two constitute the main staple food, while the latter two are the chief export commodities (Grosh 1990, Schluter 1984, GoK[1] 1979, 1986, 1989). Of the total export earnings between 1980 and

[1] GoK denotes Government of Kenya.

1984, 36% were realized from industrially processed or manufactured goods (CBS 1986:91) and the rest came from export of the agricultural produce.

Administratively, however, the country has eight provinces, and forty-three districts, as follows: Nairobi, Central, Rift Valley, Western, Nyanza, Eastern, Coast and North Eastern. Whereas at the time of independence Kenya had a population of 7,000,000, its population at present is 21,397,000, of which over 75% live in rural areas and depend on agricultural produce for both subsistence and income. Table 3.1.1 below shows a summary distribution of the population in 1979 and 1989 according to the provinces, and Appendix 2 presents a more detailed distribution.

As it will be noted later, Non-African population, notably Asians and Europeans, have continued to play a significant role, even before independence, in the Kenyan industrial sector. Available data, Appendix 3A, indicate that such Non-African population constitute about 3% of the African population, in which Asians account for about 2%.

Table 3.1.1 **Population and Area of Kenya by Provinces, 1989**

Province	Population 1979 (000's)	Population 1989 (000's)	Intercensal Growth Rate (%)	sq.km.	Concentration of Industries[2]
Nairobi	828	1,346	4.86	684	xxxxxx
Central	2,344	3,110	2.83	13,176	xx
Coast	1,342	1,850	3.21	83,603	xxxx
Eastern	2,719	3,724	3.15	159,891	xx
North-Eastern	374	372	-0.05	126,902	x
Nyanza	2,645	3,558	2.97	16,162	xx
Rift Valley	3,242	4,894	4.12	173,868	xxx
Western	1,833	2,543	3.27	8,360	xx
National Totals	15,327	21,397	3.34	582,646	

Source: Central Bureau of Statistics, 1989, 1991

With these population parameters, while the total labour force was estimated to be 7.5 million in 1984, of which 980,000—13.1%—were unemployed, it is expected to be 14 million by the year 2000. Whereas industries are dispersed with respect to regional and district endowments, a relatively high concentration of industries are in Nairobi and Mombasa, which are the major urban areas, and in Nakuru, Eldoret and Kisumu which are major semi-urban areas. These areas and their respective population are presented in Table 3.1.2 below and also in Appendix 2. In addition, while small-scale agricultural based industries are found in various urban centres, relatively high concentrations are found in Central, Rift Valley, Western, Nyanza and Coast provinces.

[2] x = lowest concentration and xxxxxx = highest concentration of industries.

Table 3.1.2 Major urban areas in Kenya by provinces and population

urban areas	province	population 1989
Nairobi	Nairobi	1,346,000
Mombasa	Coast	465,000
1)Nakuru	Rift Valley	162,800
2) Eldoret		104,900
Kisumu	Nyanza	185,100
Machakos	Eastern	116,100
Nyeri	Central	88,600

Source: Central Bureau of Statistics, 1989, 1991

3.2 TRANSITIONAL CHARACTERISTICS

Between 1954 and 1964 can be considered to be a transitional period in the development of the industrial sector in Kenya. Besides striving for independence and its effects on economic performance, it was characterized by a shift from more commercially oriented activities to industrial production. In addition, there were changes with respect to size of the market for the industrial goods and the ownership of industries. With respect to the acquisition and adaptation of the technologies, five interesting trends characterized this period: market size, disinvestment, import substitution, the indigenization programme, and institutional controls.

3.2.1 Market Size

Swainson (1978) has pointed out, in his review of industrial development in Kenya prior to 1945, that although commercial enterprises emerged as early as 1900, the industrial sector remained limited to processing of raw materials and agricultural products.

Commercial activities were concentrated in wholesale/retail, import/export, construction and agricultural production, with limited manufacturing undertaken collectively through organizations such as the Kenya Farmers Association (presently Kenya Grain Growers Co-operative Union, KGGCU), the Kenya Co-operative Creameries and the Kenya Planters Union. According to Swainson (1978:46), reversion to manufacturing from sheer commercial activities occurred, in a form of import substitution, as early as 1930 as a result of increased competition with commercial goods. Under British administration, Uganda, Tanzania and Kenya constituted a single East African market.

Between 1954 and 1965 the Kenyan industrial sector was considerably limited and characterized by low and often declining rate of capital formation (Table 3.2.1). Relatively high growth rate in capital formation occurred during the period 1965-1970 partly as a result of foreign investment protection declared with sessional No.10 of 1965, and partly as a result of East Africa Community Market which was re-constituted in 1967 through a treaty by the then three independent East African nations. The significance of this community market is the fact that it encouraged creation of large production capacities in a number of industries, resulting to adoption of capital-intensive technologies. When it collapsed in 1977, not only did most firms have to be content with a relatively smaller Kenyan market, but were also left with excess production capacity (Coughlin 1988:17). Furthermore, investment declined considerably in the subsequent years as reflected by the rate of capital formation (Table 3.2.1). It is worthwhile to note that efforts have been undertaken in recent years to revive such market in the form of the

Eastern and Southern Africa Preferential Trade Area (PTA). While discussions were commenced in 1978, PTA was constituted in 1981 and by 1988 it comprised 15 member countries. Established under the auspices of the United Nations Economic Commission for Africa, PTA aimed at reduction of tariffs on selected commodities, 10% every two years from 1988 to 1996. Since Kenya joined PTA in 1983, its export to the member countries has risen from K£101,203,000 in 1980 to 168,396,000 in 1987, while the import from the same countries has risen from K£9,679,000[3] in 1980 to 47,254,000 in 1987 (CBS, Statistical Abstract 1989:52). The exports by this East African nation to PTA in 1987 amounted to 47% of the total exports to Western Europe which stood at K£359,906,000, while the imports from PTA constituted 7% of the total imports from Western Europe which stood at K£694,965,000.

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3 The Kenyan money system is based on shillings, represented as Kshs. Conventionally, however, denominations of 20 Kshs. has been denoted as K£.

Table 3.2.1 Capital formation in Kenya, 1954-1988
(at constant prices of 1964 for 1954 to 1971, and 1982 prices for 1972 to 1988)

year	k£million (1964 prices)	percent growth rate*	year	k£million (1982 prices)	percent growth rate
1954	35.27		1972	159.94	
1955	43.81		1973	212.30	
1956	45.68		1974	289.60	
1957	45.62		1975	258.70	
1958	40.02		1976	298.60	
1959	40.32		1977	278.50	
1960	41.41	-0.94	1978	325.57	10.27
1961	31.89		1979	283.30	
1962	33.33		1980	300.64	
1963	30.69		1981	319.04	
1964	34.92		1982	338.56	
1965	43.80	2.60	1983	428.60	6.39
1966	45.90		1984	413.88	
1967	67.30		1985	408.63	
1968	67.00		1986	473.27	
1969	69.28		1987	518.64	
1970	71.63	11.60	1988	522.79	6.23
1971	74.07				

Source GoK, Development Plans 1966; 1970; 1979
Central Bureau of Statistics 1980; 1989

* percent growth rate is an average of 5 years-period, i.e. $(((((x_3/x_2)+(x_2/x_1)\ldots)/N)-1)*100)$, that coincide with policy certain initiatives. Such rates are placed at the end of the period in question, except 1954, 1971 and 1972 which are excluded in such calculations.

3.2.2 Disinvestment

Besides changes in the regional market, another trend during that transition period was disinvestment by foreign firms as a result of uncertainties that preceded independence. This led to economic stagnation and "capital flight", i.e. transfer of capital out of the country (Leys 1974), a trend which continued up to the early years of independence. Indeed, this is reflected by negative growth rates in capital formation between 1959 and 1964. This trend prompted initiation of the Foreign Investment Protection Act of 1964, a measure which was aimed at providing confidence to the foreign investors through assurance for repatriation of capital and remittance of profits. In addition, it precipitated an outline of political orientation to economic planning through sessional paper No. 10 of 1965. This latter document affirmed the free market system, encouraged foreign investment and specified conditions for expanding participation of local entrepreneurs and the skills of local labour. These initiatives encouraged an inflow of foreign investments between 1966 and 1977, whose impact can be seen with relatively high rates of capital formation, Table 3.2.1. Further, as can be noted with data in Table 3.2.2, the inflow of foreign investment stimulated considerable growth in the industrial sector and a shift from agriculture to manufacturing. Between 1964 and 1978 the annual growth rates of GDP in the industrial sector remained relatively higher as compared to those of agriculture. The sectors in which rapid expansion was experienced, according to Kaplinsky (1978:6), included footwear, leather, rubber, petroleum, chemicals, paint, soft drinks, soap and cement.

Table 3.2.2 Real Growth Rates of GDP, 1964 to 1987, in Agriculture and Industrial sectors

Year	Agriculture	Industry	Total
1964-71	4.2	8.2	6.5
1972	7.6	7.3	6.8
1973	4.4	14.4	4.1
1974	-0.2	5.9	3.1
1975	4.6	4.0	3.1
1976	3.7	14.0	4.2
1977	9.5	16.0	8.2
1978	8.9	12.5	7.9
1979	-0.3	7.6	5.0
1980	0.9	5.2	3.9
1981	6.1	3.6	6.0
1982	11.2	2.2	4.8
1983	1.6	4.5	2.3
1984	-3.9	4.3	0.8
1985	3.7	4.5	4.8
1986	4.9	5.8	5.5
1987	3.8	5.7	4.8

Source: Central Bureau of Statistics 1970, 1980, and 1989.
GoK, Development Plan 1989/93:5

3.2.3 Import Substitution

While import substitution was enforced in various forms since 1930, as mentioned above, it was a dominant industrial policy between 1963 and the 1980s. It involved application of high protective tariffs and administrative controls to protect domestic industries. According to Coughlin (1988:36), the import substitution practices led to significant progress towards self-sufficiency in consumer goods as a result of high protective tariffs, i.e. 69%, on consumer goods as compared to 20% on intermediate goods. In addition, enforcement of this structure over-emphasized substitution on consumer goods and neglected intermediate and capital goods. According to Coughlin (1988), these measures led to greater demand for foreign exchange, particularly with respect to acquisition of the intermediate and capital goods which had to be imported.

Since the 1980s to the present, two rival policy options have been debated and pursued. One option has been to continue with import substitution policy with adjustments. Proponents of such an option (Coughlin 1988:287-288) have argued that industrial growth rates attributed to import substitution are greater than those attributed to export trade, and that countries with developed industrial capability underwent a prolonged protection of domestic markets. The second option, which is reflected in the fourth and fifth development plans—see Tables 3.3.1 and 3.3.2, has been to develop industrial capabilities for export trade.

3.2.4 Indigenization Programme

The fourth trend during that transition period was the indigenization of the public service and private sector. While indigenization of the public service was for all practical purposes completed by 1966, indigenization of the private sector is still a continuing programme. Previous studies (Swainson 1980; Leys 1974) indicated that the programme started in the 1950s with the then East African Tobacco Company, a subsidiary of British American Tobacco (BAT). At that time, this company called for indigenization of its management and distribution of its company products as a way of containing conflict with the local population. This programme was institutionalized after independence with enforcement through the 1967 Trade Licensing Act which restricted non-citizens from trading in rural areas and handling some specific goods. While significant progress had been made by the 1970s, the commodities handled by local entrepreneurs, which included foodstuffs, clothing, cigarettes, soft drinks, farming implements and basic hardware were produced locally under MNCs' import substitution industries (Leys 1974:151). In such a case, the involvement of local entrepreneurs was restricted largely to handling of the distribution.

At independence, localization of agricultural and industrial enterprises was pursued principally with three types of entrepreneurs: (1) individual Africans who tended to concentrate on distribution (wholesale or retail), (2) cooperative societies which concentrated on the supply of agricultural input and the marketing of agricultural output, (3) state corporations which were initially aimed at strategic areas and sectors that were not immediately profitable to private enterprises. Among these three types of entrepreneurs, state corporations have had a considerable participation and impact in the industrial sector (Grosh 1980, 1988). Some of the state corporations have been fully or partly owned by the state directly or through development finance institutions, i.e. the Industrial and Commercial Development Corporation (ICDC), the Industrial Development Bank (IDB) and the Development Finance Company of Kenya (DFCK). In addition to the three types of entrepreneurs are Asians who have had extensive participation in commercial and industrial activities since 1922 (Swainson 1978). According to Swainson, the considerable impact that Asians have made in these sectors has occurred principally through their partnership operations. Of the 85 private firms which were registered between 1922 and 1945, 50 were owned by Asians, 90% of which operated in partnership (Swainson 1978:37-38). Such operations enabled this category of entrepreneur to acquire the competitive edge over the British-colonial entrepreneur, and to control a relatively larger proportion of the commercial and industrial activities prior to the independence of that nation.

3.2.5. Institutional Controls

One of the interesting characteristics during pre- and post-independence in Kenya is the nature of interaction between measures aimed at foreign investment, import substitution and the indigenization programme. In order to manage inherent conflict between these measures, additional institutional controls have been enforced from time to time. Among such institutions are the Industrial Protection Committee, No-Objection Certificates, Capital Issues Committee, and the Foreign Exchange Allocation Committee.

The Industrial Protection Committee, established in the 1960s, came out of the need to promote local entrepreneurs, while simultaneously—even if somewhat paradoxically— encouraging foreign investment. It bore responsibility for coordinating the protection of local industries and, at the same time, for the promotion of new investments. Under import substitution, it had a joint responsibility with selected firms to issue certificates of No-Objection Certificates (NOC). In this respect, it has been argued (Leys 1974; Langdon 1978) that selected firms were MNCs which used such privileges to expand their domestic market. During the 1980s this committee was transformed into the Industrial Promotion Centre (IPC) with the responsibility for guiding entrepreneurs, both local and foreign, in areas of investment. In addition, as a mechanism for privatization of state corporations, the Capital Market Authority was established.

The Capital Issues Committee constituted in 1971 was precipitated by disinvestment—see Table 3.2.1—in companies resisting the sale of shares to the public. It was aimed at controlling capital outflow from Kenya by approving all issues and investments of foreign firms. Other studies (Swainson 1980:209; Leys 1974:128) have pointed out that the operation of this committee increased local ownership of shares in foreign firms and protected buying out of local firms by MNCs.

While its principal function has been to regulate the use of the usually limited foreign earnings (exchange), the Foreign Exchange Allocation Committee (FEAC) has also acted as another mechanism for protecting import substitution industries from foreign competition or against imports, through allocation of foreign exchange. Such allocation is provided for the import of limited quota of goods needed to supplement local production, in addition to identified and/or prioritized goods that are considered essential for promotion of certain industries. As scarcity of foreign exchange became more acute in the 1970s and 1980s, FEAC imposed a total ban on import of goods that were considered as luxury and gave priority to import of goods for industries that were regarded as having direct foreign exchange earnings.

3.3 DEVELOPMENT PLANNING

In the post-independence period, a five-year development plan was adopted, in 1966, which outlined and detailed the policies for economic development, including those for the adaptation of technologies. While Table 3.3.1 below presents a summary of the overall development policy initiatives in Kenya since independence, Table 3.3.2 summarizes major shifts in industrial initiatives. While the development plans outline the role of the public and private sector in industrial investment as well as ways in which overall growth is to be achieved, occasional sessional papers provide overall political orientation. Notable among these sessional papers are No.10 of 1965 entitled "African Socialism and Its Application to Planning in Kenya", and No.1 of 1986 entitled

"Economic Management for Renewed Growth". Whereas the former emphasized the strategy of "mixed economy" in which the state would invest in basic infrastructure and in directly productive activities through state corporations, the latter emphasized, among other aspects, reduction of the participation of the state in directly productive activities.

Whereas acquisition of technology has been one of the primary concerns in the two sessional papers (1965 and 1986) and in all the development plans, these documents exhibit contradictions and conflict in emphasis for small scaled orientation and the large scaled, "Big Push" approach. The First Development Plan (1966-70), gave emphasis to three areas: (1) agriculture, particularly small scaled farming and extension of credit facilities; (2) indigenization of both the public service and private sector; and (3) acquisition of technology. One of the interesting features of this plan was the drive for large scaled and capital-intensive operations. It stated that "industrialization and modernization of the techniques of production would provide a new and modern setting to which the skills and ability of the people must adapt" (1966:56). In this respect, it called for acquisition and adaptation of technologies that were available abroad. It also envisaged that, while training people in the use of modern techniques was necessary, the task would take a longer period of time to achieve an adequate supply of skilled labour. While the Second Plan (1970-74) continued to pursue initiatives for rural development—mainly agriculture and infrastructure—as a strategy for achieving "balanced economic development", it promoted large scaled operations under import substitution and pursued indigenization for the citizens to be involved in an active economic life "not just as employees but also as top management and entrepreneurs" (1970:304).

Table 3.3.1 Overall development policy initiatives in Kenya

period	emphasis	mechanism
1963	Kenya became independent • import substitution policy • large scaled operations	• industrial protection committee
1964		• foreign investment protection act
1965	Government orientation to planning • mixed economy (public/private sector industrial investment)	• sessional paper No.10 of 1965
1966-70	1st development plan • on agricultural sector • large scale industrial operations • indigenization programme	• cooperative societies • state corporations
1967		• trade Licensing Act • East Africa Community market established
1971		• Capital Issues Committee
1970-74	2nd Development plan • on agricultural sector • continued import substitution • continued indigenization programme	• lower tariffs on agricultural equipment • 69% tariffs on consumer goods • Foreign Exchange Allocation Committee
1974-78	3rd Development plan • rural development and agriculture • continued import substitution • shift to small scaled industries	
1977		• East Africa Community market collapsed
1979-83	4th Development plan • on agricultural sector • promotion of export oriented industries • on small scaled industries	• 20-25% export compensation • East Africa Preferential Trade Area (PTA) • provision of loan (public/private financial institutions)
1984-88	5th Development plan • mobilization of domestic resources • review of import substitution • export-oriented industries • continued small scale industries • decentralization of rural planning	• 10-20% tax allowance to rural-based industries • district-based financial allocation
1986	Re-orientation of economic management • reduction of participation of state corporations in directly productive areas	• sessional paper No.1 of 1986 • Capital Market Authority
1988	Liberalization of imports & domestic prices	• monopolies and Price Control Act
1989-93	6th Development plan • micro industries (indigenous technology) • adjustment of import substitution • export oriented industries	• expanded loan provision

Sources adapted from GoK (1) Sessional papers 10 of 1965, 1 of 1986
(2) Development plans 1966 to 1989

The Third Plan (1974-78) hinted at a new direction. Whereas it affirmed import substitution practices, it proposed promotion of the small scaled industries, noting that "the potential manufacturers lack not only production skills and capital but also expertise in cost control, accounting and marketing" (1974:19). This new direction was given greater emphasis in the Fourth Plan (1979-83:iv) which called for "new industries that are mainly reliant on domestic raw materials and which can sell part of their output in external markets". Indeed, the Fourth Plan gave considerable attention to industrial development and concluded (1979:12) that "Much industrial capacity is presently used on a one-shift basis when the potential is there for two- or even three-shift operations. The present style of operation in many cases could be more effectively organized and more efficiently managed. Much of our productive equipment—lorries, tractors, rolling stock and machinery—lies idle because of careless handling and lack of maintenance, spare parts or petrol".

Development strategies and industrial planning in the 1980s were mediated by severe scarcity of foreign exchange, in addition to declining domestic investment and rising external debt service ratio, which had increased from 2.8% of GDP in 1976 to 13% in 1983. Against this background, the fifth Plan (1984-88) placed emphasis on three areas: mobilization of domestic resources through financial institutions; promotion of export-oriented industries, but those which utilize local resources and labour-intensive technologies; and expansion of local entrepreneurship and industrial management capabilities. It is interesting to note that this plan called for review of the import substitution policy. An additional new dimension in the fifth plan was adoption of a policy for decentralized planning and implementation of rural-based enterprises. Such projects included small scaled industrial enterprises in which incentives, 15-20% tax allowance, were made available so that new enterprises would be located outside of urban areas, particularly outside Nairobi and Mombasa.

In a re-orientation of industrial planning which parallels initiatives taken in 1965, the sessional paper, No. 1 of 1986, proposed reduction of the participation of the state in investing in directly productive enterprises, in addition to liberalization of external trade. The sixth plan (1989-93), for all practical purposes, amounted to implementation of the proposals set out in the above-mentioned sessional paper and adjustments of the import substitution measures. Indeed, the sixth plan stated that "the major thrust...rests on the quest to redress and reshape those previous policies and strategies which emphasized import substitution industrialization..." (1989:33).

Adjustment of the import substitution practices involved reduction of protective tariffs, liberalization of export trade and de-control of prices for a wide range of domestic commodities. It is interesting to note that, with respect to de-control of domestic prices, exemption was given to a few essential commodities which included maize and maizemeal, wheat flour, bread, fats and edible oils. The de-control of domestic prices also necessitated measures to control monopolist tendencies and to guard against collusion in price-fixing. Such measures were put in place with the 1988 Restrictive Trade Practices, Monopolies and Price Control Act.

Besides adjustments in import substitution practices, the sixth plan also re-emphasized promotion of micro enterprises (informal sector) as a way of creating jobs at low cost and developing indigenous technologies. In addition, it called for further restructuring of ownership in the industrial sector, noting that, whereas localization has expanded progressively through individual entrepreneurs, co-operatives and state corporations, MNCs have continued to hold a significant ownership of industrial enterprises. It is worthwhile to note that expanded localization of the industrial sector was achieved largely through state corporations. Indeed, the sixth plan pointed out that, by 1986, there were 103 state corporations in manufacturing and commercial sectors.

Table 3.3.2 Shifts in industrial policy initiatives in Kenya

Period	Emphasis	Mechanisms
1966-74	1. large-scale operations	capital-intensive techniques
	2. import substitution practices	69% tariffs on consumer goods
	3. indigenization measures	state corporations
1974-83	1. import substitution continued	
	2. small-scale industries	provisions of loan for capital
	3. indigenization measures	state corporations
1985-90	1. adjustment of import substitution	liberalization of imports
	2. small-scale operations	
	3. promotion of export industries	25% export compensation
	4. indigenization measures	reduction of state corporations

Source adapted from (1) sessional papers 10 of 1965, 1 of 1986
(2) development plans 1966 to 1989

Whereas industrial policy initiatives in Kenya indicate a dual process of emphasis in small- and large-scale operations, three trends, Table 3.3.2, can be noted with regard to major emphasis. In the first decade, 1966-74, major emphasis was placed on import substitution and large-scale operations, while in the second decade, 1974-83, the major emphasis shifted to small-scale operations. Between 1984-90 the major emphasis was placed on micro enterprises and export promotion. Overall, these shifts in the major emphasis paralleled the shifts in direction with the Balanced Growth Model. The Big-Push approach has been practised through selected enterprises with State Corporations, in addition to the privileges accorded to the firms for MNCs through import substitution. While the dual process provided support programmes to enterprises of the varied categories of entrepreneurs, the shifts in major emphasis tend to conflict with expectations for promotion of industries that can meet basic demands for the local population and necessary requirements for export trade. Indeed, while micro enterprises have potential to stimulate entrepreneurial activities in the rural areas with low cost employment, over-emphasis on such operations has led to inadequate attention to the problems of technological adaptations in large scale operations.

3.4 TRENDS IN THE BAKERY INDUSTRY

The overall development policy initiatives and, specifically, those of the industrial sector have had an important influence on the growth of the bakery industry. Earlier emphasis on large-scale operations encouraged monopolistic tendencies and constrained expansion of small-scale and medium-size operations, which explains the observation by Kaplinksy (1980) that by the 1980s one firm accounted for over 66% of the total production and distribution of the bread in that country. Lower tariffs on intermediate and capital goods, as compared to those of the consumer goods, led to limited initiatives for local production of the core equipment and peripheral components.

3.4.1 Bakery firms in Kenya

While production of bread existed in Kenya in various forms with regard to domestic consumption, commercial firms only started to appear in the 1940s. Of the 140 bakery firms that were registered with the Ministry of Industry in 1988/89, 3% were established before 1949, 7% before 1960 and 19% before 1970, with the majority—65%—being established between 1980 and 1989. The firms consisted of those which have been stable since inception as well as newly established ones. A considerable number of firms, particularly micro[4] and small- scale operations, have tended to exist for only a brief period of time. According to the Industrial Census Report (CBS 1977, 1980), 222 bakery firms existed in 1972, most of them small scaled operations employing less than 19 workers.

However, various Statistical Abstracts and industrial surveys of the 1980s provided the annual number of bakery firms, as presented in Table 3.4.1. Between 1981 and 1985 the number of firms was in fact lower, as compared to the 1972 industrial census. Considerable changes are found in small-scale operations as compared to medium and large-scale firms, which are relatively few but characterized by a consistent rate of expansion.

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4 A micro operation has also been referred to as an informal sector enterprise. In the present study, it denotes a single-person or household (up to 5 person) bakery generally operating casually and/or intermittently.

One of the notable aspects with regard to the number of bakery firms in recent years is an increase from an estimate of 255 in 1986 to 400 in 1989, in which small firms exhibit a relatively high annual average rate of growth. Whereas such impressive growth can be attributted to recent emphasis and incentives for small-scale enterprises, such bakery firms consist of micro enterprises which emerge and vanish, while others operate on a seasonal basis. While the expectation with the small-scale, Balanced Growth, Model has been that micro enterprises will gradually expand into modern operations, House (1974) has suggested that most of these enterprises are actually stagnant, such that they reflect more of surplus labour rather than dynamic entrepreneurs. In this respect, the average is a better indicator of the number of firms which have been in operation. Indeed, the average reveals that the number of stable firms during the period 1981-1989 increased by 12 as compared to those of 1972.

Table 3.4.1 Number of firms in the bakery industry, 1981-89, by the number of employees

	firms[5]			
year	0-19	20-49	Over 50	total
1981	101	24	9	134
1982	121	26	10	157
1983	155	28	9	192
1984	109	30	12	15[illegible]
1985	139	33	13	185
1986	209	35	11	255
1987	240	38	14	292
1988	288	41	14	343
1989	340	44	16	400
Average	189	33	12	234
Annual Average Growth Rate*	1.19	1.08	1.09	1.16

Source: Central Bureau of Statistics, 1977,1980, 1985 and 1989

* Annual Average Growth Rate for the period was determined as follows: $((t_2/t_1)+(t_3/t_2)...)/N-1$, where t refers to the values of a given time and N stands for the total number of years observed. It will be recognised that in such computation a coefficient of 1.00 indicates stagnation, while greater than 1.00 represents positive growth and less than 1.00 represents negative growth.

3.4.2 Aggregate Output

Whereas the gross output for the bakery industry was reported to be K£ 1653 in 1972 (CBS 1977, 1980, 1985, 1989), in 1981 it stood at K£ 3350, an increase of twice the amount. Between 1981 and 1989 the aggregate output shows a consistent increase, especially with medium and large-scale operations, Table 3.4.2A. Compared to small-scale firms, medium and large firms are characterized by relatively higher annual average rates of growth. In addition, the proportions of the contribution of the medium and large firms to the total ouput are considerably high as compared to those of the small firms. Indeed, large-scale firms accounted for as high as 80% of the total output and medium-size

5 While the census reported the number of firms in 1988 and 1989 to be 343 and 400 respectively, as can be noted in the table, most of the firms were small-scale, micro operations which are rarely registered because of their irregular operations.

operations accounted for 11% to 15%, while small-scale firms are consistently less than 9%, Table 3.4.2B.

Table 3.4.2 Gross output of the bakery industry, 1981-89 (K£'000, at 1982 prices)

year	A. Absolute value small	medium	large	Total	B. as percentage of total small	medium	large
1981	245	377	2728	3350	0.07	0.11	0.81
1982	294	549	2738	3581	0.08	0.15	0.76
1983	341	534	3005	3880	0.09	0.14	0.77
1984	171	906	5098	6175	0.03	0.15	0.83
1985	184	965	5429	6578	0.03	0.15	0.83
1986	201	1024	5760	6985	0.03	0.15	0.82
1987	237	1094	6284	7615	0.03	0.14	0.83
1988	289	1143	6724	8156	0.04	0.14	0.82
1989	361	1223	7195	8779	0.04	0.14	0.82
Average	258	868	4996	6122	0.04	0.14	0.82
Annual Average Growth Rate	1.08	1.18	1.14	1.14	0.95	1.04	1.01

Source: Central Bureau of Statistics, 1977.1980, 1985, 1989

3.4.3 Labour force

The overall number of workers absorbed into the bakery industry was indicated as 2475 in 1972 (CBS 1977, 1980, 1985, 1989) and 3509 in 1981, which represents an increase by a factor of 1.4. Because of high instability among micro and small-scale operations, the relatively steady expansion of employment opportunities can be attributed to absorptive capacity in medium and large firms. It can be noted in Table 3.4.3A below that the number of workers in the bakery industry increased consistently from 1981 to 1989, with large firms being characterized by a lower, 2%, average rate of growth as compared to 17% among small firms. Whereas large-scale firms have consistently accounted (Table 3.4.3B) for the largest proportion of the workforce in the bakery industry, it is interesting and significant to note that the contribution of small-scale firms expanded from 21% in 1981 to 42% in 1989.

Table 3.4.3 Aggregate number of workers in the bakery industry, 1981-89, by the size of the firms

year	A. Absolute value small	medium	large	total	B. As percentage of total small	medium	large
1981	724	557	2228	3509	0.21	0.16	0.63
1982	1086	624	1767	3477	0.31	0.18	0.51
1983	1282	680	1677	3639	0.35	0.19	0.46
1984	897	476	2747	4120	0.22	0.12	0.67
1985	1059	495	2911	4465	0.24	0.11	0.65
1986	1270	525	2519	4314	0.29	0.12	0.58
1987	1512	567	2433	4511	0.34	0.13	0.54
1988	1814	680	2340	4634	0.38	0.14	0.48
1989	2141	816	2137	5094	0.42	0.16	0.42
Average	1309	602	2307	4218	0.31	0.14	0.55
Annual Average Growth Rate	1.17	1.06	1.02	1.05	1.11	1.01	0.97

Source: Central Bureau of Statistics, 1977,1980,1985,1989.

One of the concomitance of the expanded small-scale operations is reduction in the average number of workers per firm. Whereas the number of firms show a considerable increase in the latter half of the 1980s, the number of workers per firm declined from an average of 26 in 1981 to 24 in 1985 and 13 in 1989 (Tables 3.4.1 and 3.4.3).

3.4.4 Labour Costs

As pertaining to the labour costs in the bakery industry, Table 3.4.4A, there was an increase by a factor of 2.6 from K£1404 in 1981 to K£3606 in 1989, with which the highest annual average growth occurred in medium-size operations. With regard to absorption of the labour costs by the various categories of firms, large-scale operations accounted (Table 3.4.4B) for over 70%, and medium-size firms accounted for 17%, while small firms absorbed less than 9%. In terms of the costs per worker, comparing Tables 3.4.4A and 3.4.3A, labour costs rose from K£400 in 1981 to K£708 in 1989 in the case of all the firms, which constitute an increase by a factor of 1.8. While considerably high increases, i.e. by factor of 2.5, in such costs are found in large and medium size firms, small-scale enterprises are characterized by virtual stagnation, at about K£189. This points to the fact that while small-scale operations have tended to absorb an increasing proportion of labour in the recent years, their wages have remained substantially lower and practically stagnant in comparison to the medium and large scale enterprises. However, as various reports (King 1974, Langdon 1984, Stewart 1990a) have indicated consistently, most of the micro and small-scale operations are family enterprises that are characterized by rather arbitrary wages, and which present difficulties in measurement and accounting.

Table 3.4.4 Labour costs in the bakery industry, 1981-89 (K£'000)

	A. Absolute value				B. As percentage of total		
year	small	medium	large	total	small	medium	large
1981	137	161	1106	1404	0.10	0.11	0.79
1982	178	108	1110	1396	0.13	0.08	0.80
1983	206	140	1218	1564	0.13	0.09	0.78
1984	165	584	2066	2815	0.06	0.21	0.73
1985	190	632	2237	3059	0.06	0.21	0.73
1986	224	659	2335	3218	0.07	0.20	0.73
1987	264	717	2539	3520	0.08	0.20	0.72
1988	323	601	2669	3593	0.09	0.17	0.74
1989	403	599	2604	3606	0.11	0.17	0.72
Average	232	467	1987	2686	0.09	0.17	0.74
Annual Average Growth Rate	1.15	1.40	1.13	1.15	1.01	1.22	0.99

Source: (1) Central Bureau of Statistics, 1977,1980,1985,1989

3.4.5 External Trade

Whereas potential exists in Kenya for export of the bakery products to neighbouring countries, available data indicate that export of such commodities has, in fact, declined consistently since 1981, with the exception of 1985. Specifically, export decreased from 1,328 tonnes in 1981 to 398 tonnes in 1988 (Table 3.4.5). This decline in domestic export of the bakery products can be attributed to steady increase in domestic consumption and also reduction in utilization of the production capacities. Although import of the bakery products has been considerably lower as compared to the export, the quantities imported show a declining trend with the exception of 1984 and 1985. In point of fact, the imports during this period account for the rather exaggerated annual growth rate.

Table 3.4.5 Domestic exports and direct imports of bakery products, 1980-88*

Year	Domestic exports MT.	K£('000)	Direct imports MT.	K£('000)
1980	2,461	615	5.90	4.44
1981	1,328	1,063	20.60	19.62
1982	635	589	6.89	7.02
1983	597	650	2.62	6.06
1984	828	753	54.81	13.13
1985	1,494	1,445	42.76	17.24
1986	944	840	12.21	34.19
1987	726	448	3.31	1.15
1988	398	367	1.93	2.48
Annual Average Growth Rate	0.89	1.05	3.38	1.66

Source: Central Bureau of Statistics (Annual Trade Reports): 1980 to 1988

* Aggregated values of the SITC codes 048411, 048419, 048422 and 048429

In summary, the trends in this food sub-sector taken together indicate that medium and large-scale operations have made a substantially high contribution to the growth of the industry, particularly with respect to aggregate gross output and absorption of labour. Besides stability that characterizes such firms, they tend to have advantage of the capacity to adopt effective technologies. On the other hand, micro and small-scale operations have, in essence, been able to expand employment opportunities, particularly in recent years. However, employment opportunities in such firms have tended to be temporary because of their high instability and seasonal operations.

4 THEORETICAL MODEL AND HYPOTHESES

The aim of this study, as stated above, is to examine variation in adaptation of the production technologies, specifically in terms of the nature of investments, adopted equipment and their utilization, inducement of local manufacturing and labour requirements in the bakery industry. One of the purposes of this investigation is to identify the extent to which such variations are influenced by the changes in the attributes of the entrepreneurs and of the firms. In Chapter 2, two theoretical models of industrial planning are presented—Small-Scale and Big Push—with their respective propositions and empirical outcome in areas that have been applied, while Chapter 3 was a discussion of development planning in Kenya with special reference to industrial planning and the way the two models of economic growth has been applied. As noted in the two chapters, the two models differ in their basic assumptions and approach with regard to the strategy or the path towards self-sustaining industrial operations, with which the identified determinant factors differ. One of the conclusions was that the determinant factors under the two models were deficient insofar as they did not include variation in the characteristics of the entrepreneurs as a causal variable. In this chapter, the differences and the deficiencies of the two models are re-examined with a view of presenting a more predictive causal relationship among the determinant factors.

4.1 THEORETICAL PERSPECTIVE

With the initial Balanced Growth Model, as indicated above, the assumption was that lack of subsequent investment and adaptation of technologies was a result of a condition of stagnation, described by Nurkse (1953:10) as "underdevelopment equilibrium", characterized by small markets, unemployment and low productivity. In order to expand the market and employment opportunities and to increase productivity, according to the proponents, it was envisaged that large-scale efforts were necessary to develop infrastructural services which would induce creation of simultaneous industries that would in turn bring about complementarity in demand and supply of goods and services. In addition, the proponents (Rosenstein-Rodan 1943, 1984) argued that large-scale operations, or firms, were necessary in order to achieve economies of scale. However, revisionists (Schumacher 1973, Stewart, 1977, 1984, 1990, Ranis 1990) have argued that such large-scale efforts would lead to adoption of inappropriate technologies, in terms of requirement for large capital, less adaptability to local skills, demand for less utilization of labour, and higher levels of risk.

In the view of these revisionists, it was necessary to promote simultaneous small-scale and dispersed industries, in respect to different industrial sectors and to "locational dimensions," particularly rural-urban balance. According to these revisionists, such a small-scale, Balanced Growth Model would lead to profitable operations and technologies that demand low capital and large utilization of labour and local resources. In this perspective, the assumption has been that the savings which arise from increases in the previous output constitute inducement for reinvestment with which production capacities and adaptation of technologies will be expanded. Additional assumption has been that, given a competitive environment, firms would adapt techniques that are efficient or that provide profitable operations. Notwithstanding these two assumptions, a third assumption has been that the nature of investment and adaptation of the production technologies will be influenced by inducements in the form of incentives that arise from improvement in the infrastructural services and taxation mechanisms. Indeed, in the application of this model in Kenya, since the late 1970s, investment allowances of 15% to 20% have been made available to firms based in rural areas and use of labour-intensive technologies.

In summary, with small-scale, Balanced Growth Model, the primary determinant factors with regard to adaptation of technologies are: 1) the nature of investment, particularly small-scale operations; 2) inducement in location in terms of terms of the infrastructural services and tax incentives, 3) and the rate of market expansion, with which the latter two are considered, in essence, as mediating factors. In this respect, the structure of causal relationship among the variables can be represented as in Table 4.1.1:

Table 4.1.1 **Causal relationship of variables under Balanced Growth Model**

	2. plant location (inducements)	
1. nature of investment ....>	firms ....>	investments & adaptation of
(small-scale operations)	3. market size	technologies

In my view, this perspective entails two major deficiencies. First, one can question its viability as a strategy towards achieving self-sustaining industrial growth and adaptation of technologies, particularly with regard to the capability of small-scale enterprises to compete with large-scale firms, usually MNCs. As noted in Chapter 3, while emphasis has been placed on micro and small-scale operations in Kenya for over a decade, large-scale enterprises have continued to have greater impact with respect to total GDP and absorption of labour within the industry. Conversely, micro and small firms have continued to be subject to a high rate of instability. This is particularly interesting in light of the fact that nation has shifted its emphasis to export-oriented industries. Indeed, other studies pointed out that small-scale firms have been characterized by difficulties related to technical, financial and marketing operations. Further, because of their numbers and dispersion, the support programmes intended to assist such firms have achieved limited success. Even experiences outside developing countries (Bhalla et al. 1984) have indicated that large-scale investments have relative advantages with respect to adaptation of the production technologies.

The second deficiency with the small-scale model, which I have indicated above, concerns the treatment of capital investment as the primary agent for expansion of production and adaptation of technologies. In my view, the role of capital is basically that of facilitating efforts of the entrepreneurs to mobilize needed resources, i.e. equipment, labour and raw materials. Indeed, Schumpeter emphasized such a role in his observation that "capital is nothing but the lever by which the entrepreneur subjects to his control the concrete goods which he needs, nothing but a means of diverting the factors of production to new uses, or of dictating a new direction to production" (1934:116). In this respect, the position of capital is that of mediating between the initiatives of the entrepreneurs and required adaptation of technologies and, subsequently, expansion of production capacities.

The Big Push, Unbalanced Growth Model assumed that the lack of subsequent investment and adaptation of technologies is a result of limited or ineffective backward and forward effects of the previous investments and that under such conditions entrepreneurs cannot decide independently on the potential areas of investment. In other words, subsequent investment depends on the strength of the "complementarity in investments". In this respect, it will be recalled that the term "inducement" with the Big Push model refers to demands that arise from backward or forward effects of the previous investment. An additional assumption is that the performance with regard to utilization of the production capacities depends on the pressure that is subject to entrepreneurs and/or managers. In order to achieve self-sustaining industrial growth and adaptation of technologies, large scaled operations are required in selected industries or firms that have the largest backward or forward linkages, and adoption of equipment in the production process which will not only indicate the level of performance but also create pressure and rhythm for the entrepreneurs and managers.

The primary determinant factors, with respect to the Big Push perspective, therefore, are (1) the nature of investment, particularly large-scale operations, (2) inducements that arise from infrastructural services in a location, and (3) the nature of the production process. This structure of the causal relationship among the variables can be represented as in Table 4.1.2:

Table 4.1.2 Causal relationship between variables under the Unbalanced Growth Model

	2. plant location (inducements)	
1. nature of investment (large-scale operations) ------------------------------>	firms ------------------------------>	investment & adaptation of technologies
	3. nature of production	

Besides its importance with respect to infrastructural services, location of the firms encompasses the effects of backward and forward linkages which can arise through investment sequences, as in the case of a lead industry, and satellite industries. It is envisaged that such satellite industries "enjoy a strong locational advantage from proximity to the master industry" (Hirschman, 1958:102).

One of the advantages of the Big-Push, Unbalanced Growth Model, is the potential that it holds with respect to accelerating industrial growth and adaptation of the production technologies. It provides a country or region with the capability for competitive operations, particularly in respect to large MNCs and export-oriented industries.

Application of this model in Kenya has been restricted to the firms that are run by the state corporations. Large-scale, capital-intensive operations undertaken by state corporations are found in steel, sugar, mining, and paper industries (Kaplinsky 1984b, Grosh 1986, Mikkelsen 1987, Coughlin 1988). As I pointed out in the previous chapter, in the private sector large industries or firms constitute an application of the Big Push development approach because of policies, incentives and privileges that have promoted the operation of such firms. In the bakery industry, the Elliots' company has had characteristics of such operation for a considerable period of time (Kaplinsky 1980) as have establishments which employ over 50 workers.

However, this Big Push approach is subject to two major deficiencies. One concerns the nature of the Big Push. The drive for Big Push in selected industries tends to impose a modern self-contained system of production upon a stagnant and equally self-contained system. In addition, such large capital-intensive operation entails "diseconomies", i.e. destruction of small enterprises, in the same sector and potentially other unrelated but physically proximate ones (Hirschman 1958, Masi 1988).

The second deficiency of the Big-Push model, in my view, concerns the proposition that change, i.e. subsequent investment or adaptation of techniques, will occur through "pressure" to redress the imbalances. Besides the fact that such pressure may not always be palatable, disproportion is a phenomenon that operates at intervals as and when pressure coalesces into a force. It cannot be over-emphasized that such coalescence may not be readily achievable as and when decisions are required. In any event, when such pressure coalesces, it can only play a mediating role, an intervening variable.

The most significant aspect, however, is the fact that the two economic models entail a substantial deficiency with respect to the nature and order of causation among the determinant factors. Inducements that arise from either expanded market opportunities, complementarity of investment (linkages) or improvement in the infrastructural services are external to the operations of the firms and do not explain on a continuous basis the problem identified by Hirschman, i.e. "inability to invest", or to take required decisions at the required speed. In Chapter 2 I pointed out the fact that Hirschman recognized this deficiency and the fact that the primary agent for investment and adaptation of the technologies ought to be entrepreneurs. However, instead, he assigned such role to machine-paced operations, which is not tenable in view of the fact that adoption of technology is preceded by certain entrepreneurial activities such as establishment of the enterprises, acquisition of input and creation of markets for the output. Adoption of technologies, in this respect, is in fact dependent on the entrepreneurship, and, as such, technology can only play a mediating role for its subsequent adaptation.

In his study of industrial development in developed countries, by placing the role of the entrepreneurs at the centre of investment activities and adaptation of technologies, Schumpeter (1934) pointed in the right direction. His analysis, however, entailed a flaw with respect to his restriction of entrepreneurship to only individuals who bring about major and often rare innovations. Indeed, Schumpeter stated that "everyone is an entrepreneur only when he actually carries out new combinations and loses that character as soon as he has built up his business" (1934:78). Such restriction discounted more regular, but equally important, entrepreneurial activities of investment and adaptation of technologies.

Leibenstein (1968) provided a more realistic perspective, which distinguished two types of entrepreneurial activities: those that can be considered as routine and those that can be considered as new initiatives. In this respect, the former consists of management functions which involve coordination of resources in well established operations, and the latter involves creation of new resources and new combinations of the techniques of production. It is my view that the entrepreneurial process is characterized by the alternate and, at times, simultaneous undertaking of both routine operations and new initiatives.

Consequently, when entrepreneurship is taken explicitly as the principal determinant factor, the Unbalanced Growth Model will be more applicable to the conditions of the firms in developing countries. Indeed, the need for deliberately sustained "pressure" in the model arose because of the failure to incorporate explicitly the role of entrepreneurs in the investment process and adaptation of the production technologies. With inclusion of the role of the entrepreneurs, the order and structure of the determinant factors can be represented as in Table 4.1.3:

Table 4.1.3 **Causal relationship between variables, proposed in this present study**

inducements (policies & incentives) ······>	external inducements (infrastructural services) 2. location	
1. entrepreneurial actions ······>	firms ······>	adaptation of technologies & production capacities
	3. nature of investment 4. nature of production	

First, in this revised model, establishment of the firms is preceded by entrepreneurial actions (characteristics and capabilities) in a direct causation, such that entrepreneurs determine the nature of investment and of the production process, which in turn influence directly the type of equipment adopted, installed capacity and utilization as well as labour requirements. Second, inducements in the form of policies, tax allowance incentives and infrastructural services as manifested in a given location play an important mediating role at various stages of industrial growth and production process.

One of the conclusions of Chapter 2 was that entrepreneurs that are characterized by group or cooperative orientation are likely to have greater impact in the investment process and the adaptation of the production technologies, with such orientation arising from coalescence of a widely distributed experience in the industrial operations.

Further, studies were cited (Kilby 1971, Cole 1968, King 1975) that indicated that such experience has been sustained through either the process of succession and/or the transfer of roles. These authors reported that entrepreneurs whose performance has been high in entrepreneurial and industrial operations had acquired the enterprises, knowledge and skills through family succession. In addition, such entrepreneurs were characterized by a background with respect to traditional occupations, specifically trade, that had roles similar to those required in the modern industrial activities. These authors observed that these processes, succession and transfer of the roles provided transmission of skills, attitudes and conditioning for effective entrepreneurial performance.

It is such experience which consists of accumulated capital, knowledge, skills and conditioning for industrial entrepreneurial operation that promotes group or cooperative orientation. It will be recalled that Schumpeter (1934) considered entrepreneurs to be individuals motivated exclusively by pursuit of individual interests. It is interesting to note that this perception of entrepreneurs as individuals motivated exclusively by psychological factors is a variant of Hirschman's ego-image of change which is also found in other expositions (McClelland 1961, McClelland and Winter 1969, Hagen 1962). However, such a view is a misconception of the roles and functions of entrepreneurs as derived from the social division of labour.

I pointed out in the previous section that Hirschman's analysis led him to the conclusion that entrepreneurs whose operations are based exclusively on individual orientation tend to have limited capabilities for promoting sustainable expansion of the production capacities and adaptation of technologies. Indeed, we noted that such a conclusion has been supported by a number of empirical studies. It is my argument that entrepreneurial functions are derived from the structure of the division of labour in a group, community or society, and as such individual orientation may not have effective mechanisms for successful undertaking of such roles. In this respect, entrepreneurs whose operations are characterized by group-image of change, or group orientation, have greater potential with respect to promoting effective performance in industrial entrepreneurial activities.

4.2 HYPOTHESES

In respect to the proposed theoretical perspective, Table 4.1.3, four sets of hypotheses are developed in this section. The hypotheses presented below concern predictions on the influence of entrepreneurs, location and size of the firms with regard to (1) production organization, (2) supply of equipment and components, (3) labour requirements and (4) acquisition of a skilled labour force. In order to examine more specific aspects, sub-hypotheses are presented in each of these areas.

4.2.1 Production organization

Several aspects of production organization lend themselves to working hypotheses. Hypotheses are developed concerning the nature of influence of the type of entrepreneurs, the location of the plant, and the size of the firms. Overall, the type of entrepreneurs is predicted to have an influence on the nature of investment which, in addition to the effects of the location of the firms, will in turn have influence on other aspects of the production organization.

4.2.1A Nature of investment

It is anticipated that *(1) the nature of investment will vary with the type of entrepreneurs, in such a way that firms of MNCs will be characterized by large-scale operations, while firms of local entrepreneurs with prior experience will be characterized by medium sized operations as compared to firms of recent industrial entrepreneurs which will be characterized by small-scale operations.* This expectation, as pointed out above, arises from the extent of the collaborative network, accompanied by resources and capabilities, that entrepreneurs have developed. In addition, it is predicted that *(2) the nature of investment will vary with the location of the firms in such a way that a shift in location from rural to urban areas will be associated with an increase in capital investment.*

4.2.1B Equipment adopted

Arising from the fact that such different levels of operations call upon a different production organization, it is predicted further that *(3) types of equipment adopted by the firms will vary with the type of entrepreneurs, in such a way that firms of MNCs are characterized by adoption of modern equipment (capital-intensive and fully integrated), while firms of local entrepreneurs with prior experience will be characterized by adoption* *of partial modern equipment (semi-automation) as compared to firms of recent industrial entrepreneurs which are expected to be characterized by limited core-processing equipment and manual operation.*

In addition, it is predicted that *(4) types of equipment adopted by firms will vary with the location of firms, in such a way that firms located in urban areas will be characterized by adoption of modern equipment, while firms located in semi-urban areas will be characterized by partial adoption of modern equipment (semi-automation) as compared to firms located in rural areas which are expected to be characterized by limited core equipment and manual operations.* This relationship is expected for two reasons. First, the size of the market is larger in urban areas as compared to rural areas, particularly in the case of bakery products. In respect to the theoretical discussion presented above, the market size is expected to be considerably larger in urban and semi-urban areas, in that order, because of greater complementarity in demand that arises from concentration of industries in such areas. The second aspect which influences the predicted relationship is the level of the infrastructural services which, because of concentration of industries, is considerably higher in urban and semi-urban areas, as compared to rural areas. One particularly important infrastructural facility with regard to adoption of equipment by firms is electrical services. It is worthwhile to note in this respect that, while electrical services had been restricted for a considerable period of time to urban and semi-urban areas, initiatives undertaken in the 1980s in Kenya involved extension of electrical services to the rural production centres. These initiatives are expected to have eased (or relaxed) some of the constraints with regard to adoption of equipment in rural areas.

As stated above, the nature of investment is influenced initially by the type of entrepreneurs after which it influences other aspects of production organization. Specifically, it is predicted that *(5) types of equipment adopted by firms will vary with their size in such a way that large firms will be characterized by adoption of fully integrated modern equipment, while medium sized firms will be characterized by disaggregated modern equipment as compared to small firms which are expected to be characterized by limited core processing equipment and manual operations.* As pointed out, this relationship is expected because large firms are able to absorb the cost of such modern equipment which, at the same time, is a constraint to small scaled operations. In addition, large investment inherently calls for adoption of technically efficient [modern] equipment as a way of maximizing marginal returns and of preserving developed markets.

4.2.1C Utilization of production capacities

It was pointed out above that the type of equipment adopted by firms determines production capacities and the proportion of utilization (Hirschman 1958, Stewart 1977). With regard to this observation, it is predicted that *(6) utilization of production capacities will vary with the types of entrepreneurs in such a way that firms of MNCs will be characterized by high utilization of production capacities, while firms of local* *entrepreneurs with prior experience will have relatively higher utilization of production capacities as compared to the firms of recent industrial entrepreneurs.*

The location of firms is expected to have influence on production capacities and their utilization through the influence, indicated above, on equipment and market size. In this respect, it is predicted that *(7) utilization of production capacities will vary with the location of firms, in such a way that a shift in location from rural to urban areas is expected to be characterized by higher utilization of production capacities.* One condition which may affect such relationship is the location of milling industries, since the bakery industry, in essence, can be a result of the forward effect of milling industries which, in Kenya, are concentrated in semi-urban areas.

It will be recognized that production capacities constitute the nature of investment such that the larger the capital investment, the larger the production capacity. The interesting aspect, however, is the way in which the nature of investment influences utilization of such capacities. In this regard, it is predicted that *(8) utilization of production capacities will vary with the size of firms, in such a way that large firms will be associated with higher utilization of production capacities as compared to relatively smaller firms.* This relationship is expected, as stated above, because of the ability of large scaled operations to minimize interruptions in the supply of input and market demand. In the case of Kenya, where frequent shortage of wheat flour is a major cause of low utilization of production capacities, large scaled operations have large storage facilities and have been vertically integrated with milling firms. These hypotheses are summarized in Table 4.2.1 below:

Table 4.2.1 Summary of hypotheses concerning production organization

Nature of investment

P1. The nature of investment will vary with the type of entrepreneur in such a way that firms of MNCs are characterized by large scaled operations, while firms of local entrepreneurs with prior experience will be medium sized operations, and firms of recent industrial entrepreneurs will be characterized by small scaled operations.

P2. The nature of investment will vary with the location of firms in such a way that a shift in location from rural to urban areas will be associated with an increase in capital investment.

Type of equipment

P3. Types of equipment adopted by firms will vary with the type of entrepreneur in such a way that firms of MNCs are characterized by adoption of modern equipment (capital-intensive, full automation), while firms of local entrepreneurs with prior experience will be characterized by partial adoption of modern equipment (semi-automation) as compared to the firms of recent industrial entrepreneurs which are expected to be characterized by limited core processing equipment and manual operations.

P4. The type of equipment adopted by firms will vary with the location of the firms in such a way that firms located in urban areas will be characterized by adoption of modern equipment, while firms located in semi-urban areas will be characterized by partial adoption of modern equipment (semi-automation) as compared to firms located in rural areas which will be characterized by limited core equipment and manual operations.

P5. Types of equipment adopted by firms will vary with their size in such a way that large firms will be characterized by adoption of fully integrated modern equipment, while medium sized firms will be characterized by disaggregated modern equipment as compared to small firms, which will be characterized by core processing equipment and manual operations.

Utilization of production capacities

P6. Utilization of the production capacities will vary with the type of entrepreneur in such a way that firms of MNCs will be characterized by high utilization of production capacities, while firms of local entrepreneurs with prior experience will be characterized by higher utilization of production capacities as compared to firms of recent industrial entrepreneurs.

P7. Utilization of production capacities will vary with the location of firms in such a way that a shift in location from rural to urban areas will be characterized by higher utilization of production capacities.

P8. Utilization of production capacities will vary with size of firms in such a way that large firms will be associated with higher proportion of capacity utilization as compared to small firms.

4.2.2 Promotion of local manufacturing

It was pointed out above that local manufacturing capability in the bakery industry would arise from the way in which firms acquire their equipment and peripheral components. In this section, hypotheses are presented concerning ways in which firms are expected to acquire equipment and peripheral components.

4.2.2A Supply of equipment

It will be recalled that, under import substitution practices, foreign investors and local entrepreneurs involved in medium sized operations were given privileges to undertake direct imports of the equipment and peripheral components. Practically speaking, such privileges were granted for importation of intermediate and capital goods (Coughlin 1988), which privileges, as in other industrial sectors, were based on the argument that bakery firms in Kenya were few and would not be able to sustain local manufacturing enterprises. In this respect, it is predicted that *(9) sources for acquisition of equipment will vary with firms in respect to the type of entrepreneur in such a way that firms of MNCs will be characterized by direct imports, while firms of local entrepreneurs with prior experience will be expected to acquire equipment through local agents of foreign suppliers as compared to firms of recent industrial entrepreneurs which are expected to acquire equipment from local manufacturers.*

Essential bakery equipment, as will be discussed in chapter five, consists of mixers, provers, moulders and ovens. This equipment, among others, has evolved with firms in developed countries through various phases and applications of scientific knowledge (Stewart 1984, Matz 1988). Local production of such equipment in developing countries requires participation of foreign firms which hold the patents. Because of what is considered to be small markets, i.e. with regard to the number of bakery firms which would require such equipment, the firms which hold the patent prefer to produce this equipment in their own countries. In this respect, the option available to a developing country with regard to local production of such equipment is upgrading of traditional equipment. The oven is one piece of bakery equipment which, because of its critical importance, has existed in many traditional societies and has been upgraded in various forms. However, such upgrading has not been accompanied by application of advanced scientific techniques as compared to those produced in developed countries. Consequently, such traditional or upgraded ovens tend to be adopted by entrepreneurs who undertake limited production and produce bread for enclaved markets.

One of the theoretical propositions is the expectation that location of the firms influences the way in which firms promote local manufacturing. It will be recalled, however, that the primary requirement is existence of firms which would create demand that would support viable operations, in addition to availability of skills. As will be shown later, in the case of Kenya, commercial bakery firms located in rural areas are sparsely distributed and characterized by small scaled operations. Concentration of such firms and those in manufacturing in other sectors are expected in semi-urban and urban areas. Consequently, it would be expected that enterprises dealing with bakery equipment would emerge in urban and semi-urban areas in order to take advantage of external economies arising from concentration of other industries. However, as pointed out, such initiatives have not occurred because of policies which have emphasized selection and importation of equipment existing in foreign countries. Indeed, such policies have provided tax allowances of up to 25% as incentives for capital investment to firms importing bakery equipment and are located in the rural areas. In this respect, demand for locally manufactured equipment occurs from small scaled operations which have limited capital for investment. Because such operations are found mostly in rural areas, it is predicted that *(10) sources of acquisition of equipment will vary with the location of firms in such a way that firms based in rural areas are expected to acquire equipment from local manufacturers, while firms located in urban areas are expected to acquire equipment and components through local agents of foreign suppliers or direct import.* One other source which has been identified by Langdon (1984) involves acquisition of secondhand equipment from other firms.

It will be recalled that the theoretical expectation is that large scaled operations would have greater impact as compared to small scale operations (Hirschman 1958, 1984) with regard to influence on local manufacturing or subsequent local entrepreneurial activities. However, empirical studies (Masi 1988) have indicated that large scaled operations may not necessarily stimulate subsequent entrepreneurial activities. One of the reasons given by Masi is the fact that large scaled operations tend to be characterized by vertical integration with other firms. In the case of developing countries, large scaled firms are subsidiaries of MNCs, which are integrated with foreign-based groups of companies which, subsequently, supply equipment. A second factor in which large scaled operations are expected in the case of Kenya to have negligible impact on the promotion of local manufacturing of bakery equipment is the privilege, mentioned above, which has been granted to such firms to import equipment. In this respect, it is predicted that

(11) sources of acquisition of equipment will vary with the size of firms with the effect that small-scale operations are expected to acquire equipment from local manufacturers, while large-scale operations are expected to acquire equipment through local agents of foreign suppliers or direct import.

4.2.2B Supply of components

The nature and extent to which bakery firms encourage local entrepreneurial activities within the sub-sector is considered separately, in this study, from the supply of equipment because of the fact that manufacturing and handling of such components are considered to be relatively easy and accessible to local entrepreneurs. One of the important daily activities in the bakery industry is packaging. As discussed in chapter 6, packaging materials are necessary in every bakery enterprise and, in most cases, such materials can be obtained or manufactured independently of the main processing equipment (Coughlin 1988:157). In this respect, it is predicted *(12) that the sources for the peripheral components will vary with firms in respect to the type of entrepreneur in such a way that firms of MNCs will be characterized by direct import of the components as compared to firms of local entrepreneurs which are expected to acquire peripheral components from local suppliers*. As stated above with regard to sources of equipment, such relationship is expected because firms of MNCs are integrated with other foreign-based firms which process required peripheral components. In the case of packaging of bread, the most common material in East Africa, for example, involved variation of polyethylene paper which is manufactured from petroleum products. While such material can be manufactured locally, MNCs control input which, in addition to supplying a large number of bakeries in the region, are able to process such material in required variation at reduced cost.

Because of the expected variation in production capacities in respect to the location of firms, it is predicted that *(13) sources of the peripheral components will vary with the location of firms in such a way that firms based in rural areas will acquire peripheral components from local suppliers as compared to firms based in urban areas which are expected to be characterized by direct import of the components.* Specifically, because the firms based in rural areas will tend to produce limited quantities of bread, the demand for high performance on materials for handling is expected to be minimal as compared to that of firms based in urban areas.

In addition to the influence of entrepreneurs and of location, it is predicted that *(14) sources of peripheral components will vary with the nature of investment in such a way that large firms will be characterized by direct import as compared to small firms which are expected to acquire components from local suppliers.* One of the reasons for expecting such a relationship, as already mentioned, is the influence of the entrepreneurs, particularly with respect to firms of MNCs. The other is the fact that large scaled production calls for handling materials which provide sustained preservation of the products and reliable supply of such materials.

Table 4.2.2 Summary of hypotheses concerning promotion of local manufacturing

Supply of equipment

E9. Sources of acquisition of equipment will vary with the type of entrepreneurs in such a way that firms of MNC's are characterized by direct imports, while firms of local entrepreneurs with prior experience will be expected to acquire equipment through local manufacturers and agents of foreign suppliers, as compared to firms of recent industrial entrepreneurs which are expected to acquire equipment from local manufacturers.

E10. Sources of acquisition of equipment will vary with the location of the firm in such a way that firms based in rural areas are expected to acquire equipment from local manufacturers, while firms located in urban areas are expected to acquire equipment through local agents of foreign suppliers and direct imports.

E11. Sources of acquisition of equipment will vary with size of firms in such a way that small scaled operations are expected to acquire equipment from local manufacturers, while large scaled operations are expected to acquire their equipment through local agents of foreign suppliers and direct imports.

Supply of components

E12. Sources of acquisition of peripheral components will vary with the type of entrepreneur in such a way that firms of MNC's are characterized by direct imports, while firms of local entrepreneurs with prior experience will be expected to acquire peripheral components through local manufacturers and agents of foreign suppliers, as compared to firms of recent industrial entrepreneurs which are expected to acquire components from local manufacturers.

E13. Sources of acquisition of peripheral components will vary with the location of the firm in such a way that firms based in rural areas are expected to acquire components from local manufacturers, while firms located in urban areas are expected to acquire components through local agents of foreign suppliers and direct imports.

E14. Sources of acquisition of peripheral components will vary with size of firms in such a way that small scaled operations are expected to acquire components from local manufacturers, while large scaled operations are to acquire their components through local agents of foreign suppliers and direct imports.

4.2.3 Labour requirements

As pointed out above, the nature of production involves combination of machinery and labour. Because of such relationship, the hypotheses which are developed in this section are complementary to those presented in section 4.2.1. above. The overall prediction, in this regard, is that the type of entrepreneurs influences the nature of investment which, in turn, and in addition to the effects of location of the firms, influences labour requirements. In other words, determination of labour requirements involves interaction of the entrepreneurs who are called upon through a set of incentives to create employment opportunities, the location and the nature of investment which exert influence on the number and combination of the labour required. In such interaction, the nature of investment is expected to have primary influence.

4.2.3A Level of employment

With regard to overall employment, it is predicted that *(15) absorption of labour will vary with firms in respect to types of entrepreneurs in such a way that firms of MNCs will be characterized by large absorption of labour, while firms of local entrepreneurs with prior experience will have relatively larger absorption of labour as compared to firms of recent industrial entrepreneurs. In addition, such relationship is expected to be characterized by a relatively large number of unskilled workers.* One of the reasons why such a relationship is expected in Kenya, as pointed out in the previous chapter, is that creation of employment is one of the conditions with which firms of MNCs and indeed foreign investors are encouraged through incentives, privileges and protection against other competitions.

Because of the expected influence of the location, as discussed above, it is predicted further that *(16) absorption of labour will vary with the location of the firms in such a way that a shift in location from rural to urban areas will be associated with an increase in the number of employees, and will be characterized by a relatively large number of unskilled workers.* This relationship is expected because, in urban areas as compared to rural areas, the demand for products is considerably larger in addition to extensive external economies which arise from improved infrastructural services.

While the type of entrepreneurs and the location of firms are expected to have influence on overall absorption of labour, theoretically, the nature of investment is a primary determinant factor (Hirschman 1958, Mikkelsen 1987, Masi 1988). In this respect, it is predicted that *(17) absorption of labour will vary with size of firms in such a way that the number of workers increases, on average, as the size of firms increases, and will be characterized by a relatively large number of unskilled workers.* In other words, large scaled operations will demand more labour as compared to small scaled operations. The reason for expecting such relationship is that while large scale operations will be characterized by capital-intensive, labour-saving equipment, demand for utilization of labour is generated from peripheral sub-processing, machine handling and distributional services.

4.2.3B Labour wages

One critical aspect which entrepreneurs use to attract and retain workers is wages. While the theoretical expectation is that the level of wages is determined by productivity and economic forces of supply and demand for labour, it is also determined by the statutory requirement for minimum wages in Kenya and most of the developing countries (Mikkelsen 1987). However, entrepreneurs are characterized by different levels of capabilities with regard to setting the level of wages over and above the minimum statutory requirement. In this respect it is predicted that *(18) average wages of workers will vary with firms in respect to the type of entrepreneur in such a way that firms of*

MNCs will be characterized by higher wages as compared to firms of local entrepreneurs. Such expectation arises from the fact that MNCs undertake large scaled operations which, besides having relatively higher productivity, can absorb higher wages. Because such characteristics are mediated by the location of firms, it is predicted that *(19) wages of workers will vary with the location of firms such that a shift in location from rural to urban areas will be associated with increase in wages.* While entrepreneurs and location of the firms influence wages, the primary determinant factor is the nature of investment in which large scaled operations are characterized by the capacity to absorb and spread the cost of production. In this respect, it is predicted that *(20) wages of workers will vary with size of firms, with average wages increasing as the size of firms shifts from micro-operations to large scaled operations.*

4.2.3C Productivity of labour

It will be recalled that one of the arguments with regard to adoption of the Big Push or small scaled production concerns the productivity of labour. It is argued (Hirschman 1958) that large scaled, capital-intensive operations will be associated with higher productivity of labour. With the theoretical perspective proposed in the present study, the argument is that such productivity is influenced also by the management practices of entrepreneurs. It is predicted that *(21) productivity of labour will vary with firms in respect to the type of entrepreneur in such a way that firms of MNCs will be characterized by high productivity of labour, while firms of local entrepreneurs with prior* *experience will be characterized by a relatively higher productivity of labour as compared to firms of recent industrial entrepreneurs*. This relationship is expected because of the variation in capabilities of the entrepreneurs to mobilize input and to expand market opportunities in order to ensure continuous production operations.

In addition to the influence of entrepreneurs, location of the firms is expected to have effects on the productivity of labour. It is predicted that *(22) productivity of labour will vary with the location in such a way that firms based in rural areas will be characterized by lower productivity as compared to firms based in urban areas*. This relationship is expected because firms based in rural areas tend to serve small markets, which fact brings about discontinuities in production which, in turn, reduces their productivity of labour.

It will be recalled that one of the major contentions between small scaled orientation and the Big Push approach concerns productivity of labour. In addition to large scaled operations, it was argued that capital-intensive equipment in such operations influence the pace of production which results in higher productivity. In this respect, it is predicted that *(23) productivity of labour will vary with the size of firms in such a way that large firms will be characterized by higher levels of productivity as compared to relatively smaller firms*.

4.2.3D Labour skills

One of the requirements for utilization of labour in production, as stated in the two previous chapters, is skilled labour. Contrary to the impression given by other studies (Kaplinsky 1980) which indicated production of bread as less skill-intensive, production of bread is considerably skill-intensive. Indeed, for viable commercial operations, entrepreneurs, management and workers require basic knowledge of input and of appropriate combination, skills for controlling the actual production process, for handling equipment, and for distribution of the products. While such basic operational skills are required in any commercial enterprise, competitive operations and innovation will depend upon the level of the skilled labour force. However, skilled labour force brings about increased cost of production which relatively recent enterprises may not be able to absorb.

Because of this tendency and the condition placed on foreign investors in Kenya to not only create employment but to also develop skilled labour, it is predicted that *(24) absorption of skilled labour will vary with firms in respect to the type of entrepreneurs in such a way that firms of MNCs will be characterized by higher absorption of skilled labour, as compared to firms of local entrepreneurs.* This relationship, as pointed out above, is subject to additional influence by the location of the firms. Consequently, it is predicted that *(25) absorption of skilled labour will vary with the location of firms in such a way that a shift in location from rural to urban areas will be associated with an increase, on average, in the number of skilled labour.* One of the reasons for expecting such relationship is that rural markets tend to be tolerant with regard to quality of the products, in addition to the fact that less complex techniques are utilized in production.

It will be recalled that one of the arguments between small scaled orientation and the Big Push approach concerns not only absorption of labour but also absorption of skilled labour, with the contention in the former that large scaled operations will require a skilled labour force. In this respect, it is predicted that *(26) absorption of skilled labour will vary with the size of firms in such a way that as the size increases, the number of skilled workers increases.* This expectation arises from the fact that while large scaled operations will be characterized by capital-intensive production, such firms will require a core of skilled labour which would handle equipment, supervisory operations and quality control (Mikkelsen 1987).

It will be recalled, however, that besides making efforts to minimize cost of production, entrepreneurs also aim to control voluntary mobility of the workers through absorption of workers with limited but operational skills (King 1975, Mikkelsen 1987). One of the characteristics of semi-skilled workers is their adaptability to a variety of operations in production and distribution. In this respect, it is predicted that *(27) absorption of semi-skilled labour will vary with firms in respect to types of entrepreneurs in such a way that firms of MNCs will be characterized by larger absorption of semi-skilled workers as compared to the firms of local entrepreneurs.* Since location of the firms is expected to exert additional influence, as discussed above, it is predicted that *(28) absorption of semi-skilled labour will vary with the location of firms* *in such a way that a shift in location from rural to urban areas will be associated with an increase in the number of semi-skilled workers.* As will be recalled, one of the expectations in the Big Push model is that large scaled operations will be associated with relatively large absorption of semi-skilled workers. In this respect, it is predicted that *(29) absorption of semi-skilled labour will vary with the size of firms, such that the number of skilled workers increases, on average, as the size of the firms increases.* This relationship is expected because of the fact that large scaled operations will be characterized by adoption of capital-intensive equipment which demands semi-skilled labour to handle peripheral sub-processing, equipment and distribution operations.

Table 4.2.3 **Summary of hypotheses concerning utilization of labour**

Level of employment

L15. Absorption of labour will vary with firms in respect to the type of entrepreneur in such a way that firms of MNCs will be characterized by large absorption of labour, while firms of local entrepreneurs with prior experience will have larger absorption of labour as compared to firms of recent indu. .ial entrepreneurs. Such a relationship is expected, however, to be characterized by a relatively large number of unskilled workers.

L16. Absorption of labour will vary with location of firms in such a way that a shift in location from rural to urban areas will be associated, on average, with an increase in the number of employees. Such a relationship is expected, however, to be characterized by relatively large numbers of unskilled workers.

L17. Absorption of labour will vary with size of firms in such a way that the number of workers increases, on average, as the size of the firm increases. Such relationship is expected, however, to be characterized by relatively large numbers of unskilled workers

Labour wages

L18. Wages of the workers will vary with firms in respect to types of entrepreneurs in such a way that firms of MNCs will be characterized by higher wages as compared to firms of local entrepreneurs.

L19. Wages of the workers will vary with location of firms, such that a shift in location from rural to urban areas will be associated with increase in wages.

L20. Wages of the workers will vary with size of firms, such that as the size of firms shifts from micro operations to large scaled operations, wages increase.

Labour productivity

L21. Productivity of labour will vary with the types of entrepreneurs in such a way that firms of MNCs will be characterized by higher productivity of labour, while firms of local entrepreneurs with prior experience will have relatively higher productivity as compared to firms of recent industrial entrepreneurs.

L22. Productivity of labour will vary with location of firms in such a way that a shift in location from rural to urban areas will be characterized by higher levels of productivity.

L23. Productivity of labour will vary with size of firms in such a way that large firms will be characterized by higher levels of productivity as compared to relatively smaller firms.

Absorption of skilled labour

L24. Absorption of skilled labour will vary with firms in respect to types of entrepreneurs in such a way that firms of MNCs will be characterized by lower proportion of skilled workers as compared to the firms of local entrepreneurs which are expected to be characterized by higher proportion of skilled labour.

L25. Absorption of skilled labour will vary with location of firms, such that a shift in location from rural to urban areas will be associated with an increase, on average, in the proportion of skilled labour.

L26. Absorption of skilled labour will vary with size of firms, in such a way that as the size of firms increases, the proportion of skilled labour increases.

Absorption of semi-skilled labour

L27. Absorption of semi-skilled labour will vary with firms in respect to the type of entrepreneur in such a way that firms of MNCs will be characterized by the highest proportion of semi-skilled workers, while firms of local entrepreneurs with prior experience will be characterized by a relatively high proportion of semi-skilled workers as compared to recent industrial entrepreneurs.

L28. Absorption of semi-skilled labour will vary with location of the firms in such a way that a shift in location to urban areas will be associated, on average, with a higher proportion of semi-skilled workers.

L29. Absorption of semi-skilled labour will vary with size of firms, with higher proportion of semi-skilled workers, on average, as the size of firms increases.

4.2.4 Training practices

As stated in chapter 3, the responsibility for developing a skilled labour force has in the past in Kenya rested with initiatives taken by individual workers, firms and the state. The notion of external economies in economic theory includes the expectation that the state will invest in the training of the labour force as part of providing incentives to the firms. It has been reported (Mikkelsen 1987) that, besides supporting general education, the state has tended to have a role in the training of the industrial labour force. With regard to the responsibility of firms, it has been reported (Masi 1988) that their primary concern is job-specific skills which can be acquired through experience and learning on the job. In this respect, two ways used by firms to acquire the level of labour required for production are recruitment and training practices.

It is predicted that *(T30) training practices will vary with firms in respect to the type of entrepreneur in such a way that firms of MNCs will be characterized by internally organized courses as compared to firms of local entrepreneurs which are expected to be characterized by learning through experience and apprenticeship.* As stated above, this relationship is expected because of the condition for foreign investors to provide skills to workers and the need for such investors to preserve the market shares for their firms through competitive operations. In addition, because of the constraints which location of firms impose on equipment that can be adopted by firms and limited training resources in rural areas, it is predicted that *(31) training practices will vary with location of firms in such a way that firms based in rural areas will be characterized by apprenticeship as compared to firms based in urban areas which are expected to be characterized by* *learning through experience and internally organized courses.* Because of the different capabilities which arise from the nature of investment, it is predicted further that *(32) training practices will vary with the size of firms in such a way that small scaled operations will be characterized by apprenticeship as compared to large scaled operations which are expected to be characterized by organized courses and learning through experience.*

Table 4.2.4 **Summary of hypotheses concerning training practice**

T30.	Training practices will vary with firms in respect to type of entrepreneurs in such a way that firms of MNCs will be characterized by internal courses as compared to firms of local entrepreneurs which are expected to be characterized by learning through experience.
T31.	Training practices will vary with location of firms in such a way that firms based in rural areas will be characterized by apprenticeship as compared to firms based in urban areas which are expected to be characterized by learning through experience and internally organized courses.
T32.	Training practices will vary with size of firms in such a way that small scaled operations will be characterized by apprenticeship as compared to large scaled operations which are expected to be characterized by formal training programmes.

5 BAKERY TECHNOLOGY AND ESSENTIAL INPUTS

The intention of this chapter is to present the types of equipment that are used in the bakery industry, with special reference to those that have been adopted by the Kenyan firms and the institutions that have financed acquisition of such equipment. In addition, essential inputs for bakery products are discussed in order to identify aspects that have brought about constraints to the competitive operations of this industry.

5.1 PRODUCTION PHASES AND EQUIPMENT

Whereas there are a wide variety of bakery products, the most common ones with the Kenyan firms are: bread, scones, burns, cakes, biscuits and other confectioneries. The 1973-76 Industrial Census (CBS 1980) and a Sectoral Status Report from a survey undertaken in 1986/87 by KIRDI (Obuon 1989) indicate that bread is a dominant product line, produced exclusively by 80% of the firms. Of the remaining 20% of the firms, 15% concentrate on two product lines while 5% undertake three product lines. In his study, Kaplinsky (1980:79) reported that firms which produce multiple products are mainly those which are located in the urban areas. Furthermore, Kaplinsky pointed out that while firms concentrated overwhelmingly on production of bread, a common combination involved scones and cakes. Precisely because of this fact, that the present study concentrated on equipment for the production of bread.

Production of bread consists, essentially, of eight phases, which can be summarized, Table 5.1, as follows: (a) storage of inputs (b) mixing (c) proving (d) moulding (e) dividing and scaling (f) baking (g) slicing and cooling (h) packaging. Equipment that are used in each of these phases are designated as (1) storage facilities, i.e. bags or silos, (2) mixers, (3) provers (4) moulders (5) dividers (6) ovens (7) slicers and (8) packaging. Each of these equipment vary in levels of advancement. In the opinion of managers in the bakery industry and of the agents that represent manufacturers, the most important piece of equipment for quality control is the oven. Indeed, Kaplinsky (1980) noted that "the only necessary pieces of baking equipment are storing and mixing receptacles, moulding tables and ovens" (1980:36), such that the other phases can be undertaken manually or with different combination of labour and machines.

Table 5.1 **Phases of production of bread and types of equipment**

phases of production	equipment
1. storage	- silos/stores - polythene papers
2. mixing	mixers
3. proving	provers
4. moulding	moulders
5. dividing	dividers/scalers
6. baking	ovens
7. slicing	slicers
8. packaging	- polythene bags - polypropylene - air-blown wrappers

Source: Adapted from Matz (1988), Kaplinsky (1980) and Field-notes

5.1.1 Storage of inputs

Basic ingredients are usually purchased and delivered to the bakery plant. The most common means of transportation in Kenya are lorries, railways and trailer trucks, depending on the quantities of the materials and location of the firms. Materials that are usually handled in bulk are flour, sugar, syrups and oil. Because of the control of wheat flour and the fact that most firms are not located near milling plants, most firms purchase it in bulk. Indeed, because of uncertainty in respect to shortage of wheat, firms attempt to acquire stock for up to three months. Consequently, transport and storage facilities become crucial. Large and medium-size firms have transport vehicles, in addition to arrangements with railways. A substantially large number of small-scale firms, however, do not have vehicles and therefore rely on a hiring arrangement.

In addition to transport, storage facilities are necessary. The way materials are stored, particularly flour and sugar influence how deliveries are made and how such materials are moved to the first phase of production. Large firms utilize constructed silos, for storage facilities, which allow for bulk handling of materials and automation of both the deliveries and the subsequent movements to the first phase of production. Accordingly, large firms are able to link bulk storage system with automatic flour-feeds. Further, as an added advantage, silos are installed with devices to control the temperature and humidity for purposes of better preservation.

In contrast, small firms tend to adopt widely varied storage facilities that range from small silos to the use of bags in small rooms. In a large number of small enterprises, however, wheat flour are usually preserved in bags which are basically made of fibres or paper and synthetic materials. Invariably, such firms tend to have limited capability for storage of large quantities and for preservation of the wheat flour for a lengthy period of time. In addition, automation of the deliveries and movement of the materials is substantially constrained.

5.1.2 Mixing of ingredients

Matz (1988) points out that mixing is a unique operation in the production of bread because human labour, machinery and chemical engineering are combined in efforts to achieve desired results. This phase of production is characterized by two distinct but concurrent processes. One is blending of originally separate materials into a dough in precise quantities, which depending on the activities at the premixing operations and the technique being used can vary from a minimum of 5 minutes to a maximum of 45 minutes. The second process is development of such dough into appropriate texture.

In most cases blending of ingredients is undertaken in two phases, premixing and final mixing. One of the purposes of premixing is to ensure even and efficient distribution of smaller quantities such as salt, vitamins and yeast in a large mass of bread dough. In this circumstance, dry ingredients and leavening chemical agents are blended with flour at the premixing phase, prior to adding water and commencing final mixing operation. Alternatively, minor ingredients are premixed with some amount of water. These premixing alternatives are associated with certain equipment, particularly where manual operations are limited.

Development of the dough is a process which takes place during mixing operations, given certain conditions. One of the important elements in this process is the development of gluten, i.e. hydration of gluten proteins which occurs promptly when flour is blended with water. Because the development of the dough is slow and requires considerable application of ordered force, Matz (1988) argues that mixing approach which promotes rapid development of gluten consists of actions of repeated stretching and folding. Such actions are undertaken until the dough achieves its state of optimum development, i.e. enfolds substantial amount of air and exhibits a marked reduction in density. Adequately developed doughs result in loaves with high specific volume, soft and uniform grain and texture as well as good shelf life.

Because of its complexity and time that it takes, it has been argued (Kaplinsky 1980, Matz 1988) that mixing was one of the first phases in the production of bread to be automated. Various types of equipment for mixing consist of devices such as blades and paddles for pushing portions of the dough through other portions, devices which elevate and drop portions of the mass in order to achieve random rebounding and re-distribution of particles and devices which create turbulent movement through current of gas or liquids. A typical mixer is a horizontal bowl of U-shaped in cross section mounted in rigid frame over a compartment holding the drive motor and transmission.

Mixing equipment is considered to have evolved in three stages (i) bath mixer (ii) continuous mixer (iii) high speed mixers. Early modern mixing equipment, basically batch system operating at given intervals, is reported (Matz 1988, Kaplinsky 1980) to have emerged during the 1860s in Europe and spread initially to North America. During the 1950s continuous mixers were introduced in the United States, which included equipment for scaling, premixing, fermenting, depositing and panning.

Consequently, in most of the medium-size operations that are based in the developed countries and large-scale operations in the developing countries, continuous systems replaced batch weigh hoppers, ingredients pre-mixers, batch mixers, fermentation troughs and rooms, dividers, and intermediate provers and moulders essentially because such systems have premixing incorporators and dough developers (Kaplinsky 1980, Matz 1988, Obuon 1990). Further, continuous systems are reported (Matz 1988) to be effective in enhancing quality and texture of the doughs.

Further advancement occurred with the advent of high speed mixers, known in the industry as Chorleywood Bread Process, and which incorporated all the characteristics of the continuous mixers. Such systems, introduced in 1962, have been adopted by most of the large bakery plants that are based in the developed nations and to some extent by firms that are based in the developing nations (Kaplinsky 1980, Matz 1988). Processing with such equipment involve intense mechanical mixing of the ingredients in such a way that the dough is ready for dividing in a duration of about 5 minutes.

Compared to relatively manual operations that include batch mixers, continuous and high speed mixers save time from a potential range of 2 to 8 hours because of substantial reduction in fermentation process. Further, Kaplinsky (1980) points out that they also save 75% of the space required by manual or traditional mixing practices. In addition, continuous and high speed systems save on operation costs, reduce variability and rate of contamination of the final loaves. Furthermore, besides saving on time, they also save on labour required in comparison to relatively manual operations. Notable restrictions, however, consists of the fact that such equipment are suitable for large-scale operations and require good management practices. Small-scale operations may not take advantage of such equipment because of required economies of scale, about 2 tonnes of flour per hour. Although saving on labour can be considered to be a disadvantage in such continuous systems, they demand, however, skilled labour because of the fact that the attendant feed-processing equipment require maintenance which is labour intensive.

Alternatives for the small-scale bakeries consists of the bath systems and/or use of chemicals which activate the dough (Activated Dough Development, ADD) to reduce the period of fermentation. Still other smaller firms may be restricted to largely manual operations.

5.1.3 Dividing the doughs

This is a phase of the production in which a dough mass is separated into smaller pieces of equal weight, or variation of desired weights. Once the dough is divided into pieces, such pieces are handled in the subsequent phases as units and end up finally as loaves. In most cases the dough mass is divided and scaled into 580 grams for production of standard loaves of 500 grams, excess of at least 10% of the final required weight is include in order to compensate for some of the moisture and solids that are lost during the subsequent processing.

The main concern at this phase is to achieve consistency in the weight of the loaves. Dividing the doughs manually necessitates weighing them manually, with such operations resulting in relatively high risks for variability in weight and losses that arise form lack of precision. A wide range of semi-automatic and automatic dividers are available at present and most of them are in use. In automated operations dividing and weighing are undertaken simultaneously in volume, which facilitate greater degree of consistency and efficiency. The basic principle in automated processing involves forcing the dough mass through pockets of given dimensions in which excess dough is sheared off. This approach underlies the design for most of the present dividers. Indeed, the size of dividers can be given in terms of the pockets. Another method involves extruding the dough so that pieces of uniform length are cut. This method is used by large firms in continuous dough processing. Future developments in the design and manufacturing of dividers are discussed by Matz (1988), who points out the potential for replacement of mechanical drives (and linkages) with hydraulic power units which reduce wearing of equipment and make dividers more compact and less expensive.

5.1.4 Proving of doughs

The principal purpose of proving is to allow the blended ingredients to undergo fermentation process: i.e. to enable the yeast to produce carbon-dioxide that would be absorbed by the dough cells for improvement of the texture and final appearance. This process may be required at various phases, depending primarily on the type of mixing technique in operation. In relatively less automated operations, proving is time consuming essentially because it becomes necessary after mixing or even premixing, dividing and moulding. Conversely, as implied above, with continuous and high-speed mixers these proving stages are skipped. In a substantial number of the Kenyan bakery firms the range of time for proving is between 2 and 8 hours, with the proving after mixing being the longest, mainly because of their semi-automated or relatively manual operations.

In order to maintain control over undesired reactions, the dough is usually kept in enclosures where the temperature and humidity can be regulated. The temperature is controlled in order to allow the yeast to proceed at required rate while humidity is controlled in order to avoid the dough becoming sticky or dry. Cabinets consisting of warm and humid cupboards are used in small-scale or relatively manual operations. In the case of medium-size operations the process take place in a warm room (or fermentation room) in which the dough may be covered with some material, such as polythene paper, in order to prevent penetration by air. In large scale operations, automated systems are used that involve the dough travelling in tins through a tunnel with controlled temperature and humidity.

5.1.5 Moulding the doughs

This phase of production is aimed at constituting the required form and shape of the dough, which is accomplished through curling of the dough, rolling and sealing. In most of the small-scale operations, the process involve flatting and rolling of the dough manually with assistance of tables or pressure boards and wooden bars. In modernized operations automated moulding systems are used in which moulders, consisting of two or more rollers, receive pieces of dough from intermediate provers and shapes them into cylinders of loaves and size appropriate for placing them in pans or tins. Such process is continued with additional curling through further rolls or pairs of canvas belts. In the case of large-scale operations that undertake continuous operations extrusion moulders are used, with application of a different principle in which undivided dough is pumped to extrusion head. In such method, the dough is mixed continuously as it moves downward to the exit of developer to the extruder where it is then extruded as a cylinder to be cut off by opposed blades.

5.1.6 Baking ovens

Baking is a semi-final phase in the production of bread which, depending on type of the oven, takes a duration that ranges from 25 to 60 minutes. This phase of production, and therefore the equipment used, is considered to be the most crucial component in processing of the bread. In the views of Matz (1988:319) oven "cannot compensate for errors committed earlier in the processing sequence, but a well-adjusted oven of the proper design can bring out the potential of a well-adjusted dough piece". In addition, ovens are directly associated with the production capacity of the plants (see Table 6.3). Matz points out that while construction of ovens is important in respect to labour requirements, fuel efficiency, frequency of product damage and sanitation, the most fundamental component is the way in which heat is effected.

Ovens are essentially heated chambers. One of the earliest type of ovens is a chamber made of mud or brick (Kilby 1965, Kaplinsky 1980, Matz 1988). Such oven is still in use with various adaptations by firms in the developing countries. Invariably, as a source of heat, fuel woods are placed and heated inside the chamber. Once the woods are burned, ashes are scraped out and pieces of dough are inserted inside. Such a method of baking is considered to be time consuming, inconvenient and wasteful of woods. A substantial change in relatively modern ovens involved construction of a baking compartment isolated from the fire chamber. Examples of this type are peel and reel ovens. Peel ovens are a fixed hearth, constructed with thick walls serving as heat sinks and also regulating fluctuations of temperature. A variation of this type of oven includes deck ovens which are widely used in small-scale operations.

Reel types of oven reduced problems of loading dough pieces into the baking chamber, of removal of the loaves and of uneven distribution of heat, which characterize peel ovens, basically because of movement of the shelves which carry loaves. Reel ovens are compartments which contain a ferris wheel type of mechanism moving a given number of shelves in a circle. In principle, these types of oven are heated with gas or electricity usually by method of forced convection in which molecules of air, water vapour or gases circulate in the oven and transfer heat by conduction when in contact with solid surfaces.

More advanced types of oven consist of constructed tunnel in which dough pieces are conveyed continuously from the input to the discharge areas. Such tunnel ovens fall into three categories: travelling hearth, travelling trays and continuous band. In travelling hearth, steel segments move through the baking chamber on conveying chains. Because the baking surface is not divided, these models provide flexibility for efficient utilization of the capacity. In travelling trays, chains are used to pull fixed trays which move from the front to back and return by lower track as baking continues. In the band tunnel, continuous steel belt forms the baking surface. These types of oven are heated either through ribbon burners located inside the chamber or combustion chambers located outside the oven.

5.1.7 Cooling of loaves

Cooling of baked products before packaging is necessary in order to prevent moisture condensation and reduction of shelf life. Although cooling can be achieved by leaving loaves in open space with sufficient movement of cool air, lengthy duration is required with such technique, in addition to high risk for contamination. While in some firms cooling fans are used, most modern operations use accelerated cooling systems in form of spiral or tunnel in which air is refrigerated.

5.1.8 Slicing of loaves

While slicing of bread is optional in most firms, Mat (1988) points out that slicing of commercial bread began early 1920s in the United States and has tended to become a compulsory practice in the industry. Manual slicing is cumbersome and subject to inaccuracies. Consequently, most modern firms use semi-automatic or automatic slicers. Bread slicers fall into two categories depending on design of the blade. One type are slicers, used mainly by small and medium-size operations, that employ straight blades with movement carried out by a motor. The second type are slicers using continuous bands and which are considered to be appropriate for large scaled operations.

5.1.9 Packaging of loaves

Packaging of loaves can be considered as the final phase in processing of the bread. Aside from marketing practices, there are basic legal and hygienic standards that must be met. Loaves can be wrapped by hand using ordinary paper or polythene bags.

Indeed, because of the hygienic standards, polythene bags are used widely. Automated system use either wax-paper, polypropylene or air-blown wrappers. The last two types of materials are recent developments and have tended to replace wax-paper in large firms.

5.2 AGENTS OF THE BAKERY EQUIPMENT

Virtually, equipment for each of the phases for production of the bread can be manufactured or assembled locally. Practically, however, all fully integrated or semi-automatic equipment are imported. In a Sectoral Status Report for KIRDI (Obuon 1989), it was pointed out that in a sample of 56 bakery firms only 4% made their own equipment, 38% imported directly while the rest, 58%, purchased from local agents. Although it is not clear in that report, other studies (Stewart 1977, Langdon 1984) have documented the fact that local agents handle both imported and second-hand equipment. Of the 58% of the firms that purchased equipment from the local agents, still a substantial proportion of them could have acquired equipment by the agents and some could have purchased second-hand equipment. Other than improvisation that may be found with acquisition of the second-hand equipment, these firms may have had insubstantial promotion of the local manufacturing capability for such equipment.

With regard to the sources of the imported equipment, the same Sectoral Status Report (Obuon 1989) indicated that among 270 equipment surveyed by KIRDI in 1986/87, 40% came from Britain while the rest were purchased from other countries as presented in Table 5.2 below.

Table 5.2 . Countries from which bakery equipment are imported and percentage of equipment in use from the respective countries, Kenya 1986/87

country	percent of equipment
Britain	40
Sweden	22
Italy	18
Germany	15
Other	3
	100%
number of equipment surveyed by KIRDI in 1986/87.	n=270

source: Obuon 1989

The category of other, in Table 5.2, consists of countries such as France, Holland, Taiwan, and Yugoslavia. Of course, these data are based on firms within the modern sector operations. While limited information are available with regard to equipment in the informal sector operations, King (1975) reported that such operations utilize, extensively, locally made or improvised equipment. Apart from the core equipment, there are peripheral and support components that are made locally, such as tins, trays, trollies, and tables.

The specific models of equipment that are in use with bakery firms in Kenya are varied, with the most common ones being: Dahlem, Tom Chandry, Kalama, Bear Glek. Besides high cost of importation, there are problems related to standardization and lack of replacement parts. Indeed, lack of standardization of equipment is a common problem throughout the industrial sector, not only because of the different sources of equipment but also because of advances and/or changes in the models. While different sources improve, at least theoretically, the scope for selection of equipment (Stewart 1977, 1984), the concomitant lack of standardization brings about incompatibility of equipment and/or replacement parts which consequently increases substantially the cost of the technology. Local agents of the various models, appointed by the foreign manufacturing firms, tend to have little control, if any, with respect to the problems related to incompatibility of equipment. Among the local agents that handle bakery equipment in Kenya include: Car and General, Serviscope East Africa Ltd., Bakequip Ltd., Project and Supplies Ltd., and P.J. Products Ltd. While Car and General is a subsidiary of an MNC, the rest are local firms which Kenyan Asians hold controlling shares. Of the local agents, Serviscope Ltd. handles about 70% of the equipment for the commercial bakeries.

Whereas local agents could serve as part of the effort towards localization of the bakery technology, they have remained essentially as trading firms. The reason that these dealers give for their lack of participation in manufacturing of core equipment is that the local market cannot sustain such venture. However, it appears that the problem lies elsewhere. First is a lack of adequate and consistent policy that would encourage and support such venture. One firm was established, in 1980/82, with the aim of producing bakery equipment and after two years it collapsed. While the reasons for its failure are not clear, it is apparent that adequate mechanisms for intervention do not exist, otherwise such venture would have been sustained. This characteristic is common in the industrial sector. On this matter, Coughlin (1988:283) points out that Kenya does not have "a systematic and comprehensive policy to govern the transfer of technology and to guide the development of local technological capability".

The second, and perhaps a critical constraint with regard to lack of manufacturing of the core equipment, is the nature of the contract between the local agents and the foreign manufacturing firms (Gershenberg 1983). Except for the manufacturing of peripheral components and kitchen equipment, local agents do not hold patent for any the core equipment. The preference of the foreign firms is an arrangement in which equipment are imported directly by their subsidiary or locally established agents.

Importation of equipment accounts partly for the existence of excess capacity and of course over-investment. Although available in various capacities, i.e. output per hour or day, imported equipment tend to provide limited flexibility for adaptation to local market changes. Further, while technological choice is supposed to be based on profitability criteria (Stewart 1977; James 1983; Bhalla and James 1986), the actual selection is constrained substantially by the financing arrangements. With exception of considerably smaller proportion of enterprises that are initiated exclusively with savings from other or previous undertakings, most of the enterprises are financed through loans. In order to secure the needed loan and also to absorb added taxes, entrepreneurs tend to manipulated market prospects.

There have been, however, uncoordinated initiatives to improvise some of the equipment, especially with small scale firms (King 1975, Coughlin and Ikiara 1988). In the case of the bakery firms, improvisation has been undertaken with such equipment as moulders, dividers, provers and even mixers but subject to desired production capacity. When required output exceeds 2000 loaves per day importation of mixers become inevitable. Since the sources for financing equipment are financial institutions which aim at avoiding risks, these institutions encouraged imported ovens. In one of the financing institutions, a manager remarked that "importation of ovens is necessary and there is still a long way to go before such equipment are produced locally".

5.3 FINANCING OF THE BAKERY EQUIPMENT

In the Sectoral Status Report (Obuon 1989) mentioned above, it was indicated further that the cost of the bakery equipment in Kenya ranged from K£ 62.50 (US$ 50) to K£ 500,000 (US$ 400,000) with the average cost at K£ 56829.10 (US$ 45,463.30). Informal sector enterprises of up to K£ 7500 (US$ 400) are usually financed through either individual savings or short-term bank loans, because of limits imposed by the financial institutions in the case of long-term loans. Consequently, those which utilize facilities of development financial institutions are basically modern-small and medium size enterprises, of which most of them do not have adequate savings or collateral.

Financial institutions which have supported bakery enterprises include: Kenya Industrial Estate (KIE), Development Finance Company of Kenya (DFCK), Industrial Development Bank (IDB) and Kenya Commercial Bank (KCB). While KCB is a state corporation involved in commercial banking, it has developed with the assistance of United States Agency for International Development (USAID) a programme for small scale enterprises and which combines lending and advisory services. This programme, which was started in 1985, has received support, in recent years, in terms of policy initiates for the promotion of the informal sector enterprises. In contrast KIE which started initially with a primary mandate to promote small scale enterprises has been shifting its loan provisions to "a viability type of commercial bank-lending" according to one project manager. Accordingly, while adjusting for inflation and other factors, it has raised its maximum funding level from K£150,000 (US$ 120,000) then K£250,000 (US$ 200,000) to the present level of K£500,000 (US$ 400,000) in a period of ten years. Although DFCK funds mainly large-scale ventures, it also supports small scale bakery enterprises through its subsidiary, Small Enterprises Financing Company (SEFCO).

Funds made available by these institutions, however, are not always readily accessible to most of the entrepreneurs primarily because of mandatory share contribution, collateral for the loan and inability to provide proven effective management. As pertaining to share contribution, entrepreneurs must raise an average of 30% in the case of KIE, DFCK 40% and KCB 25% of the total capital investment. In addition to such contribution, entrepreneurs must provide sufficient collateral for the loan, and must also be able to demonstrate organizational as well as management capabilities. These conditions limit substantially the borrowing ability, especially of recent or new entrepreneurs.

Financial institutions can be effective mechanisms for the transfer of technology to the indigenous enterprises. One arrangement that exists but which has been difficult to enforce for a number of reasons, is a requirement for indigenous entrepreneurs to control more than 50% of the shares before the venture is funded. Because of frequent violation of this condition even before and after disbursement of funds, such arrangement has been largely ignored.

5.4 ESSENTIAL INPUTS AND THEIR SUPPLY

Bakery products are made with a variety of raw materials, with the basic ingredients being: wheat flour, yeast, sugar, salt, powder, oil and fat. Of course, in turn, these are products of other industries and their supply can influence performance of the bakery enterprises. Practically, these ingredients are processed by local industries and, with the exception of salt, their subsequent raw materials are obtained from the agricultural sector. While baking powder, oil and fat are processed by a number of small industries, East Africa Industries (EAI) is a major producer. EAI is one of the oldest firm in Kenya concentrating on food related products. It is a subsidiary of a MNC and has adequate infrastructure for distribution of its products throughout the county, such that rarely has there been any substantial shortage of oil and fat in Kenya. Oil and fat are extracted from both livestock and vegetable products which so far have been available in sufficient quantities in Kenya.

While salt is also processed by a number of small industries in Kenya, one major producer is KENSALT Ltd., a local firm whose products, distributed through wholesalers and retailers, are available throughout the country. Raw materials for processing of salt are provided by Magadi Soda Company which is a subsidiary of an MNC (Swainson 1978).

In the case of sugar, it is grown in large quantities in Kenya, with two provinces in West Kenya depend largely on it as a cash crop. The sugar industry is characterized by a combined effort of the individual farmers, private enterprises and state corporations. Whereas farmers undertake production of the sugar cane, private firms and state corporations process the final product. Because of its critical demand, sugar has elaborate distribution arrangements provided by one of the largest trading state corporation, Kenya National Trading Corporation (KNTC). Although often there are shortages of sugar for varied reasons, the shortages have rarely lasted for a period prolonged enough to significantly affect the operations and performance of the bakery firms.

The major input in the bakery industry is wheat. It constitutes over 70% of all inputs in production of the bread. This input is, therefore, discussed extensively below because of its importance to the bakery industry. Shortage of wheat for even two weeks can have a profound impact on operations and performance of the bakery industry and, indeed, there are frequent and sustained shortages of wheat in Kenya.

5.5 TRENDS IN WHEAT PRODUCTION

Wheat is the second largest food crop in Kenya after maize. It is grown in large-scale, mainly in the Rift Valley province (Uasin Gishu, Nakuru and Trans-Nzoia) and some parts of the Central province. Notwithstanding the fact that majority of the indigenous population had not adopted consumption of bread because of cultural and economic conditions, Kenya was relatively self-sufficient in wheat up to the late 1960s. Since the 1970s, domestic production of this commodity has been characterized by fluctuating trend that has remained, on average, below the consumption level which increases annually at an estimated rate of 5%.

Available data indicate that by 1964 the domestic production of wheat was 128100 metric tonnes(mt) and the population was estimated to be 8,868,000, which results in a per capita of 0.015. In 1974 such production of wheat stood at 159500mt with the population estimated at 12,269,000 in which per capita declined to 0.013. Still in 1984 the production of wheat was 144400mt for a population of 18,469,000, which results to a further decline of per capita to 0.008. The production of wheat in 1989 was 243000mt for a population of 21,397,000, with which the per capita stood at 0.011. Clearly, the domestic production of wheat has substantially lagged behind the rate of the population increase. Of course, the gap between domestic production and demand has continued to be filled with increasing imports, as reflected in Table 5.3.

Table 5.3 Domestic wheat production and imports - 1985-1989 (000 mt)

Year	Production	Imports
1985	225.0	135.0
1986	252.0	153.0
1987	207.0	198.0
1988	234.0	207.0
1989	243.0	202.5

Source: Central Bureau of Statistics, 1989

Factors that account for stagnation in domestic production of wheat include: crop management, division of land and incentives (i.e. policy shifts). One major determinant of crop production is yield. Between 1959 and 1968, whereas the average yield of wheat was 1.6 metric tonnes per hectare (mt/ha), it declined to 1.3 mt/ha during the decade of 1969/1979 and only increased slightly to 1.4 mt/ha during the decade of 1979/1989. The constraint has been lack of adoption of the high yield seeds, which have continued to be developed and made available. Because of lack of knowledge and inadequate management for control of the wheat diseases, farmers tended to avoid high yield seed varied, which happens to be more susceptible to diseases.

Consequently, indigenous farmers, most of whom took over from the white settlers, tended to opt, therefore, for adoption of low yield seeds and/or expanded production of maize. The slight improvement during the period 1979-89 was as a result of sub-division of large cooperative farms which tended to expand the area under wheat production. Furthermore, an increasing proportion of farmers had acquired knowledge for wheat management and were taking risks in expanded production. Sub-division of the farms, however, led to new problems, notably lack of appropriate technology for small-scale wheat production, especially the machinery for harvesting. Again the actual constraint has not been lack of machinery per se, but basically inadequate planning and innovation for acquisition of such equipment. Israel and India are good examples of countries that have had equipment, or generally technology, for small-scale wheat farming.

Additionally, whereas wheat and maize have been competing for otherwise diminishing land and although prices for both commodities are controlled, most farmers have tended to opt for maize, continuously increasing its area and adopting high yield seeds. In the late 1970s other crops, namely barley and triticale, competed for land with wheat in addition to maize. Barley and Triticale are promoted by the private sector; barley by the Kenya Breweries for processing of beer, and Triticale by the bakery industry and particularly the House of Manji. Triticale is used as substitute to wheat in preparation of bakery products (bread, loaves and confectioneries). Because these two crops are not controlled, the private sector provides favourable incentives to the producers.

5.5 MILLING FIRMS AND THEIR DISTRIBUTION

Distribution of wheat is basically a responsibility of the National Cereals and Produce Board (NCPD). This organization purchases wheat, locally produced and imported, and stores and distributes to the millers which subsequently distribute the wheat-flour to the bakery firms. Shortage of wheat grains influences substantially the operations of the milling industry which, in turn, influences the operations and performance of the bakery industry.

At present, there are 18 milling plants which are distributed throughout the major urban centres of Kenya. Of the 18 milling plants, Table 5.4 below, 7 are located in Nairobi; 3 in Mombasa; 3 in Kisumu, 2 in Nakuru and one in Eldoret, Thika and Nyeri. While these areas are strategic for distribution of the wheat flour to the bakery enterprises in that country, one notable aspect is the fact that three of the plants belong to one company, namely Unga Ltd. The three Unga plants are located in Nairobi, Nakuru and Eldoret — areas that are either leading in production of wheat or in concentration of bakery enterprises.

Table 5.4 Distribution of milling plants and their monthly production capacities, July 1990

Area	Type of location	Number of firms	Installed Capacity (MT)	% Capacity Utilization
Nairobi	urban	7	20754.2	50
Mombasa	urban	3	5359.6	59
Nakuru	semi-urban	2	8034.0	72
Eldoret	semi-urban	1	4840.0	44
Kisumu	semi-urban	3	6072.0	64
Thika	semi-urban	1	3300.0	47
Nyeri	semi-urban	1	1980.0	44
		N=18	50939.8	mean=56

Source: Ng'weno 1990 (Industrial Review)

While the aggregate potential capacity for the existing milling plants is 50939.80 metric-tonnes (mt) per month, Table 5.4 above, 56% of such capacity was being utilized in 1990 resulting to a distribution of approximately 28526.30mt of wheat flour. Given that no other wheat substitute has been adopted in the production of bread, such reduction threatens considerably the operations of the bakery industry. Whereas the three Unga plants operated during the same period below average of their installed capacities, in total they accounted for 10024mt, which constituted 35%, of the distributed wheat flour. Historically, the operations of Unga Ltd. have had substantial influence on a large number of bakery firms. The three Unga plants are owned and managed by MERGAT Group of Companies which also owns the leading bakery firm, Ellic s Bakery Ltd.

6 METHODOLOGICAL PROCEDURES AND CHARACTERISTICS OF THE SAMPLE FIRMS

The purpose of this chapter is to present methodological procedures that were used in acquisition of the empirical data and to present an overview of characteristics of the sample from the Kenyan bakery firms. It begins with presentation of indicators, operational definitions, for the major variables and in the second part is a discussion of the sample and sampling procedures as well as the nature of the interviews. In the last section is presentation of the characteristics of the firms in the present sample.

6.1 OPERATIONAL DEFINITIONS

Aspects that required indicators with respect to acquisition and analysis of the empirical data in the present study were: (1) type of entrepreneurs, (2) location of the firms, (3) the nature of investment, (4) types and adoption of equipment, (5) inducement of local technological capability, and (6) labour requirements. Indicators for these aspects are presented below.

6.1.1 Types of Entrepreneurs

Effects if the different characteristic of entrepreneurs were examined in terms of the firms for MNCs, Asians, Africans and of the mixed ownership. The two characteristics of entrepreneurs, discussed in Chapter 2, the experience that arises through the process of succession and the orientation for group operation, are found with the firms of the MNCs and for the Asians. Whereas with firms for MNCs, succession occur through selection and promotion of the managers, it has been pointed out that such firms are characterized by cooperation and inter-linkages through which effective performance is insured (Cochran 1971, Leys 1974, Langdon 1987, Hirschman 1984).

It is, however, interesting to note that Asian entrepreneurs have been reported to have a similar succession process and cooperative orientation which ensure successful performance in the industrial operations (King 1975, Swainson 1978). According to Swainson conditions which prevailed during the pre-independence period forced Asian entrepreneurs to invest first in the commercial activities and that later in the industrial production, with transfer of the capital and skills accumulated were transferred to the industrial sector. According to King, succession among these entrepreneurs was undertaken through family members. In addition, Swainson provided data which indicate that, as early as 1945, a majority of the private enterprises in Kenya were owned by Asians, of which the "overwhelming proportion", 90%, were operated in partnership. Such partnership extended beyond simple registration to collaborative learning and formation of "captive markets".

In contrast, we recall from the study mentioned above of the African artisan that African entrepreneurs lacked such cooperative operation (King 1975). In addition, in the study of the maize milling also mentioned above, Stewart (1977) pointed out that the enterprises that were characterized by low utilization of production capacities and inability to adopt more effective technologies were owned by African entrepreneurs, who had limited experience besides lack of cooperation. Indeed, Swainson (1978) reported that whereas MNCs and Asians were investing in trade and industrial sectors, in Kenya as early as the 1920s, any significant participation of African entrepreneurs in these sectors commenced in the 1960s.

6.1.2 Location

Effects of the location of the firms were examined with four categories, (1) urban areas, (2) semi-urban, (3) rural towns, and (4) rural centres, which represent different levels of growth with respect to population and industrial activities. These categories are associated with various levels of demand for bread and of the external economies that arise from expanded infrastructural services. In addition, they are consistent with those applied to the development planning in Kenya (development plan, 1979:340). The size of the population as a criteria for this categorization is as follows: (a) over 100,000 constitute urban areas, (b) between 100,000 and 30,000 constitute semi-urban areas, (c) between 30,000 and 10,000 constitute rural towns, and (d) less than 10,000 are rural centres. These are summarized in Table 6.1.1 below:

Table 6.1.1 Categorization of the location according to their respective population

	Location	Population
1.	rural centres	< 10,000
2.	rural towns	10,000 - 30,000
3.	semi-urban areas	30,000 - 100,000
4.	urban areas	> 100,000

Source: GoK, 1979:340

6.1.3 The nature of investment

With respect to hypotheses P1 and P2, concerning the effects of the entrepreneurs and location of the firms on the scale of investment, the nature of investment was examined with three indicators. First, is the size of the firm's installed capacity. Such measurement procedure or its adaptation in the industrial sector, and particularly in the bakery industry (Kilby 1965, Kaplinsky 1980). As discussed above, it involved determining the number of loaves of bread that adopted technologies can produce per day. The second indicator is the level of capital investment, i.e. the cost of the production equipment. Because the two measurement procedures are highly correlated, as expected, analysis was performed with the use of the installed capacities. One of the reasons in which installed production capacity was preferred as compared to capital investment is the difficulty in verification of the costs of the equipment in some of the firms. Whereas in most cases, information were available from the records or feasibility studies that were undertaken before commencement of operations. it was difficult to determine the costs of the equipment in some of the large firms. One reason was that records were not readily available. Secondly, release of information required authority from higher levels of the establishment hierarchy. In the case of Elliots such authority would have to come from London.

The third indicator of the nature of investment involved the use of the total number of employees as a criteria. This approach has been applied in a number of studies (Bhalla et al. 1984, Uribe-Echevarria 1990), and in the industrial statutory surveys in Kenya, such as those undertaken by the Central Bureau of Statistics. Although there are variations in categorization, the standard approach in Kenya involves the following categories: less than 4, micro operations; between 5 and 19, small; between 20 and 49, medium size, and over 50, large firms. These are summarized in Table 6.1.2 below:

Table 6.1.2 Size of the firms according to number of employees

	Size	Number of employees
1.	micro	< 4
2.	small	5-19
3.	medium	20-49
4.	large	>50

Source: GoK, 1980, 1986

In relation to the nature of the production process, the sequence in the production of bread consists of three critical phases in terms of saving time, improving the quality and conditioning the degree of centralization. These phases involve mixing of the ingredients, proving of the dough and baking in the oven. While production of the bread tends to be product-centred when performed manually, the tendency is to shift to process-centred operations when these three phases are automated. As it turned out in the present study, the firms that had automated the three phases of production were also large-scale.

6.1.4A Equipment adopted

Hypotheses P3 to P5 were examined in terms of the types of equipment that were used by the firms in five phases of the production of bread. As will be discussed in the next chapter, the production of bread consists of seven phases as follows: mixing, proving, dividing, moulding, baking, slicing and packaging, in which each is characterized by a set of equipment that can be used. As indicated in Table 5.1, equipments which correspond to these phases are as follows: (1) mixers; (2) provers; (3) dividers; (4) moulders; (5) ovens; (6) slicers; (7) and packaging.

One of the indicators of the adaptation of equipment in the bakery industry is the type of baking oven. Ovens determine the nature and pace of the production process. Specifically, the type of oven influences the level of production capacities, the level of automation and the pace of production (Hirschman 1953, Kaplinsky 1980, Matz 1988). Indeed, Matz noted that ovens "dominate the layout and determines in large part the arrangement and location of the other pieces of machinery (1988:319). While there are many variations of ovens, those which are common in the bakery establishments of Kenya fall into three categories.

One category consists of simple brick ovens, i.e. various types of chambers made of mud or bricks, usually heated with fuel wood, which have been considered to be traditional (Kaplinsky 1980). The second category consists of ovens that are heated with electrical or gas tubes and include such models as peel, reel and rack which have been considered to be of conventional types (Matz 1988). The third category and which are advanced consists of constructed ovens in the form of a tunnel, with advanced and automatic control systems. In addition, they are characterized by high speed and continuous production. In this respect, ovens were classified into these three categories, i.e brick ovens, tube-heated ovens and tunnel ovens.

Table 6.3 Type of commercial baking ovens and the range of output at full capacity utilization

type	output (bags p.a)	distinct features
brick	1,000-10,000	-brick chamber -heated with fuel wood
tube	5,000-20,000	-various model -low and high speed
tunnel	100,000-400,000	-constructed tunnel -high speed -and continuous production

Source: adapted from (1) Kaplinsky 1980, (2) Matz 1988

As can be noted in the above table, adoption of any of these types of ovens will determine the subsequent equipment particularly with respect to those of mixing, proving, moulding and dividing.

Another measure of adaptation of the production equipment which was used in this study is the level of automation. Full automation involved an operation in which production in the seven phases were integrated such that raw materials were processed to the finished products with minimal use of labour. Semi-automation involved use of equipment only in certain phases of production, usually mixer, oven and moulders such that labour is used in the other phases of production. In all cases a manual system will have an oven and at least one other piece of equipment. Using this criteria, the level of adaptation of this equipment was categorized as follows: (i) full-automation, (ii) semi-automation, and (iii) manual operation.

6.1.4B Utilization of Production Capacities

The hypotheses, P6 to P8, concerning utilization of the production capacities were examined in terms of the percentage of the difference between installed capacity and the actual number of loaves produced by a bakery. A firm whose production per hour or day exhausts the limit provided by the existing technology can be said to have 100% utilization of capacity. Capacity utilization therefore refers to the extent to which capacities provided by the existing technology are used. In this respect, it is one of the important measures of the performance of a firm.

Such capacity utilization is determined by taking a ratio of the actual quantities produced per hour or day to the maximum quantities that technology provides (installed capacity). In order to control random fluctuations, it is preferable to use the average of the actual quantities produced. The extent to which the resulting value deviates from unity (or 100%) reflects the extent of "under-utilization" of the capacity. This procedure was applied by Coughlin (1988) in the study mentioned above.

In the present study, capacity utilization was assessed by taking the difference between the installed capacity and the actual production level per month in each establishment. Average of one month was preferred in order to take into account daily fluctuations that arise for many reasons. This procedure was found to be relatively reliable as records were readily available for both the installed (equipment) capacity and actual monthly output. In addition, most managers did not have difficulties recalling their monthly output.

6.1.5 Promotion of local manufacturing

Hypotheses, E1 to E3, which concerns inducement of local manufacturing of the bakery equipment were examined in terms of the sources of the adopted equipment. Specifically, the core equipment in each of the seven phases in the production of bread were classified with respect to: (1) local manufacturers; (2) secondhand; (3) local agents; (4) direct import. Besides reflecting technological capability with regard to the source, these categories provides also an understanding of the nature of adaptation of the equipment. As reported in other studies (Stewart 1977), directly imported equipment tend to be packaged with limited flexibility for modification at the plant or local environment. In contrast, equipment supplied by the local agents are usually disaggregated which allow for addition of other components at a later time.

Hypotheses E12 to E14 were aimed specifically to the promotion of local production of the peripheral components, mainly because production of such components requires relatively low level of organization and technology. Essential components which can be supported by existing bakery firms include pans (tins), trays and packaging materials. Sources of these components were classified into two categories: (1) local suppliers, and (2) direct import.

Such dichotomy, however, is rather restrictive and does not tap a wide range of dynamic processes of the firms with regard to promotion of subsequent entrepreneurial activities. In order to overcome this constraint additional indicator was used which involved the percentage to the local suppliers of the total expenses on packaging materials. In contrast with other peripheral components, packaging materials are required routinely (on daily basis) by all commercial bakeries. Such requirement arise from the need to meet the legal obligation for preserving the products in acceptable hygienic standard and from the need to ensure competitive marketing of the products. As noted in the case of milk packaging (Coughlin 1988:157), while such products can be produced locally, firms continue to import fully process packaging materials or large proportion of input for local production.

6.1.6 Labour requirements

As far as absorption of labour is concerned, hypotheses L15 to L17, overall employment was examined in terms of the total number of workers employed by a bakery. In the bakery industry, employment consists of the workers employed by the firms and individuals involved in the distribution and other peripheral services working on commission (Kilby 1965). In the present study, workers of a bakery was restricted to full-time employees who undertake operations related directly to the production process. While such data were provided by the owners or managers, they were also readily available, in some firms, on reports or roasters.

In the case of hypotheses L18 to L20, labour wages were examined with the use of the average wages for the workers in a bakery. This procedure was necessary for two reasons. Firms do not provide wages for individual workers for a variety of reasons. Secondly, the use of averages enhances reliability of the data by eliminating extreme cases.

In the predictions L21 to L23, productivity of labour was measured with the procedure used in other studies (Kilby 1965, Kaplinsky 1980). It involved taking the ratio of wheat flour, in bags, processed in a year to the total number of employees. As noted by the mentioned authors, this procedure is subject to limitations which arise from heterogeneity of labour and losses in the production process. However, as Kilby pointed out, the coefficients of this procedure provide 'physical productivity' that is useful for comparing performance across the firms.

In respect to hypotheses L24 to L26, categories consisting of (1) skilled workers,

(2) semi-skilled workers, and (3) unskilled workers were used to examine absorption of labour with various levels of skills. These categories are adopted from the categories of the classification of industrial workers by the International Labour Organization (ILO). The classification of ILO which has been adopted by the Ministry of Labour of the Government of Kenya consists of six categories as follows: (a) university level skills, (b) professional skills without university education, (c) skilled technicians, (d) qualified artisans, (e) semi-skilled and (f) unskilled. Categories (a) and (b) did not apply to the present study since such workers do not exist in the bakery industry, with exception of isolated cases such as expatriate in large firms such as Elliots bakery. Categories (d) and (e) were combined in the present study because the underlying qualifications were identical.

6.3.7 Training practices

As for the development of labour skills, assumptions T30-32, training practices by the firms were examined with three categories: (1) learning through experience, (2) learning through colleagues, i.e. apprenticeship, and (3) learning through courses sponsored by the firms. As noted by previous studies (King 1975, Mikkelsen 1987) training in the industrial sector tend to be largely a responsibility of the individual workers. However, with the use of government aided programme, firms tend to organize short and special purpose training programmes.

6.2 DATA COLLECTION PROCEDURES

With interruptions due to unavoidable circumstances, fieldwork for the data collection used in this dissertation was undertaken in two phases between 1984 and 1991. Extended fieldwork, nonetheless, provided opportunity to the writer to observe dynamics in the adaptation of technologies in the overall industrial sector in Kenya and specifically in the bakery industry. The first phase of the study commenced in 1984 with a case study of six bakery firms that were used to examine the less quantitative aspects, i.e. the more qualitative ones, that influenced selection, utilization and adaptation of the production technologies. Detail aspects of the case study are presented in Chapter 9. The second phase of the study which involved an extensive survey of 82 bakery firms was undertaken between March 1990 and March 1991. The aim of the survey was to acquire quantitative data to test hypotheses as identified above and to assess the extent to which such statistical patterns can be generalized to the entire industry. In addition, aggregate trend data for the entire bakery industry, presented in Chapter 3, were obtained for the period 1981-1989. Such data were necessary for assessment of the overall production levels of the bakery industry over the years and the pattern of growth, in addition to its contribution to employment creation.

6.2.1 Number of bakery firms

The sample of the 82 firms for the present study was drawn from a population of

140 bakery firms which were registered in 1987/88 with the Ministry of Industry, Directorate of Registration of industries, and also the Kenya Industrial Research and Development Institute (KIRDI, 1987), of which the list is reproduced in Appendix 5.

In his study on the bakery industry in Kenya, Kaplinsky (1980) noted that the number of bakeries in Kenya is not known. Indeed, he estimated the total number of stable commercial firms to have been 90 in 1980. As it can be noted, however, in Table 3.4.1 of the 400 bakeries expected in 1989 with the estimates from the Central Bureau of Statistics, 60 (15%) were medium and large-scale enterprises that have stable operations, as compared to 85% small-scale enterprises which consisted of micro firms whose operations are seasonal and are non-existent for most of the year. While, on average, about 234 firms were expected to be operational in 1987/88, only 140 firms were registered with the Ministry of Industry and also at the KIRDI. Since it is a legal requirement to register commercial enterprises, these registered firms constituted valid and reliable list for commercial firms that were in operation during the study. As it can be noted in Table 6.2.1 below, the 140 registered firms represented all the provinces in Kenya, with concentration in the areas of high population density.

Table 6.2.1 Distribution of bakery firms registered in 1987/88 with the Ministry of Industry and KIRDI, and of the sample in the present study*

Provinces	Population 1989	Registered firms	Sample firms	%
Nairobi	1,346,000	27	12	44
Central	3,110,000	18	13	72
Coast	1,850,000	19	14	73
Eastern	3,724,000	14	6	42
Nyanza	3,558,000	10	10	100
Rift Valley	4,894,000	34	18	52
Western	2,543,000	16	9	56
North Eastern	372,000	2	0	0
	21,397,000	140	82	59

Source: (1) Ministry of Industry and KIRDI 1987, p.15-21
(2) Survey 1990

* χ^2=7.12, df=7, p<.50[1]

In addition, as indicated in Tables 3.4.2 to 3.4.4, these registered firms are of significant important with regard to their impact on investment in this food sub-sector and in adaptation of the production technologies. Indeed, they account for over 80% of the total output and between 52% and 79% of the total labour force in the bakery industry.

6.2.2 Sample and sampling procedure

In obtaining a sample of the 82 firms, a stratified sampling procedure was used in order to ensure representation of the firms with respect to the different provinces (or locations), nature of productions and types of entrepreneurs. Table 6.2.1 presents registered firms with the sample drawn, alongside the population of their respective provinces. Over 50% of the firms were selected in all other provinces, with the exception

[1] Given df=7 and p<.01, χ^2 > 16.8 would be needed for the sample and registered firms to be considered as different. The computation of the results of the Goodness of Fit is presented in Appendix 3B.

of Nairobi area and Eastern province where over 40% of the firms were selected. One area that was not represented in the sample is North Eastern, which had only two known bakeries at the time of the study. Table 6.2.2 presents characteristics of the registered firms in terms of the scale of operations, in Table 6.2.3 are similar data with regard to sample firms.

Table 6.2.2 Distribution of bakery firms registered in 1987/88 with the Ministry of Industry and KIRDI, by province and size

Provinces	5-19	20-49	over 50	%	N
Nairobi	63	22	15	100	27
Central	50	28	22	100	18
Coast	78	11	11	100	19
Eastern	64	29	7	100	14
Nyanza	50	50	0	100	10
Rift Valley	76	15	9	100	34
Western	68	19	13	100	16
North Eastern	100	0	0	100	2
Total	95	29	16		140

Source: (1) Ministry of Industry
(2) Kenya Industrial Research and Development Institute 1987, p.15-21

Among the registered firms, larger proportion, 50%-78%, were small-scale operations employing between 5-19 workers (Table 6.2.2). Because of limited capabilities for adaptation of the technologies among informal sector enterprises, in the sample firms this category is split further into micro enterprises, employing between 1 and 4 persons, and small scale operations, employing between 5 and 19 persons. Otherwise when the two categories are combined, the percentage of the small-scale firms in the sample show negligible difference with the registered firms. With regard to medium and large-scale operations, the percentages for the sample and for the registered firms indicate small deviations.

Table 6.2.3 Distribution of sample bakery firms by province and size[1]

province	micro	small	medium	large	total	N
Nairobi		50	25	25	100%	12
central		46	23	31	100%	13
Coast	43	43	7	7	100%	14
Eastern		50	33	17	100%	6
Nyanza	10	10	50	10	100%	10
Rift Valley	17	44	22	17	100%	18
Western	22	56	11	11	100%	9
N/Eastern	0	0	0	0	0	
Total	12	37	19	14	100	82

6.2.3 Questionnaire

A questionnaire was the primary instrument used in the collection of the survey data, a copy of which is presented in Appendix 6. While interviews were undertaken with managers of the firms, in small-scale firms the manager was often the owner. The questionnaire, consisting of 35 questions of which some were open-ended for qualitative responses, was personally administered in interviews with the owners or managers of the firms. Administration of the questionnaire in person was undertaken partly because of the sensitivity in collection of industrial data, and partly to improve clarity of the responses and quality of the information. Where necessary and where possible, some information was extracted from the records of the firms. While reliable data were obtained, collection of data was characterized by sensitivity and secrecy that made the research process rather cumbersome. One of the reasons is that firms guard against exposure of their operations to competitors.

[1] In the subsequent chapters, tables without sources are those constructed from the data of the present survey.

6.3 CHARACTERISTICS OF SAMPLE BAKERY FIRMS

6.3.1 Statistical Methods

One of the aims of this study, as noted so often above, was to assess empirical distribution of production capacities and production technologies in the bakery industry. Such characteristics arising from analysis of the survey data are presented in this chapter. For analysis of the data, two procedures were used: descriptive statistics and frequency distributions. Descriptive statistics involving the use of average and standard deviation are used in respect to variables that are measured in either actual numerical values or in terms of percentage of the actual numerical values. Such procedure applies without violation of underlying assumptions to aspects such as production capacities and the number of workers, as well as average wages.

Frequency distributions are used in respect to variables that are measured in discrete scale such as the methods used to recruit or to train the workers, types of entrepreneurs and some other aspects of production technologies. There are, of course, variables that fall between these two types of measurement, i.e. those in which the Likert form of ordinal scale was used in the measurement. I should point out that whereas these variables, measured in ordinal scale, are presented in frequency distribution in this section, some of them are in actual fact quasi-interval scale measurements and will therefore be analyzed later alongside the other variables that are measured at the numerical values and/or interval scales of measurement.

Analysis in this section will focus on aspects of production technologies used by bakery firms in Kenya. These aspects are divided into three for purposes of presentation: those related to employment and labour skills, those related to machinery and equipments and promotion of local technological capabilities.

6.3.2 Characteristics of the firms

It will be recalled that our assumption was that variation of the aspects considered above would be dependent on variation in the types of entrepreneurs, location and the size of the firms. Table 6.3.2 summarizes statistics that reflect variation in the type of entrepreneurs, management, location and size. It will be noted, Table 6.3.2(A), that most of the firms, 51%, are owned by African entrepreneurs, while 32% are owned by Asian entrepreneurs. It is interesting to note that 12% of the firms are owned in joint collaboration between African and Asians. It is also worthwhile to note that 5% of the firms are subsidiaries of MNCs. Further, it will be noted that most of the firms—Table 6.3.2(B)—, 55%, are managed by the owners, as compared to 32% which are managed by one of the directors, or share holders, and 13% which are managed by executives.

Table 6.3.2 Ownership, size and location of the sample firms, Kenya, 1990/91

characteristics	firms	%
A) major share holder		
African	42	51
Asian	26	32
mixed	10	12
MNCs	4	5
B) managers		
owner	45	55
director	26	32
executive	11	13
C) location		
rural centres	29	35
rural towns	19	23
semi-urban	18	22
urban centres	16	20
D) size		
micro	12	15
small	37	45
medium	19	23
large	14	17
Total	82	100

Table 6.3.2(C) presents statistics concerning the location of the firms in which it can be seen that 58% of the firms are located in rural areas, i.e. 35% in rural centres and 23% in rural towns. In contrast, 42% of the firms are located in urban areas, i.e. 22% in semi-urban and 20% in urban areas. It will be noted, Table 6.3.2(D), that most the firms, 45%, are small-scale enterprises which employ between 5 and 20 workers, while 23% are medium sized operations which employ between 21 and 49 workers. Micro firms which employ fewer than 4 workers are 15%, while large establishments that employ over 50 workers are 17%.

6.3.3 Production Organization

6.3.3.1 Equipment adopted

The types of equipment that are used in each of the production phases by firms in the sample are presented in Table 6.3.3A below. The mixing sub-process of the production of bread, as already stated elsewhere, is unique and considered to be the most crucial phase. The aim in this phase is to combine otherwise separate materials or input and to develop the dough or, more specifically, the gluten . In this respect, processing involves use of equipment and chemicals. It can be noted, Table 6.3.3A(1), that most of the firms, 38%, used a batch type of mixers to mix the input, while a considerable number of firms, 35%, used a relatively manual operation, i.e. 23% used hands alone and 12% used hands in addition to dough activators. A small proportion of firms, 17%, used continuous mixers while 10% used high-speed mixers.

Table 6.3.3A Equipment adopted by sample bakery firms in Kenya, 1990/91

phases		firms	%
1) mixing			
	hand	19	23
	activator	10	12
	batch	31	38
	continuous	14	17
	high-speed	8	10
2) proving			
	paper	30	36
	cabinets	39	48
	tunnel	13	16
3) moulding			
	hand	31	38
	tools	40	49
	machines	11	13
4) dividing			
	hand	31	38
	tools	40	49
	machines	11	13
5) baking			
	brick	26	32
	tube	46	56
	tunnel	10	12
6) slicing			
	manual	42	51
	automated	40	48
7) wrapping			
	manual	47	57
	automated	35	43
	total	82	100

Most of the firms, 48%, used warm/humid controlled cabinets for the proving phase of the dough, Table 6.3.3A(2). In comparison, 36% of the firms used relatively manual methods which involved control of temperature and humidity through polythene papers or equivalent technique. A smaller proportion of firms, 16%, used high capacity tunnels. This pattern applies to moulding and dividing of the dough, Table 6.3.3A(3) and (4). As pointed out in Chapter 5, the most critical phase, in addition to mixing and proving, is baking of the dough. It can be seen in Table 6.3.3A(5) that most of the firms, 56%, use a tube-heated type of oven. In comparison, a considerable number of firms, 32%, used an adaptation of traditional bricks for baking the dough. It can be noted, again, that a smaller number, 12%, used sophisticated and high-capacity tunnels for baking the dough.

Two important peripheral phases, slicing and wrapping, Table 6.3.3A(6) and (7), were considered in the study mainly because of their importance in respect to maintaining the quality and marketing strategy. Most of the firms, 51%, undertook manual slicing of the loaves. The actual interpretation, in essence, is that these firms do not slice the bread unless required by some customers. Unsliced bread, however, is common in Kenya and therefore these firms are not under intensive pressure to provide sliced bread. In comparison, 48% of the firms have equipment, even though varied in capability, for slicing the bread. In this respect, these firms sell loaves that are sliced and others that are not sliced. Packaging is one of the phases that can enhance competition in respect to marketing. In addition, there are legal requirements to ensure hygienic preservation. Most of the firms, 57%, undertook manual wrapping using polythene paper, while 43% used equipment that are varied in capability and sophistication.

6.3.3.1 Production Capacities and Utilization

While the aggregate installed capacity of production in the present sample of the Kenyan bakery firms is 7,809,482 loaves per day (lpd), the actual production is 4,528,930 lpd (Table 6.3.3B). Further, both installed and utilized capacities, Table 6.3.3B (1) and (2), are characterized by a wide variation. With regard to the installed capacities, some firms are capable of producing 750,000 lpd while some can produce as low as 2250. Practically, however, the highest number of loaves produced per day is 578,750 while lowest is 500 lpd. Such large variation was reported by Kaplinsky (1980) pointing out that two firms accounted for most of the production of bread in Kenya while the rest were small-scale enterprises that served small markets.

Table 6.3.3B Installed and utilized production capacities, i.e. loaves per day (lpd) in the sample bakery firms, Kenya, 1990/91.

variable	mean	std.dev.	minimum	maximum	sum	n
(1) installed	95238	152788	2250	750000	7809482	82
(2) utilized	55231	110990	500	578750	4528930	82
(3) % utilized*	46.20	16.15	10.00	80.00	100	82

* the average percent of utilized capacity (3) was determined as follows $\Sigma((U/I)*100)/N$, where U represents number of loaves per day in individual firms and I represents installed capacity.

In order to obtain the percentage of capacity utilization for each firm, the difference between installed capacity and actual production for each firm was computed and represented in terms of percentage, Table 6.3.3B(3). Whereas the average of percentage of the actual production is 46%, it can be noted that variation ranged between 10% and 80% which indicates, in other words, that some firms utilized as low as 10% of their installed capacities while others utilized as high as 80%. We can conclude therefore that even the most productive firms still have 20% of idle capacity.

It can be noted in Table 6.3.3C (1) that while the total capital investment by all the firms is about Kshs 175 million, there is a large variation between the firms. Whereas the average is kshs 2,130,441, the range is as high as kshs 18.5m and as low as kshs 37500. In his study Kilby (1965) reported a much wider variation of capital investment in the bakery industry in Nigeria. The exact amounts cannot be compared directly, however, because of the time lapse and different currencies. As expected, the pattern of the capital invested should parallel that of the installed capacities.

Table 6.3.3C Characteristics of investments and returns in the sample bakery firms, Kenya, 1990/91.

variable	mean	std.dev.	minimum	maximum	sum.	n
(1) investment (Kshs)[3]	2130441	3760791	37500	18500000	174696226	82
(2) returns (Kshs)	5166768	9997176	48100	52666250	423675005	82
(3) prices (Kshs/loaf)	3.78	.24	3.00	4.20		82

It can also be noted that the returns to the firms, or the gross earnings of the firms exhibit a similar pattern. The total returns for all the firms, Table 5.3.3C (2), from the sale of bread per month stands at kshs 423.7 million in which the average is kshs 5.2 million. In this respect, some firms earn as high as kshs 52.7 million, while others earn as low as kshs 48.1 thousand. Although the prices of the bread are controlled, there is, however, a variation in which some firms sell a loaf for Kshs 3.00 while other sell it for Kshs 4.20. Consequently, the average price of a loaf in the present sample stands at Kshs 3.78.

[3] Monetary values from official sources are represented as Kenya £. Otherwise, in the data collected from the present survey the monetary values are represented with Kenya Kshs. See footnote 3 in Chapter 3.

6.3.4 Promotion of local manufacturing

One of the concerns of the study in respect to the equipment that is used is the source of supply of such equipment and related peripheral components. In Table 6.3.4 are statistics which indicate the sources of the core equipment and peripheral components. In respect to the core equipment, Table 6.3.4(A), it can be noted that most of firms, 46%, acquire secondhand equipment. During the field study, it was observed that such secondhand equipment is purchased from other bakeries or local dealers. While 22% of the firms acquire their equipment through local manufacturers, a considerable number of firms, 18%, acquire new equipment from local agents, who are in essence representative of the foreign manufacturers. Still, a smaller number of firms, 14%, undertook direct import of the equipment. In contrast, Table 6.3.4(B), most of the firms, 82%, acquired peripheral components from local manufacturers, while 18% undertook direct import.

Table 6.3.4 Supplies of equipment and components in the sample bakery firms in Kenya, 1990/91

components	firms	%
A) core equipments		
local	15	18
secondhand	38	46
local-agent	18	22
direct-import	11	14
B) peripheral components		
local supplier	67	82
direct-import	15	18
total	82	100

6.3.5 Labour requirements

6.3.5.1 Level of employment

The total number of employees, Table 6.3.5A (1), for all the firms in the sample, is 2874, with an average of 17 persons per firm. These workers are involved in direct production and distribution activities of the bakeries, but they do not include individuals working on commissions. The range indicates that some firms employ as many as 310 persons while others employ as few as one. In order to understand the extent to which these figures represent the level of employment in the entire bakery industry, it is necessary to consider data from other sources. Most recent estimates of the employment in the bakery industry in Kenya is provided by the 1989 Statistical Abstract.

Table 6.3.5A Number of employees, labour wages and productivity in the sample bakery firms in Kenya, 1990/91.

variable	mean	std.dev.	minimum	maximum	sum	n
(1) employees	17	56	1	310	2874	82
(2) wages (Kshs)	1197.3	533.0	630.0	2950.0		82
(3) labour (bags/year)	907	701	156	3600	74409	82

In the referred Statistical Abstract, employment in the bakery industry for all the firms is indicated to have been 3,696 in 1977 (CBS 1977,1980,1989:121). This happens also to be the latest published data of the comprehensive industrial census which has been undertaken every five years since 1954. According to various reports and indicators, the overall growth in the bakery industry, however, has been stagnant and exhibiting drastic decline in recent years. Specifically, the Statistical Abstract (CBS 1989:120) provides the data of employment in the bakery industry among the registered firms as being 2,228 in

1981; 2,911 in 1985; 2,433 in 1987 and 2,340 in 1988. These data are consistent with the findings of the present survey which indicate that the total number of employees in this industry in 1990 was 2874.

6.3.5.2 Labour wages

In Table 6.3.5A (2), are statistics which reflect the average wages per month for the firms in the sample. While the average level of wages is kshs 1197, the differences between the firms ranged from kshs 650 to 2950. In comparison, the Statistical Abstract (CBS 1989:119-121) indicated the average wages to have been kshs 486 in 1977 for all the firms in the bakery industry and kshs 2284.90 in 1989 for large firms, while the economic survey (1990:56) indicates the average wages in 1990 to have been kshs 623.70 per month in the entire manufacturing sector. In this respect, statistics from the sample of firms in the present study are fairly similar to those from other sources.

6.3.5.3 Labour productivity

It should be recalled that the procedure used to determine productivity of labour was adopted from Kilby (1965) and Kaplinsky (1980), which involves taking the ratio of the annual quantities of bags of wheat flour processed and the total number of employees of the firm. The result is a unit in bags processed annually by each employee. The productivity of labour for all the firms is 74409 bags per year, in which the average is

907 bags, Table 5.3.5A (3). The variation, however, is considerably large, with some firms exhibiting as high as 3600 bags while others realize as low as 156 bags for every employee. It is interesting to note that these figures are comparable to those reported by Kaplinsky (1980) despite a time lapse of over ten years.

6.3.5.4 Labour skills

The structure of the employees for all the firms in the sample in respect to skills is presented in Table 6.3.5B in which it can be noted that the total number of workers with technical skills is 274 with an average of 4 persons per firm. These statistics indicate that the difference between the firms ranged from one to 34 persons. A similar pattern applies to the employees with artisan skills, i.e. semi-skilled workers. Whereas the total number of workers with artisan skills is 1174, the average is 7 persons per firm. Variation in this category of workers is considerably large as it ranges from one person to 230 workers in some firms. Further, the total number of workers without skills is 1426, with an average of 10 persons per firm and a variation between the firms which ranged from 2 to 240 persons.

Table 6.3.5B Structure of the labour skills[4] in the sample bakery firms in Kenya 1990/91

variable	median	std dev	minimum	maximum	sum	n
A) technicians	4	6	1	34	274	51
B) artisans	7	30	1	230	1174	80
C) unskilled	10	37	2	240	1426	63

6.3.6 Training Practices

In respect to the utilization of labour, an important aspect is the way in which firms improve the skills and competence of their workers. Basically, at least in the case of firms in Kenya, there are two ways that are discussed extensively in the literature. One of the ways in which firms improve skills of the workers is through recruitment practices and the other is through training arrangements. While recruitment of the school leavers is expected, Table 6.3.6 (A), recruitment practices of workers from other bakeries is interesting. Whereas most the firms, 52%, recruit school leavers who usually have limited experience and skills in bakery or industrial production, a considerable proportion of firms, 32%, recruit their workers from other bakeries, which seek to employ workers with some experience and/or training in operations of bakeries. It is interesting to note that in the opinion of other authors (King 1975, Mikkelsen 1987), firms restrain from sponsoring workers for formal training because of fear of "voluntary mobility". Such mobility, however, is the source of recruitment of experienced workers by other firms. It is indeed a component which constitutes in theory external economies. While workers recruited from other bakeries may be induced with relatively competitive rewards, they bring into

[4] Technicians and artisans are 51 and 80 respectively, because some firms did not have these categories of the employees.

the firms savings in respect to training expenses and time. Still, it is interesting to note that a number of firms undertake recruitment from the technical institutions.

Table 6.3.6 **Sources of recruitment of workers and methods of training in the sample bakery firms in Kenya 1990/91**

aspects		firms	%
A) sources of recruitment			
	other bakeries	26	32
	school leavers	47	57
	technical institutes	9	11
B) methods of training			
	experience	51	62
	apprenticeship	20	24
	inside courses	11	14
	total	82	100

The distribution of fi...ns in respect to the ways in which workers have been trained in the past two years is presented in Table 6.3.6 (B). Essentially, training is a responsibility of the individual workers. In most firms, 62%, workers acquired skills through experience or learning by doing, while in other firms, 24%, workers learned through apprenticeship in which case firms attached one or two workers to another worker with a longer experience, or new skills, or a consultant. Usually, such arrangements were made for new employees or when new equipment was acquired. It can be noted further that a smaller proportion of firms organized formal courses within the firm. Invariably, such courses are for a special purpose intended for adaptation of new equipment or to solve supervisory problems, such as was the case in some particularly large firms.

7 STATISTICAL ANALYSES OF HYPOTHESES

In this chapter I turn to testing of the hypotheses and, in essence, to identifying empirically factors that account for variation in the levels of production capacities and adaptation of production technologies. Basically two methods of analyses are used for this purpose. One-way analysis of variance is used in respect to the dependent variables that are measured as interval numerical values or ordinal scale with underlying order of continuity, and independent variables are measured in discrete categories. In this procedure, the focus is on changes on the averages across various categories of the independent variable and associated probability level. The other method of analysis used is cross-tabulation which is appropriate when both the dependent and independent variables are measured in discrete categories. The focus in this procedure is on the changes on percentages of the cases across the categories of the independent variable and associated probability level.

7.1. PRODUCTION ORGANIZATION

7.1.1. The nature of investment

It was predicted, hypothesis P1, that the nature of investment will vary with the type of entrepreneurs, in such a way that firms of MNCs will be characterized by large-scale operations, while firms of local entrepreneurs with prior experience will be characterized by medium sized operations as compared to firms of recent industrial entrepreneurs which were expected to be characterized by small scaled operations. This hypothesis is given support, in principle, by the empirical data collected from the sample of the firms, Table 7.1.1A.

Table 7.1.1A Production capacities of firms by type of entrepreneurs

group	number	mean	std.dev.	F	p
Africans	42	36559.1	49339.0		
Asians	26	59519.2	55995.5		
mixed	10	255500.0	198581.1		
mncs	4	542875.0	201344.8		
total	82	95237.6	152787.5	49.1	<.0001

It will be noted, however, that while the investment pattern for mixed entrepreneurs was not predicted, it falls in second place after MNCs. This is because such collaboration brings together resources and capabilities which are not available separately in each type of local entrepreneur. Because of investment constraints arising from different locations, it was predicted, hypothesis P2, that the nature of investment will vary with location of the firms in such a way that a shift in location from rural to urban areas will be associated with increase in capital investment. While empirical data, Table 7.1.1B, support this hypothesis, the data indicate that in fact the largest investments, in aggregate, are found in semi-urban areas. There are two explanations with regards to this observation. One is the fact that such location enables firms to service both rural and urban markets with optimum transport costs. The second explanation concerns the fact that milling industries in Kenya are concentrated in semi-urban areas.

Table 7.1.1B Production capacities of firms by location

group	number	mean	std.dev.	F	p
rural centres	29	27840.0	38971.4		
rural towns	19	75638.2	86010.3		
semi-urban	18	175389.0	184181.4		
urban areas	16	150500.0	235932.8		
Total	82	95237.6	152787.5	5.0	<.003

7.1.2 Equipment adopted

With regard to adoption of the equipment, it was predicted that entrepreneurs and location of the firms influence the nature of investment which in turn would have primary influence on the type of equipment to be adopted by the firms. In such relationship, it was predicted, hypothesis P3, that entrepreneurs will have additional direct effects on the equipment adopted by the firms. This hypothesis is also supported by empirical data. Indeed, variation in the type of equipment adopted by firms in five critical phases of production is systematically related to variation in the type of entrepreneurs. The data in Table 7.1.2A, 1-5, indicate that these relationships are significant at a level of significance less than 0.0001. In addition, the strength of the relationships allows for considerable accuracy in prediction, i.e. 76% to 80% with the correlation ratio, eta.[1]

Table 7.1.2A **Equipment adopted by type of entrepreneur**

associations[2]	X^2	df	p	Eta
1. adoption of mixers	92.8	12	<.0001	.77
2. adoption of provers	72.3	6	<.0001	.76
3. adoption of moulders	82.9	6	<.0001	.77
4. adoption of dividers	93.2	6	<.0001	.80
5. adoption of ovens	85.4	6	<.0001	.77

It was predicted, hypothesis P4, that location of the firms will have direct additional influence on equipment adopted by the firms in such a way that firms located in urban areas will be characterized by adoption of modern equipment as compared to firms located in rural areas which were expected to be characterized by limited core equipment and manual operations. The empirical data support this hypothesis, Table 7.1.2B. Variation in equipment adopted by the firms is systematically related to changes in the location of the firms in five phases of production. These relationships are significant at

[1] Correlation ratio, eta, is used because of its relevance in an analysis of a categorical independent variable and dependent variables measured in continuous scale.

[2] Full cross-tabulation tables are presented in Appendix 4, Tables A7.1.1 to A7.1.5.

0.0001 probability level of error, and with a strength of association in each that allows for a considerable accuracy in prediction. In the case of Somer's D statistic, such strength ranges from 48% to 52% of association[3], while with the correlation ratio such associations range from 63% to 68%.

Table 7.1.2B Equipment adopted by location of firms

	associations[4]	X^2	df	p	D	Eta
1.	adoption of mixers	46.7	6	<.0001	.51	.67
2.	adoption of provers	35.8	6	<.0001	.48	.63
3.	adoption of moulders	36.3	6	<.0001	.48	.63
4.	adoption of dividers	35.6	6	<.0001	.49	.63
5.	adoption of ovens	46.5	6	<.0001	.52	.68

While entrepreneurs and the location of firms were expected to influence equipment adopted by the firms, it was predicted, hypotheses P5, that the nature of investment will have primary influence on the type of equipment adopted in such a way that large firms will be characterized by fully integrated modern equipment, while medium size will be characterized by disaggregated modern equipment, as compared to small firms which will be characterized by

[3] Somer's D statistic is used in addition to correlation ratio, because of its relevance in analyses of the variables which both the independent and dependent are measured in an ordinal scale.

[4] Full cross-tabulation tables are presented in Appendix 4, Tables A7.1.7 to A7.1.12.

limited processing equipment and manual operations. As can be noted in Table 7.1.2C, this hypothesis is given support by the empirical data from the sample of the Kenyan bakeries. Variation in equipment adopted is systematically related to the changes in the size of firms in the five phases of production. Again, these relationships are significant at 0.0001 probability of error and the strength of the associations is considerably higher, i.e. 61% to 77% in the case of Somer's D statistic and 69% to 74% with the correlation ratio.

With regard to the equipment adopted by firms, it can be seen that the three hypotheses are supported by the data, which indicate that the three factors—entrepreneurs, location and the nature of investment—determine the type of equipment adopted by firms. While the prediction was that the nature of investment will have primary effects, the strength of the associations as reflected by the Somer's D and the correlation ratio indicate that both the entrepreneurs and the nature of investment have strong influence as compared to the location.

Table 7.1.2C Equipment adopted by size of firms

associations[5]	X^2	df	p	D	Eta
1. adoption of mixers	77.1	8	>.0001	.77	.74
2. adoption of provers	56.6	4	>.0001	.64	.68
3. adoption of moulders	64.0	4	>.0001	.62	.68
4. adoption of dividers	64.0	4	>.0001	.61	.69
5. adoption of ovens	58.4	4	>.0001	.61	.69

It is apparent in Table 7.1.1C(6) that the level of automation varies systematically with the increase in the size of the firms. Indeed, the F ratio is 26.5 and significant at F statistics less than 0.0001.

7.1.3 Utilization of production capacities

As pointed out above, utilization of production capacities reflects the performance of firms in adaptation of technologies. It was predicted, hypothesis P6, that utilization of the production capacities will vary with type of entrepreneurs in such a way that firms of MNCs will be characterized by high production capacities, while firms of local entrepreneurs with prior experience will have relatively higher utilization of the production capacities as compared to firms of recent industrial entrepreneurs. This hypothesis is

[5] Full cross-tabulation tables are presented in Appendix 4, Tables A7.1.13 to A7.1.18.

supported by the data. It can be noted in Table 7.1.3(A) that percentage of capacity utilization by the firms changes with variation in the type of entrepreneurs. Specifically, it increases from 40% in the case of firms of African entrepreneurs to 65% in the case of firms of MNCs, with firms of Asian and mixed entrepreneurs falling between the two extremes. This association is significant at 0.0001 probability level of error.

Table 7.1.3 Percentage of capacity utilization by type of entrepreneur, location and size of the firms

Group	Number	Mean	Std.Dev.	F	P
A) entrepreneurs					
Africans	42	40.0	15.0		
Asians	26	47.3	12.4		
mixed	10	62.2	15.0		
mncs	4	65.1	13.1		
total	82	46.3	16.1	9.5	<.0001
B) location					
rural centres	29	37.3	14.3		
rural towns	19	44.3	11.2		
semi-urban	18	52.6	15.6		
urban areas	16	57.7	15.8		
Total	82	46.3	16.2	8.6	<.0001
C) size					
micro	12	38.8	14.7		
small	37	42.3	15.4		
medium	19	48.4	14.0		
large	14	60.2	14.4		
Total	82	46.3	16.2	6.1	<.0001

In addition, it was predicted, hypothesis P7, that utilization of production capacities will vary with the location of firms in such a way that a shift in location from rural to urban areas will be characterized by higher utilization of the production capacities. This hypothesis is supported by the data. It is clear in Table 7.1.3(B) that as the location shifts from rural centres to urban areas, the average percentage of capacity utilization changes. Specifically, the percentage of utilization of production capacities increases from 37% in rural centres to 57% in urban areas and is significant at 0.0001 probability level of error. While entrepreneurs and location of firms were predicted to have influence on the utilization of production capacities, the nature of investment was predicted, hypothesis P8, to have influence in such a way that large firms will be characterized by higher utilization of production capacities as compared to small firms. This hypothesis is supported by the data. Specifically, it can be noted in Table 7.1.3(C) that as the size of firms shifts from micro operations to large scale operations, the average percentage of capacity of utilization changes. More specifically, the percentage changes from 38.8% to 60.2% in the case of micro operations and large scaled operations respectively. Small and medium sized operations fall in between the two extremes with 42% and 48%, respectively, of the capacity utilization. This relationship is significant at 0.0001 probability level of error. As expected, the data indicate that the three factors—entrepreneurs, location and the size of firms—are associated with the levels of utilization of the production capacities.

7.2 PROMOTION OF LOCAL MANUFACTURING

7.2.1 Supply of equipment

One of the concerns of the study was the way in which bakery firms encourage manufacturing capability in the sub-sector. It was predicted, hypothesis E9, that sources of acquisition of equipment will vary with types of entrepreneurs in such a way that firms of MNCs will be characterized by direct imports, while firms of local entrepreneurs having prior experience will acquire equipment through local agents of foreign suppliers, as compared to firms of recent industrial entrepreneurs which will be characterized by acquisition of equipment from local manufacturers. This hypothesis is supported by empirical data. It can be noted in Appendix 4, Table A7.2.1, that all four firms of MNCs and seven out of ten of the firms with mixed entrepreneurs acquired their equipment through direct import. Among the firms of Asian entrepreneurs, 46% imported their equipment through local agents, while 50% acquired their equipment through secondhand purchase. Whereas 33% of firms of African entrepreneurs obtained their equipment from local manufacturers, 57% acquired their equipment also through secondhand purchase. As summarized in Table 7.2.1(A), this association is significant at the criterion probability level of 0.01. The strength of the association provides considerable explanation of the variation. In respect to Somer's D statistic, it can be noted that 68% of the variation in acquisition of equipment is explained by the influence of entrepreneurs.

Table 7.2.1 **Supply of equipment in respect to types of entrepreneurs, location and size**

associations[6]	X^2	df	p	Lambda[7]
A. entreprenours	82.3	9	<.0001	.22
B. location	48.2	9	<.0001	.06
C. size	62.4	6	<.0001	.20

In the case of the influence of location of the plants, the prediction was, hypothesis E10, that the sources of equipment will vary with the location of firms in such a way that firms based in rural areas were expected to acquire equipment from local manufacturers as compared to firms based in urban centres which were expected to acquire equipment through direct import and local agents of foreign suppliers. This hypothesis is supported by the data. It can be noted in Appendix 4, Table A7.2.2, that 52% of firms located in rural areas acquired their equipment from local manufacturers and 63% of those located in rural towns obtained their equipment through secondhand purchase. It is interesting to note that there is no systematic pattern with regard to firms located in semi-urban and urban areas. However, as indicated in Table 7.2.1(B) above, this association is significant at 0.0001 probability level of error and the strength of the association is considerably high such that a 54% of variation is explained.

[6] Full cross-tabulation tables are presented in Appendix 4, Tables A7.2.1 to A7.2.3.

[7] Lambda as a measure of association is used in these tables because the dependent variables are measured with a nominal scale which demands categorical analysis.

In addition to the influence of entrepreneurs and of location, it was predicted, hypothesis E11, that sources of equipment will vary with the size of firms in such a way that large firms will be characterized by direct import of equipment as compared to small firms which were expected to acquire their equipment from local manufacturers. This hypothesis is affirmed by the data from the sample of the bakery firms. Among the large firms, 72% acquired their equipment through direct import, Appendix 4, Table A7.2.3, while 58% of small firms acquired their equipment through secondhand sources. Further, 49% of medium-sized firms obtained equipment through local agents of foreign suppliers, while 38% acquired equipment through secondhand purchase. Whereas this relationship is significant at 0.01, and the strength of the association, Table 7.2.1(C) above, is such that 59% of the variation is explained.

7.2.2 Supply of peripheral components

As stated above, supply of peripheral components is considered separately from the supply of equipment because of the fact that components are relatively easy to manufacture locally. It was predicted, hypothesis E12, that supply of components will vary with firms in respect to type of entrepreneurs in such a way that firms of MNCs will be characterized by use of direct import as compared to firms of local entrepreneurs which were expected to be characterized by use of local supplies. The data from the sample in the present study lend support to this hypothesis. Most of the firms of local entrepreneurs, 97% in the case of African entrepreneurs and 96% in the case of Asian entrepreneurs, acquired their components from local suppliers, Appendix 4, Table A7.2.4. This is in contrast to firms of MNCs, all four of which acquired their components through direct import. It is interesting, however, to note that most firms, 90%, with mixed entrepreneurs acquired their components through direct import. This association, summarized in Table 7.2.2(A) below is significant at the criterion probability level of 0.01, and the explained variation is as high as 42%.

Further, it was expected, hypothesis E13, that location of firms will influence sources of supply of components in such a way that firms based in rural areas will acquire their components from local suppliers as compared to firms based in urban areas. While this hypothesis is supported by the data at a significant level of 0.01, most of the firms, Appendix 4, Table A7.2.5, obtained their components from local suppliers. As summarized with Table 7.2.2(B) below, the strength of the relationship between location and supply of the components is as low as 15%, which suggests that the location of the plant has limited impact on the acquisition of components.

Table 7.2.2. Supply of the components by the type of entrepreneurs, location and size

	associations	X^2	df	p	Lambda
A.	entrepreneurs	63.0	3	<.0001	.80
B.	location	12.2	3	<.007	.15
C.	size	75.6	2	<.0001	.54

With regard to the influence of the nature of investment, hypothesis E14, the prediction was that large firms will be characterized by direct import of components as compared to small firms which were expected to acquire components from local suppliers. This hypothesis is affirmed by the data from the present sample. Indeed, while all the large firms acquired components through import, all the small firms acquired components from local suppliers, Appendix 4, Table A7.2.6. It is interesting to note that virtually all, 96%, of the medium sized firms also acquired their components from local suppliers. In fact, as summarized in Table 7.2.2(C), while the relationship between the size and acquisition of components is significant at .0001, the explained variation is as high as 54%.

7.3 LABOUR REQUIREMENTS

In this section hypotheses concerning labour requirements are considered. While there are several sub-hypotheses, the overall prediction was that entrepreneurs and location of the firms will have primary influence on the nature of investment which, in turn, influence labour requirements. In this perspective, entrepreneurs and location of the firms were expected to have direct effects, in addition to the influence of the nature of investments, on labour requirements.

7.3.1 Level of employment

With regard to overall employment, it was predicted, hypothesis L15, that absorption of labour will vary with firms in respect to the type of entrepreneurs in such a way that firms of MNCs will be characterized by a high number of employees, while firms of local entrepreneurs having prior experience will have a relatively high number of employees as compared to firms of recent industrial entrepreneurs. This hypothesis is given support by empirical data from the present sample. As can be noted in Table 7.3.1(A), the average number of workers changes with the categories of the entrepreneurs. Specifically, it increases from an average of 13 workers per firm, in the case of firms of African entrepreneurs, to 20%, in the case of firms of MNCs. It is interesting to note that firms with mixed entrepreneurs are characterized by the second largest average number of employees, while firms of Asian entrepreneurs fall into third place in terms of the average number of workers. This association is significant at the criterion probability level of sampling error of 0.001.

Table 7.3.1 Level of employment in respect to type of entrepreneurs, location and size

group	number	mean	std.dev.	F	p
A) type of entrepreneurs					
Africans	42	13.0	12.0		
Asians	26	21.0	13.0		
mixed	10	96.0	68.6		
mncs	4	207.0	95.7		
total	82	35.0	56.6	58.8	<.0001
B) location					
rural centres	29	12.0	9.2		
rural towns	19	26.0	25.3		
semi-urban	18	59.7	68.5		
urban areas	16	60.1	92.4		
Total	82	35.1	56.7	4.5	<.006
C) size					
micro	12	3.0	1.0		
small	37	12.1	5.2		
medium	19	29.4	8.1		
large	14	131.0	86.0		
Total	82	35.0	56.6	42.6	<.0001

In addition, it was predicted, hypothesis L16, that absorption of labour will vary with location of firms in such a way that a shift in location from rural to urban areas will be characterized by increase in the number of employees per firm. The data from the sample of the bakeries lend support to this prediction, Table 7.3.1(C). However, it is worthwhile to note that the average number of workers in semi-urban areas is the same as for urban areas. The reason for this pattern, as will be recalled, is the fact that production capacities in semi-urban areas are as large as in urban areas.

Furthermore, in addition to the influence of entrepreneurs and of location, it was predicted, hypothesis L17, that absorption of labour will vary with the size of the firms in such a way that the number of workers increases, on average, as the size of the firms increases. This hypothesis is supported by empirical data at the criterion probability level of 0.01. It can be noted in Table 7.3.1(C) that the average number of workers changes with the size of the firms. Indeed, it increases from 3 in the case of micro operations to 131 in the case of large-scale operations. It terms of the overall data in Table 7.3.1, while both entrepreneurs and size of the firms are characterized by larger variation in the absorption of labour, the size of the firms is associated with the largest variation.

7.3.2 Labour wages

It was pointed out earlier that wages of the labour force was considered in this study because of its importance in attracting and retaining required labour. It was predicted, hypothesis L18, that wages of workers will vary with firms in respect to the type of entrepreneurs in such a way that firms of MNCs will be characterized by higher wages as compared to firms of local entrepreneurs. In respect to the data in Table 7.3.2(A), this hypothesis is supported at the criterion probability level of 0.01. As can be noted, average wages change with the categories of entrepreneurs. Specifically, it increases from Kshs. 897.50, in the case of firms of African entrepreneurs, to Kshs. 2572.50 in the case of firms of MNCs.

Table 7.3.2 Average wages of firms by type of entrepreneurs, location and size

group	number	mean	std.dev.	F	p
A) type of entrepreneurs					
Africans	42	897.5	256.2		
Asians	26	1210.0	299.3		
mixed	10	1873.2	458.2		
mncs	4	2572.5	302.3		
total	82	1197.3	533.0	58.3	<.0001
B) location of firms					
rural centres	29	826.4	187.5		
rural towns	19	972.9	271.4		
semi-urban	18	1629.7	473.9		
urban areas	16	1649.5	594.1		
Total	82	1197.3	533.0	26.4	<.0001
C) size of firms					
micro	12	802.0	282.0		
small	37	1019.2	303.0		
medium	19	1169.6	317.2		
large	14	2044.3	548.2		
Total	82	1197.3	533.0	34.4	<.0001

In addition, it was expected, hypothesis L19, that location of the firms will have influence on wages of workers in such a way that a shift in location from rural to urban areas will be associated with increase in wages. The data in Table 7.3.2(B) confirms this prediction. It can be noted that average wages change with the categories of the location of firms. It rises from Kshs. 826.4, in the case of firms based in rural areas, to Kshs. 1649.5 in the case of firms based in urban centres.

The effect of the entrepreneurs and of the location of firms on wages were expected to be additional to the influence of the nature of investment. In this respect, it was predicted, hypothesis L20, that wages of workers will vary with size of the firms in such a way that as the size increases, wage also increases. With respect to the data in Table 7.3.2, this hypothesis is supported at the criterion probability level of 0.01. As can be noted, the average wage increases from Kshs. 802, in the case of micro operations, to Kshs. 2044 in the case of large-scale firms.

7.3.3 Labour productivity

It will be recalled that productivity of labour is considered in the present study because of the argument that such productivity varies between capital-intensive and labour-intensive operations. It was predicted, hypothesis L21, that productivity of labour will vary with firms in respect to the type of entrepreneurs in such a way that firms of MNCs will be characterized by the highest productivity of labour, while those of entrepreneurs with prior experience will have a relatively higher productivity of labour as compared to firms of recent industrial entrepreneurs. As can be noted in Table 7.3.3(A), this hypothesis is not supported by data at the criterion probability level of 0.01. This indicates that entrepreneurs are less important with regard to variation in the productivity of labour.

Table 7.3.3 **Productivity of labour by types of entrepreneurs, location and size of the firms**

group	number	mean	std.dev.	F	p
A) entrepreneurs					
Africans	42	710.6	694.4		
Asians	26	995.5	605.2		
mixed	10	1340.0	841.0		
mncs	4	1319.4	188.5		
total	82	907.4	700.8	3.2	<.03
B) location					
rural centres	29	518.1	302.6		
rural towns	19	924.3	671.6		
semi-urban	18	1359.3	1003.8		
urban areas	16	1084.6	475.4		
Total	82	907.4	700.8	7.2	<.0003
C) size					
micro	12	599.2	306.8		
small	37	811.2	702.5		
medium	19	1107.2	915.9		
large	14	1155.0	462.4		
Total	82	907.4	700.8	2.2	<.10

With regard to the influence of location, it was predicted, hypothesis L22, that productivity of labour will vary with the location of firms in such a way that a shift in location from rural to urban areas will be characterized by increase in productivity of labour. This hypothesis is supported by data. It can be noted in Table 7.3.3(B) that average productivity of labour changes with the location of firms. Specifically, it increases form 862 bags per year in the case of firms based in rural areas to 2262 for firms based in semi-urban areas. While this relationship is significant at the criterion probability level of 0.01, it is interesting to note that productivity of labour for firms based in urban areas is relatively lower as compared to firms based in semi-urban areas.

In addition to the influence of entrepreneurs and of location, it was predicted, hypothesis L23, that productivity of labour will vary with the nature of investment such that large operations will be characterized by higher productivity as compared to small scaled operations. This hypothesis is not supported by the data. It is interesting to note in Table 7.3.3(C) that while the relationship is not significant at the criterion probability level of 0.01, there is systematic variation in the average productivity in respect to the size of firms.

7.3.4 Labour skills

Skills of the labour force was identified above as one of the most important aspects in the utilization of labour and in adaptation of production technologies. It was predicted, hypothesis L24, that absorption of skilled labour will vary with firms in respect to the type of entrepreneur in such a way that firms of MNCs will be characterized by lower proportion of skilled workers as compared to firms of local entrepreneurs. This expectation is supported with respect to the absolute number of skilled workers. However, in the case of the ratio of skilled workers to the total labour force, it is not supported by the data. Whereas the average proportion of skilled workers changes with the type of entrepreneur, Table 7.3.4A(1), the association is not significant at the criterion probability level of 0.01. This means that while firms of MNCs absorb relatively larger numbers of skilled workers, such numbers are not necessarily different to those of firms of local entrepreneurs in relation to total employees.

Table 7.3.4A Proportion of skilled labour by type of entrepreneurs, location and size of the firms

group	number	mean	std.dev.	F	p
1) entrepreneurs					
Africans	15	23.0	25.2		
Asians	22	21.0	14.7		
mixed	10	10.3	5.5		
mncs	4	10.1	2.1		
total	51	18.6	17.3	1.60	<.2009
2) location					
rural centres	14	24.3	24.8		
rural towns	11	18.3	11.3		
semi-urban	12	12.0	10.0		
urban areas	14	18.8	17.0		
Total	51	18.6	17.4	1.07	<.3722
3) size					
micro	3	61.0	34.7		
small	22	20.7	15.3		
medium	13	15.6	7.2		
large	13	8.5	4.2		
Total	51	18.6	17.4	13.4	<.0001

In addition, it was predicted, hypothesis L25, that the location of the firms will have influence on the absorption of the skilled labour in such a way that a shift in location from rural to urban areas will be associated with higher proportion of skilled workers. This expectation is not supported by the data. In fact, it can be noted in Table 7.3.4A(2) that there is no systematic change in the average proportion of skilled workers in respect to changes in category of the location of firms. It is worthwhile to note that, even with regard to absolute numbers of skilled workers, table A7.3.3, the location of firms does not effect any significant variation on the absorption of skilled workers.

Besides the predicted influence of entrepreneurs and of the location of firms, it was predicted, hypothesis L26, that the nature of investment will influence absorption of skilled labour in such a way that, as the size of firms increases, the proportion of skilled workers decreases. This anticipation is supported by empirical data from the sample in the present study. It can be noted in Table 7.3.4A(3) that as the size of firms shifts from micro to large scaled operations, the average proportion of skilled workers changes. Specifically, it changes from 61% in the case of micro operations to 8% in the case of large scaled operations, and such association is significant at the criterion probability level of 0.01. These results indicate clearly that the size of firms is a determinant fact in absorption of skilled labour.

In addition to skilled labour, it was predicted, hypothesis L27, that semi-skilled labour will vary with firms in respect to the type of entrepreneur in such a way that firms of MNCs will be characterized by the highest proportion of semi-skilled workers, while firms of local entrepreneurs having prior experience will be characterized by a relatively higher proportion of semi-skilled workers as compared to recent industrial entrepreneurs. This prediction is upheld by empirical data at the criterion probability level of 0.01. However, as can be seen, Table 7.3.4B(1), variation across the categories of entrepreneurs is considerably small. In the case of the effect of location of the firms, hypothesis L28, it was predicted that absorption of semi-skilled labour will vary with the location of firms in such a way that as location shifts from rural to urban areas, the proportion of semi-skilled workers would become higher. This hypothesis, as can be seen in Table 7.3.4B(2), is not supported by empirical data.

Besides the influence of entrepreneurs and of the location, it was predicted, hypothesis L29, that the nature of investment will have primary influence in such a way that higher proportion of semi-skilled workers will be associated with increase in the size of firms. This expectation is not supported as predicted by empirical data from the present sample of the firms. The relationship which is significant is a negative one. It can be noted in Table 7.3.4B(3) that the average ratio of semi-skilled workers changes inversely with the size of firms. Specifically, among micro firms, 81% of the work force have artisan skills as compared to 38% among large scaled firms. This characteristic does not support the theoretical prediction that arises from the Big Push model with regard to absorption of semi-skilled labour. On the contrary, as reported in "Other Studies" (Mikkelsen 1987, Masi 1988), large-scale firms are characterized by the largest proportion of unskilled workers in personnel and, given the scale of their operations, seem predominantly interested in on-the-job training for their operatives.

Table 7.3.4B **Proportion of semi-skilled labour by type of entrepreneurs, location and size of the firms**

group	number	mean	std.dev.	F	p
1) entrepreneurs					
Africans	40	57.5	27.1		
Asians	26	48.5	20.8		
mixed	10	29.0	15.2		
mncs	4	52.5	23.5		
total	80	50.8	25.1	3.95	<.0113
2) location					
rural centres	28	55.5	29.5		
rural towns	18	53.5	23.4		
semi-urban	18	44.6	22.0		
urban areas	16	46.4	21.7		
Total	80	50.8	25.1	.9189	<.436
3) size					
micro	11	81.0	27.9		
small	37	51.3	22.9		
medium	19	40.9	13.8		
large	13	38.1	21.8		
Total	80	50.8	25.1	9.92	<.0001

7.4 Training practices

As it was pointed out earlier, one of the ways which firms use to acquire required skills is training. The prediction in this regard, hypothesis T30, was that training practices will vary with firms in respect to the type of entrepreneurs in such a way that firms of MNCs will be characterized by internal courses as compared to firms of local entrepreneurs which were expected to be characterized by learning through experience. This anticipation is supported by empirical data from the present sample of the Kenyan bakeries. As can be seen in Appendix 4, Table A7.3.1, most firms–81%, for African entrepreneurs and 62% for Asian entrepreneurs–workers acquired their skills through experience which is in contrast to the firms of MNCs in which all the four sponsor internal courses for the workers. It is, however, interesting that 50% of firms with mixed entrepreneurs organize courses for the workers. As summarized in Table 7.4.1(A), this relationship is significant at <.0001 and a considerable variation of 26% is explained with Lambda statistics.

Concerning the effects of location of the plants, the prediction, hypothesis T31, was that location would influence training practices. It was the expectation of the study that firms based in rural areas would be characterized by workers learning through experience as compared to firms based in urban areas, which were expected to be characterized by the providing of organized courses for the workers. This hypothesis is supported by the data at the criterion probability level of 0.01. As reflected by the data presented in Appendix 4, Table A7.3.2, most firms based in rural centres and rural towns, 86% and 79% respectively, workers acquired skills through on-the-job learning. However, there is no systematic pattern with regards to firms based in semi-urban and urban areas. As a matter of fact, because of this tendency only 6% of the variation is explained, Table 7.4.1(B) below.

Apart from the influence of the entrepreneurs and of the location of firms, it was predicted, hypothesis T32, that the nature of investment will influence training practices. The data support this expectation. In fact, in most small-scale operations, 80%, workers acquire skills through on-the-job experience as compared to large scaled operations, 64% of which organize inside courses for the workers, Appendix 4, Table A7.3.3. Medium sized operations are characterized by workers acquiring skills through on-the-job experience and through apprenticeship.

Table 7.4.1 Training practices by types of entrepreneurs, location and size of the firms

associations	X^2	df	p	Lambda
A. entrepreneurs	53.3	6	<.0001	.26
B. location	25.3	6	<.0003	.06
C. size	43.9	4	<.0001	.19

Indeed, as summarized in Table 7.4.1(C), this association is significant at 0.0001 and a considerable percentage, 19%, of the variation is explained.

In summary, the two principal aims of this chapter were to evaluate the proposed theoretical model presented in Table 4.1.3 and to identify relative advantages in the application of the small-scale and Big Push models, with repsect to attainment of self-sustaining industrial growth and overall economic development. It is clear that the data analyzed in this chapter lend support to the proposed theoretical model. In point of fact, entrepreneurs and location of the firms are substantially associated with the nature of investment. While firms of the MNCs are characterized by the largest production capacities in conformity with the expectation, firms of the mixed entrepreneurs represented larger production capacities as compared to those of the Asian and African entrepreneurs. Nonetheless, as predicted, firms of the Asians reflected relatively larger production capacities as compared to those of the African entrepreneurs. Further, the three factors, entrepreneurs, lcoation of the plants and the nature of investment reflected statistically significant and strong associations with the level of equipment adopted, and utilization of the production capacitites, as well as with the indicators of the promotion of local manufacturing. Furtherfore, the three factors also exhibited strong relationships with the various aspects in the utilization of labour and development of the labour skills.

Pertaining to the relative advantages in application of the small-scale and Big Push models, the data analyzed in this chapter indicate that medium size operations have greater potential in the context of the developing countries, especially when the concern is adoption of technically efficient equipment of medium capacity. Indeed, medium size firms, 95%, operated batch or continuous equipment, as compared to small enterprises of which 62% had relatively manual equipment, and large firms which 57% operated high-speed and integrated systems. Further, 87% of the medium size firms acquired their equipment either through secondhand or local agents as compared to large firms, most of which, 72%, imported their equipment. While large firms absorb the highest number of workers, medium size enterprises are characterized by relatively higher ratios of skilled and semi-skilled workers.

8 THE NATURE OF INFLUENCE IN ADAPTATION OF TECHNOLOGIES

Analyses in the previous chapter indicate, in principle, that hypotheses being examined in the present study are supported by empirical data. Specifically, significant associations existed between the nature of investment and the type of entrepreneurs and location of the plants. Further, these three factors exhibited significant statistical association with the level of production equipment, utilization of the production capacities, inducement of local entrepreneurial activities and labour requirements. One of the main problems with bivariate statistical associations, as in chapter 7, is the lack of control of the overlapping influence between the determinant factors, such that effects due to other factors and interactive effects can be reflected by one factor.

Principally, one of the purposes of this chapter is to examine the nature of influence between the determinant factors and the indicators of adaptation of the production technologies in order to evaluate further the predictions of the model set forth in Chapter 4. In order to control overlapping effects and to determine the relative importance of each factor, the influence of the determinant factors needs to be analyzed simultaneously. One of the statistical methods suitable for this purpose is the multiple regression procedure in which, while controlling the confounded effects, the explained variation can be identified in any of the indicators of the dependent variables taking into account the relative importance of each determinant factor.

It will be recalled that the overall hypothesis of this study is that entrepreneurs and location of the firms influence the nature of investment which in turn influence, in addition to direct effects of entrepreneurs and location, the type of equipment adopted, inducement of local production capabilities and labour requirements. In this chapter, regression analysis is performed between the nature of investment as a dependent variable and the type of entrepreneurs and location of the firms as independent variables, in order to determine the nature of influence and the relative importance of the two determinant factors. The model under consideration in this case is as follows:

$$Y_i=A+B_1X_1+B_2X_2+E \qquad (1)$$

where Y_i are the values of the dependent variable, X_1 and X_2 are the type of entrepreneurs and location of the firms respectively, with E standing for error or residuals. Whereas location is measured with an ordinal scale[1] such that 1 represents rural centres and 4 represents urban areas, it is treated as a continuous scale and used in the regression analysis. The types of entrepreneurs, however, are essentially a categorical scale which, because of this fact, their categories are transformed into dummy variables with which three, i.e. MNCs, Mixed and Asians, are examined explicitly in the analysis,

[1] See Tables 6.1 and 6.2.3.

while the fourth, which consists of African entrepreneurs, is used as a reference group. The purpose of this procedure is to be able to examine the extent to which effects of the other entrepreneurs depart from the average levels of the African entrepreneurs. The specific model of analysis in this respect is as follows:

$$Y_i=A+B_1X_1+B_2X_2+B_3X_3+B_4X_4+E \qquad (2)$$

such that A is the mean of the reference category–in this case African entrepreneurs–X_1,X_2 and X_3 represent the categories of the other entrepreneurs, and X_4 is the location of the firms[2]. Since the usual regression beta weights are difficult to interpret when dummy variables are included in the regression, unstandardized B is used to indicate the effects of the factors and of the covariate, i.e. the categories of the entrepreneurs and location of the plants respectively. Further, analysis of variance in multiple regression with dummy variables is equivalent to the conventional correlation ratio (Eta), used in chapter 7, such that $Eta^2=R^2=SS_b/SS_t$. In other words, the predicted value of the dependent variable is the mean of the category and the residuals of the sum of squares $\Sigma(Y\text{-}Y')^2$ is equivalent to the sum of squares for "within", while regression sum of squares $\Sigma(Y'=Y)$ is equivalent to the sum of squares for "between" the groups in the one-way analysis of variance. In view of this fact,

[2] In such a model dummy variables are referred to as factors, while variables measured with continuous scale are referred to as covariates.

the coefficient of the R^2 reflects the amount of variance explained[3] by the dummy factors, as the case with the covariate, i.e. location of the firms.

In the subsequent analyses, the three factors–type of entrepreneurs, location of the plants and the nature of investment–are treated as independent variables, and the level of equipment adopted, utilization of the production capacities, promotion of local entrepreneurial activities and labour requirements as dependent variables. Consequently, the model for analysis is as follows:

$$Y_i=A+B_1X_1+B_2X_2+B_3X_3+B_4X_4B_5X_5+E \qquad (3)$$

such that X_5 is the size of the firms. In addition, three parameters for the effects of the interaction between the entrepreneurs, location and size are included such that the full model is as follows:

$$Y_i=A+B_1X_1+B_2X_2+B_3X_3+B_4X_4B_5X_5+B_6X_6+B_7X_7+B_8X_8+E \qquad (4)$$

where X_6, X_7 and X_8 represent the interaction effects between the entrepreneurs–Asians, Mixed and MNCs–with the location and size of the firms.

[3] The null hypothesis in the analysis in this chapter is that of R^2 equals 0 against the alternative that R^2 is not equal to 0.

In view of the theoretical perspective, Table 4.1.3, the method of the multiple regression applied in the analysis is a hierarchical procedure in which the effects of categories of the entrepreneurs are first determined, followed by the effects of the location and of the nature of investment, and lastly by the interaction effects. With this procedure, the unique influence of a factor or covariate is determined, while the common variance–confounded effects–is controlled. Furthermore, the effects of the subsequent variables are determined from the residuals of the factors already taken into account.

Besides evaluation of the theoretical model, this procedure provides effective way for controlling, or in essence to manage, multicollinearity among the independent variables. With data of this nature, some interdependence among the determinant factors is expected. For this reason, in addition to the control of the confounded effects through interaction parameters and hierarchical analyses, the nature of the collinearity among the predictor variables was assessed further with Factor Analysis. The results in terms of the eigenvalues and factor loadings indicate that the location of the enterprises and the size of the firms represent different dimensions with respect to the adaptation of technologies. As can be noted in Appendix 4, Table A8.0, the two variables load with considerably high coefficients (.98) on different factors, i.e. 5 and 6 in the case of the location and size of production respectively, which justify their treatment as two independent variables. As pertaining to the entrepreneurs, i.e. the dummy variables, they exhibit a moderate loading (.27%) on the same factor with the size of production. Such moderate loading permit utilization of the two variables in prediction of the adaptation of the technologies. Furthermore, the nature and extent of such overlap are reflected by the coefficients of the interaction terms between the factors and the covariates in the regression analysis.

8.1 PRODUCTION ORGANIZATION

8.1.1 Nature of investment

With regard to production organization, hypotheses P1 & P2, the prediction was that the nature of investment will be influenced by the type of entrepreneur and the location of firms. It was expected that firms of MNCs would be characterized by large-scale operations, while firms of the entrepreneurs with prior experience were expected to be medium-sized operations as compared to firms of recent industrial entrepreneurs which were expected to be small-scale operations. Additionally, the expectation was that location of the firms would have further influence on the nature of investment, such that firms which are based in rural areas would have lower production capacities as compared to those based in the urban areas.

This hypothesis is supported in principle by the empirical data obtained from the present sample of the bakery firms in Kenya. As can be noted in Table 8.1, the primary determinant of the nature of investment is the type of entrepreneurs. Of the 53% explained variance (R^2=.53) significant at less than .0001 probability level of error, 48% arises from the categories of the entrepreneurs, while location and interacting effects add 2% and 3% respectively. In addition, the contribution of the firms of MNCs, Mixed and Asian entrepreneurs are significantly higher, as reflected by the t-values and their respective probabilities, as compared to those of the firms of African entrepreneurs. Clearly, these results lend support to the expectation pertaining to the theoretical perspective adopted in this study and the subsequent hypotheses.

Table 8.1 Determinants for the nature of investment[4] in the bakery industry

Variable	B	SE B	R^2 change	t	p
mixed	0.90	0.18		5.4	<.0001
MNCs	1.30	0.26		5.2	<.0001
Asians	0.30	0.13		2.4	<.0001
R^2=.48 F=24.4 p<.0001					
location	0.08	0.05		1.5	<.1300
R^2=.50 F=19.1 p<.0001			R^2=.02 F=2.3 P<.132		
Asians/location	-0.23	0.11		- 2.1	<.0400
mixed/location	0.24	0.22		- 1.1	<.2700
MNCs/location	0.09	0.47		0.2	<.8513
(constant)	3.90	0.14		27.2	<.0001
R^2=.53 F=11.4 p<.0001			R^2=.03 F=1.6 P<.182		

[4] Installed capacities used as indicator for the nature of investment were transformed into log 10 in order to achieve homogeneity of variance, in which 1=10, 2=100, 3=10,000 etc.

The effects of the location of the plants, however, failed to be significant at the criterion probability level of 0.05. One of the explanations, as noted in chapter 7, is the fact that large production capacities are found in both urban and semi-urban areas. Besides, expanded infrastructural services in Kenya in recent years has reduced impediments to investment, especially in rural areas. With respect to the model, this outcome was anticipated. It can be recalled that the theoretical perspective presented in Table 4.1.3 indicated the effects of the location to be indirect in relation to those of the entrepreneurs. The way in which location was expected to exert influence on the nature of investment was through constraints imposed by market size and infrastructural services, particularly electricity and transport which, as noted in Chapter 3, have been reduced with the growth of urban centres and improvements in the supply of electrical services.

One of the outcomes in Table 8.1 is the fact that the interaction between firms of Asian entrepreneurs and location of the plants has significant negative effects. This indicates that firms of the Asian entrepreneurs that are based in rural areas are essentially small-scale operations. Such investment practices occur as a result of the tendency of the entrepreneurs to shift increasingly large-scale operations to semi-urban and urban areas.

8.1.2 Equipment adopted

The overall hypothesis in the case of production equipment was that entrepreneurs and location of the firms would influence the nature of investment which in turn influence, in addition to the effects of the entrepreneurs and of the location, the type of equipment adopted by firms. Specific prediction of the effect of the three determinant factors are stated with hypotheses P3 to P5. Regression analyses was performed with levels of equipment in the three critical phases of production in the bakery industry, i.e. mixers, provers and ovens, with a scale in which one represents manually operated equipment, and three or five represent advanced automated equipment. Practically, as discussed in chapters 5 and 6, this equipment reflects the ways in which all other equipment is adopted in this industry since it determines the pace of production and the requirements.

The outcome of the regression analysis for the level (manual-advanced continuum) of the mixers adopted by the firms is presented in Table 8.2. These results affirm the expectation with respect to the stated hypotheses. Of the 85% explained variance (R^2=.85) significant at less than .0001 probability level of error, 59% is accounted for by the categories of the entrepreneurs, while the location and the size of the firms contribute 22%, and 3% are from interacting effects. In terms of the specific effects of the factors, at least two categories of firms–i.e. those of the Asian and mixed entrepreneurs–exhibit a significant difference, as reflected by the t-values, in the adoption of relatively advanced equipment as compared to the firms of the African entrepreneurs. The fact that the influence of the MNC firms are not significant as compared to those of the African entrepreneurs must be interpreted with caution, since it tends to be confounded with the effect of the size of the firms. Furthermore, it will also be noted that the interactive effects between the firms of Asian and mixed entrepreneurs and the location of the plants result in a significant difference in the adoption of less advanced equipment in comparison with the firms of the African entrepreneurs.

Table 8.2 Influence of equipment in mixing phase of production

Variable	B	SE B	R^2 change	t	p
mixed	2.30	0.76		3.0	<.004
MNCs	2.80	1.50		1.8	<.074
Asians	1.60	0.32		4.9	<.001
R^2=.59 F=38.0 p<.0001					
location	0.43	0.09		4.9	<.001
size	1.16	0.13		8.9	<.001
R^2=.82 F=67.6 p<.0001			R^2=.22 F=46.1 p<.0001		
Asians/location	-0.10	0.03		-3.6	<.001
mixed/location	-0.11	0.05		-2.4	<.020
MNCs/location	-0.11	0.08		-1.5	<.148
(constant)	-3.65	0.54		-6.7	<.001
R^2=.86 F=52.0 p<.0001			R^2=.032 F=5.6 p<.002		

The nature and extent of influence of the determinant factors in the case of the levels of equipment for proving of the dough in production of bread is similar that of the mixers. Of the 75% explained variance (R^2=.75) which is significant at less than .0001 probability of error, 58% is the effects of the categories of the entrepreneurs and 16% is due to the effects of the location and size of the firms, while the interaction between the factors contribute 1% which is practically negligible. While the categories of the firms for MNCs, mixed and Asian entrepreneurs indicate positive effects, i.e. adoption of advanced techniques, as compared to those of the African entrepreneurs, significant effects are found only with firms of the Asian entrepreneurs.

Table 8.3 Influence of equipment in proving phase of production

Variable	B	SE B	R^2 change	t	p
mixed	0.67	0.55		1.2	<.225
MNCs	1.52	1.11		1.4	<.174
Asians	0.64	0.23		2.8	<.006
R^2=.58 F=35.4 p<.0001					
location	0.18	0.06		3.0	<.004
size	0.54	0.09		5.8	<.001
R^2=.74 F=43.3 p<.0001			R^2=.16 F=24.0 p<.0001		
Asians/location	-0.04	0.02		-1.8	<.074
mixed/location	-0.01	0.03		-0.3	<.765
MNCs/location	-0.05	0.06		-0.9	<.364
(constant)	-1.22	0.39		-3.1	<.002
R^2=.75 F=27.8 p<.0001			R^2=.01 F=1.2 p<.290		

As expected, the nature and the extent to which the three determinant factors influence adoption of the oven equipment is similar to that of the other two types of equipment, i.e. mixers and provers. To be precise, of the 85% explained variance (R^2=.85) significant at .0001 probability of error, 59% is due to the effects of the categories of the entrepreneurs; while location and the size of the firms add 22%, interacting effects add only 4%. One notable observation is that the effects of the firms of MNCs and mixed entrepreneurs does not depart significantly from the reference group, i.e. African entrepreneurs. As stated above and consistent with the prediction, location and the nature of investment exert effective influence in the adoption of advanced equipment. To be sure, in this respect, the additional effects of the location and the nature of investment are highly significant. Firms of the Asian entrepreneurs reveal significantly positive effects—adoption of relatively advanced equipment—that depart from those of the African entrepreneurs, while their interaction with the location of the plants indicates negative and significant effects, i.e. adoption of less advanced equipment. This is because Asian entrepreneurs undertake medium-size operations in which they have greater influence in the selection and adoption of the equipment.

Table 8.4 Determinants of the type of ovens for baking phase of production

Variable	B	SE B	R^2 change	t	p
mixed	-0.18	0.39		-0.5	<.651
MNCs	1.53	0.79		1.9	<.060
Asians	0.67	0.16		4.1	<.001
R^2=.59 F=37.4 p<.0001					
location	0.23	0.04		5.2	<.001
size	0.53	0.06		8.1	<.001
R^2=.81 F=66.4 p<.0001			R^2=.22 F=45.7 p<.0001		
Asians/location	-0.04	0.01		-3.2	<.002
mixed/location	-0.03	0.02		1.2	<.226
MNCs/location	-0.06	0.04		-1.4	<.156
(constant)	-1.22	0.28		-4.4	<.001
R^2=.85 F=50.5 p<.0001			R^2=.04 F=5.2 p<.003		

It is apparent from the above findings that the way in which the determinant factors influence these three types of crucial equipment is consistent, such that it can be generalized for all other equipment in this industry. More importantly, this consistency and the high proportion of the explained variance confirm the prediction that adopted equipment would be influenced by the nature of investment, in addition to the effects of the entrepreneurs and location of the firms. While entrepreneurs accounted for a considerably high variation, i.e. 59%, 58%, and 59% in the case of mixers, provers, and ovens, the location and the nature of investment had substantially significant further effects, i.e. 22%, 16% and 22%.

8.1.3 Utilization of production capacities

The anticipation with the hypotheses P6 to P8 was that utilization of the production capacities would be influenced by the nature of investment, in addition to the effects of the entrepreneurs and of the location of the firms. As can be noted in Table 8.5, these hypotheses are given support by empirical data. Of the 36% explained variance (R^2=.36) which is significant at .0001 probability of error, the categories of entrepreneurs are responsible for 27%, while location and the size of the firms add 8% and interacting effects add another 2%. It is worthwhile, however, to note that neither the effects of the firms of MNCs, Asians nor mixed entrepreneurs depart significantly from those of the African entrepreneurs. In fact, only the effects of the location of the plants indicate significant departure from those of the African entrepreneurs.

The fact that the total amount of explained variance is considerably lower and the lack of significant departure in the effects of the firms of MNCs, Asians and mixed entrepreneurs as well as the nature of investment indicate that other factors are responsible for variation in the utilization of the production capacities. To be sure, it was pointed out in chapter 5—section 5.5—that shortage of wheat may be one of the principal determinants of the capacity utilization in this industry.

Table 8.5 **Determinants of the utilization of the production capacities**

Variable	B	SE B	R^2 change	t	p
mixed	13.87	20.35		0.7	<.497
MNCs	-30.25	41.45		-0.7	<.468
Asians	07.39	08.48		0.9	<.386
R^2=.27 F=9.5 p<.0001					
location	05.38	02.27		2.4	<.020
size	00.04	03.42		-0.1	<.904
R^2=.34 F=7.9 p<.0001			R^2=.08 F=4.7 p<.01		
Asians/location	- 0.43	00.72		-0.6	<.547
mixed/location	- 0.06	01.23		0.1	<.958
MNCs/location	02.30	02.06		1.1	<.267
(constant)	32.76	14.45		2.3	<.026
R^2=.36 F=5.1 p<.0001			R^2=.02 F=0.6 p<.617		

The shortage of wheat may explain the fact that large variation, i.e. 64%, in the utilization of the production capacities remains unexplained. This inference is given support by the positive and significant effects of the location of the plants. As noted in chapter 5, Table 5.6, practically all the milling plants are located in the semi-urban and urban areas.

8.2 PROMOTION OF LOCAL MANUFACTURING

The presupposition with regard to the promotion of local entrepreneurial activities, hypotheses E12 to E14, was that firms of MNCs and Asian entrepreneurs as well as large-scale operations would have lower expenses in purchases of the locally manufactured components as compared to the firms of the African entrepreneurs and small-scale operations. With respect to the model, the expectation was that the nature of investment would have primary and substantial effects as compared to those of the entrepreneurs and of the location of the plants. Clearly, the results in Table 8.6, pertaining to the percentage of expenses of the firms in purchases of locally manufactured packing materials, lend support to these expectations. Of the 75% explained variance (R^2=.75) significant at .0001 probability of error, the entrepreneurs accounted for 48%, whereas location and size of the firms added 27%, with zero contribution from the interactive effects. Concerning specific effects of the factors and the covariates, the nature of investment has significant negative influence, as reflected by the t-values, in comparison to that of the African entrepreneurs. This outcome lends support to the premise that the nature of investment would have primary and substantially high influence as compared to the entrepreneurs and location of the firms.

Table 8.6 **Determinants of the purchases of local components**

Variable	B	SE B	R^2 change	t	p
mixed	-19.05	15.37		-1.2	<.219
MNCs	-25.00	31.33		-0.8	<.427
Asians	-07.13	06.41		-1.1	<.269
R^2=.48 F=23.6 p<.0001					
location	-01.43	01.72		-0.8	<.407
size	-22.47	02.58		-8.7	<.001
R^2=.75 F=45.5 p<.0001			R^2=.27 F=41.7 p<.0001		
Asians/location	0.19	00.55		0.4	<.728
mixed/location	0.77	00.93		0.8	<.414
MNCs/location	0.78	01.55		0.5	<.616
(constant)	157.9	10.92		14.5	<.001
R^2=.75 F=27.8 p<.0001			R^2=.00 F=0.3 p<.824		

These findings contradict the supposition that the Big Push model would induce subsequent local entrepreneurial activities. As can be noted, the positive effects of the African entrepreneurs arise from the fact that most of their enterprises are small-scale. This is consistent with the findings reported by Masi (1988) in the case of the steel industry in Italy. As pointed out in Chapters 2 and 3, lack of inducement for subsequent entrepreneurial activity by large firms has been attributed to two tendencies. One, which is presented by Masi (1988), is their vertical integration with their affiliated firms outside the country. The other is the priority given to large firms in allocation of the foreign exchange.

8.3 LABOUR REQUIREMENTS

The overall prediction, as can be recalled, was that the entrepreneurs and location of firms would influence the nature of investment which in turn influences, in addition to the effects of entrepreneurs and of location, labour requirements.

8.3.1 Overall absorption of labour

The anticipation with regard to the overall absorption of labour in this industry, hypotheses L15 to L17, was that firms of the MNCs and of the Asian entrepreneurs, as well as firms based in the urban areas and large-scale operations, would have comparatively larger absorption of labour in contrast to the firms of the African entrepreneurs, firms based in the rural areas and small-scale enterprises. In light of the result presented in Table 8.7, these expectations are confirmed by the data. Of the 84% explained variance (R^2=.84) significant at .0001 probability of error, entrepreneurs account for 69%, whereas location and size add 5%, and interactive effects add 9%. More specifically, the effects of the firms of MNCs and of the mixed entrepreneurs, as well as the nature of investment, are significantly positive, indicating absorption of a larger proportion of labour, as compared to those of the African entrepreneurs. While the effects of the firms of Asian entrepreneurs and location of the plants are not significant, the coefficient for the latter indicates negative effects.

Table 8.7 **Determinants of the absorption of labour**

Variable	B	SE B	R^2 change	t	p
mixed	82.78	11.25		7.36	<.0001
MNCs	193.38	16.72		11.56	<.0001
Asians	7.57	7.98		0.95	<.3452
R^2=.69 F=58.8 p<.0001					
location	- 4.19	04.02		-1.04	<.3007
size	27.37	06.05		4.52	<.0001
R^2=.75 F=44.8 p<.0001			**R^2=.05 F=7.9 p<.0007**		
Asians/location	0.79	01.28		0.6	<.5400
mixed/location	1.99	02.19		0.9	<.3600
MNCs/location	23.08	3.64		6.3	<.0001
(constant)	-95.72	25.57		-3.74	<.0004
R^2=.84 F=46.9 p<.0001			**R^2=.09 F=13.5 p<.0001**		

In view of these findings, it can be concluded that whereas the firms of MNCs and large-scale operations have negative impact on the promotion of the local entrepreneurial activities, they have a substantially high contribution towards creation of employment opportunities in this sector.

8.3.2 Labour wages

The assumptions regarding labour wages in this industry, hypotheses L18 to L20, were that, on average, the wages for the firms of the MNCs and of the Asian entrepreneurs, as well as firms based in the urban areas and large-scale operations, would have comparatively higher wages in contrast to the firms of the African entrepreneurs, firms based in the rural areas and small-scale enterprises. In principle, these expectations are given support by the result presented in Table 8.8. These results indicate that of 84% explained variance (R^2=.84) significant at .0001 probability of error, entrepreneurs accounted for as much as 69%, whereas the location and the size of the firms contributed 13%, with interacting effects contributing only 2%. Furthermore, in terms of the specific influence of the factors and the covariates, effects of the firms of MNCs, location of the plants and the nature of investment are significantly positive, i.e. higher wages, as compared to those of the African entrepreneurs. Effects of the firms of Asians and mixed entrepreneurs, although negative, does not however depart significantly from those of the African entrepreneurs.

Table 8.8 Determinants for the labour wages

Variable	B	SE B	R^2 change	t	p
mixed	- 374.32	331.27		-1.13	<.262
MNCs	1485.73	674.94		2.20	<.030
Asians	- 99.21	138.12		-0.70	<.470
R^2=.69 F=58.3 p<.0001					
location	107.63	37.02		2.90	<.004
size	227.19	55.69		4.07	<.0001
R^2=.82 F=71.1 p<.0001			R^2=.13 F=28.5 p<.0001		
Asians/location	17.06	11.75		1.45	<.1500
mixed/location	57.99	20.11		2.88	<.0050
MNCs/location	- 17.14	33.49		-0.51	<.610
(constant)	-243.37	235.33		-1.03	<.304
R^2=.84 F=49.5 p<.0001			R^2=.02 F=3.2 p<.03		

While the positive effects of the firms of MNCs indicate an average increase of the wages over and above those of the African entrepreneurs, the effects of location and size indicate that increases in average wages as the location shift from rural centres to urban areas in the case of the former, and from small-scale to large-scale investment in the case of the latter.

8.3.3 Productivity of labour

The presupposition pertaining to productivity of labour in this industry, hypotheses L21 to L23, was that it would be influenced by the type of entrepreneurs, such that the firms of the MNCs would show the highest productivity of labour while firms of the Asian entrepreneurs would show higher productivity as compared to those of the African entrepreneurs. Furthermore, it was the expectation of this study that firms based in urban areas and large-scale enterprises would show higher levels of productivity. These hypotheses are given partial support by the data. The results in Table 8.9 reveal that while entrepreneurs are responsible for 11% of the variance, specific effects of the firms of MNCs, Asians and mixed entrepreneurs, although negative, does not depart significantly from those of the African entrepreneurs. Moreover, the effects of location, even though positive, are not significantly different from those of the African entrepreneurs. The nature of investment, however, exhibits significant positive effects. As a matter of fact, the nature of investment and location account for an additional 33% of the explained variance, such that the total amount of variance in productivity of labour by the factors and the covariates is 43%.

Table 8.9 **Determinants for the productivity of labour**

Variable	B	SE B	R^2 change	t	p
mixed	-507.55	830.45		-0.61	<.5422
MNCs	-348.67	1691.9		-0.21	<.84001
Asians	- 80.08	346.25		-0.23	<.8200
R^2=.11 F=3.2 p<.02					
location	134.94	92.81		1.45	<.1540
size	802.73	139.63		5.75	<.0001
R^2=.43 F=11.6 p<.0001			R^2=.32 F=21.6 p<.0001		
Asians/location	- 7.23	29.47		-0.25	<.8000
mixed/location	5.06	50.42		0.10	<.92
MNCs/location	- 23.73	83.98		-0.28	<.770
(constant)	-2911.43	589.94		-4.94	<.00001
R^2=.43 F=6.99 p<.0001			R^2=.00 F=0.05 p<.98		

These findings confirm the postulation of the Big Push model that the nature of investment is the principal determinant factor in productivity of labour. As can be recalled, such effects were anticipated in the case of large-scale, capital-intensive production and their capacity to ensure supply of input and expansion of the size of the market for their output.

8.3.4 Skilled labour

In the case of the absorption of labour, the anticipation in hypotheses L24 to L26 was that firms of the MNCs and those based in urban areas, as well as large-scale operations, would exhibit relatively larger absorption of labour as compared to the firms of the African entrepreneurs, firms based in rural areas, and small-scale enterprises. These expectations are affirmed by the results presented in Table 9.10, which indicate that with 95% of the explained variation in the absorption of skilled labour, the entrepreneurs account for 63%, the location and the nature of investment add 12%, while the interactive effects contribute a considerable 20%. In terms of the specific effects of each factor and the covariate, firms of the MNCs and of the mixed entrepreneurs as well as the location and nature of investment have significantly positive effects, i.e. absorption of a larger number of skilled workers, as compared to those of the African entrepreneurs. Further, such positive effects are found with interaction of location with MNC firms and with firms of mixed entrepreneurs.

Table 8.10 **Determinants of the absorption of the skilled labour force**

Variable	B	SE B	R^2 change	t	p
mixed	5.08	1.84		2.76	<.0080
MNCs	24.49	2.74		8.22	<.0001
Asians	- 1.26	1.31		-0.97	<.3400
R^2=.63 F=26.6 p<.00001					
location	0.41	0.33		1.23	<.0220
size	4.12	0.49		8.20	<.0001
R^2=.75 F=27.2 p<.0001			**R^2=.12 F=11.0 p<.0001**		
Asians/location	- 0.08	0.10		-0.70	<.4500
mixed/location	0.78	0.18		4.33	<.0001
MNCs/location	3.73	0.29		12.49	<.0001
(constant)	-14.07	2.09		-6.71	<.0001
R^2=.95 F=105.61 p<.0001			**R^2=..20 F=59.43 p<.00001**		

The only effects which do not conform to the expectation are those of the firms with Asian entrepreneurs. While negative, their effects on absorption of labour are not significantly different from those of the African entrepreneurs.

One of the contentions in the case of use of labour skills is the fact that absolute numbers are not as important as the ratio of skilled workers to the total labour force. As can be recalled, the argument in both Small-Scale and Big Push models led to the expectation that the proportion of skilled workers would be relatively lower among MNCs and large-scale operations. In principle, this expectation is given support by the result presented in Table 8.11. Whereas the explained variation in the ratio of skilled workers to the total labour force is 30% (R^2=.30), entrepreneurs are responsible for 8%, the location and nature of investment contribute 28%, and the interactive effects add only 2%. Specifically, however, the effects of MNCs, Asians and Mixed entrepreneurs, as well as of location are not significantly different as compared to those of the African entrepreneurs.

Table 8.11 Determinants of ratio of skilled workers to the total labour force

Variable	B	SE B	R^2 change	t	p
mixed	-19.49	30.094		-.65	<.5208
MNCs	-15.50	61.32		-.25	<.8001
Asians	- 1.80	12.54		-.14	<.8800
R^2=.08 F=1.45 p<.24					
location	- 2.21	3.36		-.66	<.5122
size	-16.81	5.06		-3.32	<.0020
R^2=.28 F=3.49 p<.009			R^2=.19 F=6.08 p<.005		
Asians/location	0.93	1.06		.87	<.3800
mixed/location	1.69	1.82		.92	<.3660
MNCs/location	1.57	3.04		.52	<.6110
(constant)	95.41	21.34		4.47	<.0001
R^2=.30 F=2.29 p<.04			R^2=.02 F=0.49 p<.66		

In conformity with the prediction of the two models, the nature of investment exerts significantly negative effects in the case of the proportion of the skilled workers who are absorbed by the firms.

8.3.5 Semi-skilled labour

The expectations in the case of the absorption of semi-skilled labour, hypotheses L27 to L29, were that MNCs and firms based in urban areas as well as large-scale operations would have larger absorption of semi-skilled workers as compared to firms of African entrepreneurs and firms based in rural areas as well as small-scale enterprises. Principally, these expectations are confirmed by the result presented in Table 8.12. The combined influence of the entrepreneurs, location, the nature of investment and interaction effects explain 75% (total R^2=.75) of the variation in the absorption of semi-skilled workers. While entrepreneurs accounted for 66% of the variation, location and the nature of investment add 3%, and interaction effects add 8%.

Table 8.12 Determinants of the absorption of semi-skilled workers

Variable	B	SE B	R^2 change	t	p
mixed	17.8	6.52		2.72	<.0080
MNCs	108.30	9.69		11.17	<.0001
Asians	- 3.07	4.63		0.67	<.5100
R^2=.63 F=43.1 p<.00001					
location	- 0.83	2.63		-0.32	<.7500
size	8.90	3.95		2.26	<.0300
R^2=.66 F=28.2 p<.0001			R^2=.03 F=2.8 p<.06		
Asians/location	0.16	0.83		0.20	<.8400
mixed/location	1.60	1.40		1.12	<.2600
MNCs/location	12.20	2.38		5.14	<.0001
(constant)	-30.17	16.6		-1.81	<.0710
R^2=.75 F=26.9 p<.0001			R^2=.09 F=9.1 p<.0001		

With respect to the specific influence of the factors and the covariate, effects of the firms of Asian entrepreneurs and of location, although negative, are not significantly different from those of the African entrepreneurs. This suggests that this factor and the covariate—firms of the Asian entrepreneurs and location—are less important in the absorption of semi-skilled workers. Effects of MNCs and firms of mixed entrepreneurs, however, are significantly positive, i.e. larger absorption of semi-skilled workers, as compared to those of the African entrepreneurs. Moreover, such significant effects are also reflected in the nature of investment and the interaction effects between MNCs and the location.

In the case of the proportion of semi-skilled labour to the total work force, the results in Table 9.13 lend support to the expectation that entrepreneurs and the nature of investment have a substantial influence on variation of the ratio. Of the 26% (R^2=.26) of the variation explained, the entrepreneurs account for 13%, the location and the nature of investment add 12%, and interaction effects add a negligible 1%.

Table 8.13 **Determinants of proportion of the semi-skilled labour force**

Variable	B	SE B	R^2 change	t	p
mixed	-35.23	34.62		-1.02	<.3108
MNCs	7.02	70.53		0.10	<.9210
Asians	- 6.08	14.43		-0.42	<.6700
R^2=.13 F=3.9 p<.01					
location	- 0.24	3.86		-0.06	<.9600
size	-19.05	5.82		-3.27	<.0010
R^2=.25 F=4.9 p<.0006			**R^2=.12 F=5.7 p<.005**		
Asians/location	0.40	1.23		0.33	<.7400
mixed/location	1.66	2.10		0.79	<.4300
MNCs/location	0.83	3.50		0.24	<.8100
(constant)	138.31	24.59		5.63	<.0001
R^2=.26 F=3.06 p<.005			**R^2=.00 F=.23 p<.87**		

In terms of the specific influence of the factors and the covariates, the effects of MNCs, firms of Asians and mixed entrepreneurs are not significantly different as compared to those of the African entrepreneurs. Such effects are also found with respect to the influence of location of the firms. Significantly negative effects in this case are from the nature of investment. Conforming to the prediction of the two models, the results indicate that large-scale operations tend to absorb a lower proportion of semi-skilled workers.

In order to identify the nature and the extent of influence for the overall use of labour skills in this industry, analysis was performed with the ratio of the combined skilled and semi-skilled workers. The results presented in Table 8.14 indicate that entrepreneurs have the dominant influence of all the factors.

Table 8.14 Determinants of the ratio of skilled and semi-skilled workers

Variable	B	SE B	R^2 change	t	p
mixed	-65.10	42.80		-1.52	<.1308
MNCs	1.80	87.2		0.02	<.9821
Asians	12.81	17.85		0.72	<.4700
R^2=.22 F=4.3 p<.009					
location	2.65	4.78		-0.55	<.580
size	-11.46	7.19		-1.59	<.111
R^2=.27 F=3.24 p<.01			R^2=.05 F=1.5 p<.23		
Asians/location	-0.29	1.52		-0.19	<.844
mixed/location	2.64	2.59		1.02	<.320
MNCs/location	0.59	4.33		0.14	<.890
(constant)	105.81	30.34		3.49	<.001
R^2=.30 F=2.1 p<.05			R^2=.02 F=.41 p<.74		

Specifically, of the 30% explained variation (R^2=.30) significant at .05 probability of error, the entrepreneurs account for 22%, while the location and the nature of investment add 5%, which are not significant. One of the interesting aspects in the case of both skilled and semi-skilled workers is that the effects of firms of MNCs and of the Asian entrepreneurs are not significantly different from those of the African entrepreneurs. Further, such effects are also found with respect to the influence of the location and the nature of investment.

In the matter of the overall conclusion, besides revealing the nature of influence among the determinant factors, the analyses in this chapter, as was the case in Chapter 7, provide support to the prediction of the model presented in Chapter 4, Table 3.4.1. In the case of the nature of investment, attributes of the entrepreneurs were the main determinant factors accounting for 48% of the variation. Such considerably high influence was found also with the level of equipment adopted, expenditure of the firms on local purchases and absorption of labour. Specifically, as anticipated, firms of the MNCs, Asians and mixed entrepreneurs had positive effects as compared to those of the African entrepreneurs, especially in relation to the nature of investment, equipment adopted and the overall absorption of labour. However, firms of the African entrepreneurs had relatively higher effects in the case of the expenditure on local purchases and the ratio of skilled workers to the total labour force. One of the notable aspects in the nature of investment is the fact that location of the firms had relatively limited impact, confirming the prediction by the model that its effects would be indirect and also the observation by Masi (1988) that its influence has become less important.

Nonetheless, an additional, modest explained variation was accounted for by the combined effects of the location and the nature of investment, especially with equipment adopted (23%), expenditure on local purchases (27%), and absorption of skilled labour 12% in the case of absolute number, and 20% in the case of the ratio to the total labour force.

Pertaining to the advantages of the small-scale and Big Push Models, while large firms had positive impact on the equipment adopted and absorption of the labour force, their impact on the expenditure on local purchases and the ratio of skilled and semi-skilled workers was negative. This outcome indicates once again that medium-size operations would have greater potential in terms of the net benefits.

9 CASE STUDY

The purpose of this chapter is to provide illustration of the ways in which firms adapt their production technologies, through a case study of six bakery firms. These firms were selected in respect to their characteristics in terms of location, entrepreneurs and the nature of investment. Elliots and Pangani are located in Nairobi, Kahama and Sitima are located in semi-urban areas and Wama and Muhoroni are based in rural areas.

9.1 PRODUCTION ORGANIZATION

9.1.1 Characteristics of entrepreneurs

Elliots is owned by a multinational group of companies, Mercat Group. The other firms in Kenya are Proctor and Allan which specializes in breakfast cereals, and Unga Ltd., the largest milling company. Under this arrangement Elliots enjoys priority in distribution of wheat flour. Placed in the position of grain processing (mainly maize and wheat) and production of bread, Mercat has had considerable influence on overall policies, including on prices of raw materials as well as on the processed products. This influence, however, dissipated with the introduction of the anti-monopoly act of 1988. In addition, the rearrangement of wheat allocation in 1989 at the NCPB has had an impact on the operations of both Unga and Elliots.

Besides, such influence and arrangements, Elliots has an elaborate management structure. Mercat offices in London undertakes major policy decisions, while the local office in Nairobi is characterized by five levels of organization: (i) management which comprises the board of directors and senior executives; (ii) general managers in charge of areas such as production, sales and distribution; (iii) managers responsible for various operations; (iv) supervisors; and (v) workers.

In contrast, Pangani bakery is a family-owned business which has changed ownership twice; first in 1965 and second in November 1985. The present owner, who took over in 1985, is an Asian family living in Mombasa where they own another bakery, in addition to a two-chain wholesale business. Because of these commitments in Mombasa, in 1990 a 34-year old son, with secondary school education and apprenticeship experience from their Mombasa based bakery, managed the bakery. The owner undertakes all the management activities under the guidance and supervision of the family. Because the bakery operates in rented premises, the new owner actually bought equipment in order to preserve the market share of the bakery. Although some changes were later made, workers were also absorbed in order to preserve skills and experience. The production supervisor is actually a clerk who also maintains the accounts including purchases and deliveries.

Kahama bakery is owned by an African family which also owns a large retail shop and other operations. The principal shareholder in 1990 was and still is the head of the household, a 58-year old businessman with no formal education, and the other directors are his two sons, who have secondary education and no training in the bakery industry. Decision-making is usually a consultative process among the three family members. Between 1984 and 1989 the Kenya Commercial Bank through the Rural Enterprise Scheme provided advisory services in business operations following a loan arrangement. In order to improve its management capability, the bakery engaged a firm of accountants to supervise financial management and to maintain the accounts. The Kenya Institute of Business Training has been providing training to the Directors on management and expansion of the market.

Sitima bakery is owned by an Asian family which delegated management to one of the three brothers. He is a 48-year local entrepreneur with high school education who also owns a medium-sized retail shop and other business concerns in the same town. Whereas the owner undertakes supervision of the operations, the daily and routine management is undertaken by an African manager who has high school education. In addition, the African assistant is trained in the field of business management and accountancy at a local technical institution. He has no training, however, in the bakery industry.

The owner of Wama bakery is a 38-year old African entrepreneur with high school education in a technical school. His wife who assists in management of the bakery has a diploma from Kenya Polytechnic on Institutional Management which includes preparation of food. Prior to commencing a bakery enterprise, the wife worked with Elliots bakery where she acquired experience in production, distribution and management. Wama bakery, however, commenced operations with a loan from Small Scale Enterprise Finance Company Limited (SEFCO), a subsidiary of the Development Finance Company of Kenya (DFCK). Loan arrangement from DFCK or SEFCO involves a provision for their participation in the Board of Directors for the duration of the loan. In this respect, SEFCO constituted the management of Wama bakery. The owner may make routine management decisions but major issues such as those involving the workers, technologies and market expansion would require consultation with SEFCO.

The proprietor of Muhoroni bakery is an African entrepreneur, university-educated and retired from civil service, who presently undertakes farming in the same area. Whereas he undertakes supervision of the overall operations, the routine management of the bakery is undertaken by a supervisor who has secondary school education and technical training. Prior to his employment at the Muhoroni bakery, he worked at another bakery, Mayfair Holdings in Kisumu. As in the case of Kahama and Wama bakeries, Muhoroni bakery was established with a loan from Kenya Industrial Estates (KIE), which undertook a feasibility study in collaboration with Servicescope (E.A.) Limited, a local dealer of bakery equipment. Although development of Muhoroni bakery became a collaborative effort involving the three parties, composition of the directors did not include KIE as a legal obligation. In this respect, development of Muhoroni bakery became a collaborative effort involving the three parties.

9.1.2 Location

Elliots, established in 1950, is one of the oldest and is the largest bakery firm in Kenya. While at present it provides 20% of the total national bread production, until the 1980s it accounted for over 60% of the total production (Kaplinsky 1980). Presently, it has three branches in Nairobi, Nakuru and Nyeri, with the latter two branches being established in 1970 and in 1987 respectively. These areas provide locational advantages to the operations of Elliots in terms of both the level of demand for bakery products and supply of input, particularly wheat flour. As indicated in table 9.1.1, the Nairobi branch of Elliots bakery serves a population of 1,346,000 in the immediate area and 2,260,000 including the surrounding areas. In addition, as per table 5.3, milling industries are concentrated in Nairobi, Mombasa, Nakuru, Eldoret, and Nyeri which enable Elliots bakeries to receive wheat flour with minimum transport costs.

Pangani bakery, established in the 1950s, is as old as Elliots. At present, it is indicated in official records as having been established in 1986 because of its change of ownership in November 1985. It is located in Nairobi, 7 kilometres from the city centre. The population of this area was about 42,000 people in 1988, in which the demand for bread was estimated to be 18,000 loaves per day. During the pre-independent period, Pangani had a large Asian community. Whereas this is still the case, the Asian population has declined as the proportion of middle income Africans has increased. The importance of this trend is that the demand for bread is considerably high among the members of the Asian community. In addition, they comprised captive customers for the Pangani bakery.

Kahama bakery, which was established in 1977 and expanded in 1984, is located in Eldoret town, about 420km from Nairobi. Eldorat town is a rapidly expanding town in terms of population size and industrial activities. Eldoret's population is 104,000, with a total population of 1.8 million including the surrounding districts. Demand for bread is estimated to be 40,000 lpd within the town, and 270,000 lpd when the surrounding areas are included. Other bakeries which distribute up to 90000 loaves, i.e. 31% of the market, in the same area include Elliots, Paul, Kimilil, Kitale, Kisumu and Bungoma. There are also small bakeries which distribute much smaller quantities in the area.

Sitima bakery, established in 1977 and expanded in 1989, is located in Kericho town, approximately 350km from Nairobi, and has a population of 40,000 within the town and 859,000 including the district. Demand for bread in the district arises mainly from workers at the tea plantations, residences in the township, and public institutions such as schools and hospitals. Estimated demand for bread in 1989 was 95,400 lpd., 40% of which was met by other bakeries which included Elliots from Nakuru, Gilani also from Nakuru, Broadways from Thika and Mayfair from Kisumu. In addition, there are small bakeries whose total output and distribution was estimated to be 7,000 lpd.

Wama bakery, established in 1986, is located in Othaya town in Nyeri district, about 250Km from Nairobi. The population of the town itself is 4,500, while that of the whole district is 613,000. In recent years, there has been a rapid expansion of small scaled industries in the district involving mainly processing of agricultural products. In 1989 demand for bread in the district was estimated to be 250,000 lpd, including the demand from surrounding districts, i.e. Isiolo, Samburu and Marsabit. However, besides competition from small local bakeries, there are three major distributors of bread in the same area—Batian from Nyeri town, Elliot's Nyeri branch and Broadways which operates from Thika.

Table 9.1.1 Location, population and market share of the sample six bakery firms

		population		% market share	
firm	location	immediate location	including surrounding areas	immediate location	including surrounding areas
Elliot	Nairobi	1,346,000	2,260,000	70	50
Pangani	Nairobi	42,000	1,346,000	20	5
Kahawa	Eldoret	104,000	1,920,000	60	15
Sitima	Kericho	40,000	859,000	72	30
Wama	Othaya	4,500	613,000	80	7
Muhoroni	Muhoroni	7,800	674,000	65	21

Source: Central Bureau of Statistics: population census 1979 and 1989

Muhoroni bakery, which was started in 1985, is located in Muhoroni town, approximately 420km from Nairobi and 60km from Kisumu municipality, the nearest large urban centre. The town has a population of 7800, while Kisumu district in which it is located has a population of 674,000. Muhoroni area, however, is basically a sugar belt zone. Among the sugar factories located in the area are: East African Sugar Industries, Chemelil and Miwani. Each of these factories have satellite settlements which constitute additional small towns. Because of sugar factories and other small business activities, demand for bread is estimated to be 70,000 lpd, which therefore established the bakery's projected market demand. In addition to small bakeries which distribute bread in the area, there is competition from large bakeries which include Mayfair from Kisumu, Gilani from Nakuru and Electric from Kericho.

The trend in location of these bakeries conforms to the theoretical expectation that subsequent entrepreneurial activities will be induced by previously established industries and accompanying improvement in infrastructural services. While the Nairobi-based Elliots branch and Pangani serve a large industrial and service workforce, the other four bakery firms have been established in response to expansion in industrial activities, population and infrastructural services. In Eldoret where Kahama bakery is based, textile and wool industries are expanding, while in Kericho, where Sitima is dominated by industries which process tea, and in Kisumu where Muhoroni is based, concentrations of sugar-processing industries are found. With the exception of Kericho, milling industries are also based in these areas.

9.1.3 The nature of investment

Whereas the argument in balanced economic growth model is that the nature of investment is influenced by capital and the size of the market, the important factor in the argument in unbalanced growth model is considered to be entrepreneurial inability to make appropriate decisions. The case of the six bakery firms indicates that entrepreneurial capability is one of the important determinants with respect to the nature of investment. Such capability is crucial in terms of managerial and organizational operations.

Of the six bakery firms, Elliots is characterized by large scaled operations in terms of capital investment, installed production capacities and the workforce. Such operations are supported by extensive management structure and entrepreneurial organization which involve, as stated above, a group of companies. With regard to the five medium and small scaled firms, investment was not constrained by the size of the market or capital requirement. While Sitima and Pangani were characterized by a varied scale of investment, in which the former is medium sized and the latter is small scaled, their problem was neither limited capital nor the size of the market, but instead organization of operations. Whereas the other three firms--Kahama, Wama and Muhoroni--were established with loans from financial institutions, such institutions constituted entrepreneurial organizations in order to enhance the organization of operation.

The nature of investment as reflected by installed production capacities corresponds to organizational capabilities of the entrepreneurs. With regard to Elliots, installed capacities in the three branches range from 750,000 to 304,000 loaves per day, table 9.1.3A. The total installed capacity for Elliots constitutes 20% of the national capacity for production of bread.

Table 9.1.3A Production of loaves per day at each of the Elliots' bakeries, October 1990

branch	installed (lpd)	actual (lpd)	%
Nairobi	750,000	517,500	71
Nakuru	450,000	270,000	60
Nyeri	304,000	151,500	49
	1,484,000	939,0003	

Besides the establishment of the Nyeri branch in 1987, investment to create new production capacities at Elliots has stagnated since 1977. This is attributed to the collapse of the East African Community Market which restricted production to the relatively smaller Kenyan Market. Average capacity utilization at Elliots bakeries was 63%, which was well above the national average, i.e. 46%. Capacity utilization at the Elliots' bakeries has been characterized, however, by reduction in production levels in recent years. This reduction in production has been attributed to two factors: persistent shortage of wheat flour, and the introduction of the Anti-monopoly act of 1988 which restricted the products of Elliots to specific areas. Consequently, the Nairobi branch was restricted to the market within Nairobi city. In addition, other medium-sized bakeries expanded their production which increased competition.

The other five bakeries have been characterized by various phases of expansion. Pangani bakery increased its production capacity from 18,500 lpd in 1985 to 31,500 lpd in 1990. While its capacity utilization oscillated on average between 75% in 1985 and 45% in 1990, the market share declined from 34% in 1985 to 20% in 1990. The reason given for the declining trend in production is regular shortage of wheat flour and the new system of wheat allocation by the National Cereals and Produce Board (NCPB). The entrepreneurs claimed that the new system of allocation made it difficult for small firms to acquire required quantities of wheat flour on a regular basis. However, it was my observation that there were also management problems in the bakery. While workers complained of low wages, customers were discontent with the service and quality of the bread. Persistent complaints resulted in the decline in orders even within the bakery's traditionally captive customers, i.e. members of the Asian community and public institutions.

Table 9.13B Investment and production in the six firms

Firm	Capital investment (Kshs)	Installed capacities	Actual production	%
Elliots (Nairobi)	18,000,000	750,000	520,000	70
Pangani	888,150	31,500	14,000	44
Kahama	2,383,000	90,000	56,000	62
Sitima	2,386,338	87,500	31,250	35
Wama	3,413,788	38,500	20,000	52
Muhoroni	1,708,000	36,000	15,000	42

Kahama bakery expanded its production capacity from 35,000 in 1983 to 90,000 in 1985 with a loan of kshs 2.4 million in 1984 from Kenya Commercial Bank. The actual production, however, remained at 72%, and serviced 40% of the market share within Eldoret town and surrounding areas. Production operations are undertaken in two shifts of nine hours. Between 1985 and 1987, the average sales stood at 66,000 lpd with returns of kshs 148,050.

With the assistance of a consulting firm from Nairobi, in collaboration with a dealer of bakery equipment, Sitima bakery expanded its production capacity from 38,000 in 1977 to 87,500 lpd in 1989. Actual production, however, in 1989 was, on average, 43,750 lpd, i.e. 52% of the installed capacity. In addition to recommending expansion of the production capacities, the consultancy report also made the following recommendations: (1) separation of production, management and marketing services, (ii) increase of employees in a proportion of 4-2-1 for production, management and marketing respectively, (iii) increase of wages equivalent to the national average in order to attract and maintain worker with better aptitude, (iv) acquisition of new equipment, and (v) improvement of transport and the building.

Wama bakery commenced operations in December of 1986 with an installed production capacity of 6,500 lpd in two shifts of 8 hours. By 1988, it produced and distributed 6,000 lpd and which constituted 92% utilization of the installed capacity. Its market share in Othaya town stood at 80% and 7% in respect to the demand for the entire district. Co-sponsor SEFCO noted in their appraisal report that the bakery was performing better as compared to local competitors because of prompt and regular supply of high quality bread. In 1989, production capacity was expanded to 38,500 lpd with an additional loan from Kenya Commercial Bank, the Rural Enterprise Scheme, whereby, by 1990, the bakery was producing an average of 20,000 lpd.

Muhoroni bakery commenced its production in 1988 with an installed capacity of 36000 lpd which was aimed at the township and surrounding areas. The actual production and distribution remained at 15000 lpd, which constituted 42% capacity utilization. Its market share stood at 65% within Muhoroni and 21% in respect to the estimated demand in the district.

With the six bakeries, the nature of investment was determined by three aspects: availability of capital for investment, the market share and the capability for management operations. Elliots bakery has been upgrading its production equipment from its savings, and has been characterized by monopolistic operations at the national scale. Expansion of the two Asian firms, Pangani and Sitima, have been financed from savings in other operations as compared to the three African firms, whose expansions have been supported by loan from entrepreneurial financing agencies. The amount of the loan was always restricted in relation to the characteristics of the entrepreneurs. Specifically, there was a certain ceiling on loans given to entrepreneurs in respect to their organizational and managerial capabilities.

9.2 EQUIPMENT ADOPTED

Adoption of equipment in the six firms was influenced by the capabilities of the entrepreneurs and planned volume of production. In the case of three firms—Kahama, Wama and Muhoroni—an additional factor which influenced selection of equipment was the conditions of the financing institutions. One of the requirements in such conditions was adoption of equipment with the capacity for the intended production, proven technical efficiency and durability. Such requirement restricted the adoption of traditional equipment because such equipment lacked proven technical efficiency.

9.2.1 Elliots Bakery

Production at Elliots bakery is fully automated. Machines and equipment are used from the storage of raw materials for mixing, moulding, dividing, proving and baking the dough, as well as for slicing and packaging. Acquisition and adaptation of equipment has been gradual over many years. It consists of storage silos and fixtures, four tunnel ovens (three relatively large and one smaller), high speed mixers, moulders, provers, conveyor elevators, slicing and wrapping machines.

The estimated cost of equipment as indicated in table 9.2.1 does not include infrastructural components since observations were restricted to primary processing technologies. In comparison with a national state-owned bakery in Tanzania (Coulson 1979), Elliots has seven times the production capacity at about the same cost of equipment. As indicated by Kaplinsky (1980) the ovens can process up to 252,000 bags per year.

Table 9.2.1 Baking equipment at Elliots Nairobi branch, 1988

	equipment	cost (Kshs.)
(1)	storage silos & fixtures	3,000,000
(2)	three tunnel ovens (Spooner, 700 bags p.d)	8,478,300
(3)	one tunnel ovens (Spooner, 195 bags p.d)	4,521,760
(4)	ten mixers (high speed, 160 bags p.d.)	3,360,640
(5)	five long moulders	906,240
(6)	five dividers/scalers	899,635
(7)	five bun dividers	542,330
(8)	two proving tunnels	500,000
(9)	three conical rounders	596,980
(10)	five elevators	536,600
(11)	five steam generators	611,720
(12)	five bread slicers (gravity feed)	365,800
(13)	five wrapping & dating machines	792,960
	total	18,386,338

Adaptation of equipment at Elliot's bakery is such that a large volume of input can be stored and processed with a fully integrated system. Storage silos are structured to meet three requirements: (i) storage of 50,000 bags of wheat flour, including stock, for at least 30 days; (ii) preservation of the wheat flour against infestations; (iii) automatic feeding of the wheat flour to the mixing receptacles. Mixing of the dough is undertaken with high speed mixers in order to achieve improved texture of the final product and to be able to process a large volume of dough. Whereas this phase of production takes an average of 45 minutes of manual operations and 20 minutes of mostly semi-automated operations, in less than ten minutes a large volume of the dough is fully developed and shifted directly to a weighing and dividing chamber.

Dividing and scaling are undertaken simultaneously in volume, in most cases with four pieces of automatic equipment. One is used always as a back-up. In order to facilitate continuous processing, dividing is undertaken with equipment which extrudes the dough and cuts it into pieces of equal length. This production technique is associated not only with substantial time-saving but also with greater standardization in weight, and reduction of losses. Automatic moulders receive pieces of dough from intermediate provers and reconstitute them into cylinders of loaves and the required size. Whereas moulding could be undertaken manually, quantities to be processed in a given time at Elliots necessitate use of the equipment. In addition, they point out other technical aspects related to strengthening the loaves and making them suitable for slicing. Proving is undertaken with two tunnels in which the pieces of dough travel through controlled temperature and humidity and, in less than 20 minutes, are ready and placed in the pans or tins ready for baking. The ovens used for baking are tunnel constructions, three medium-sized with a capacity of 700 bags per day, and one relatively small with a capacity of 195 bags per day.

Whereas one large tunnel oven could be sufficient, four are used for three reasons: (i) acquisition has been gradual, two of them purchased in the 1970s and an additional two in the 1980s; (ii) there is need to have back-up capability in case of breakdown; (iii) there is need for flexibility to dispose of unnecessary units in case of drastic reduction of the market.

The orientation of Elliots bakery on methods of production is, according to the production manager, clearly based on the technological advantages. It aims at adopting technologies that enhance competitive operations. Its leadership in the bakery industry in

Kenya is attributed by its managers to the adoption of advanced technologies "in consideration of the economic situation and the necessary economies of scale". Little attention is given to normative considerations and, particularly, to the need to employ labour-intensive techniques. Its production manager argued, however, that there is considerable utilization of labour not only in the delivery and distribution services but also in the production process. Each sub-process is attended by an average of 4 workers per shift, in addition to labour utilized on maintenance of the equipment.

Because of its scale of operations, Elliots bakery influences the standards of production of bread among Kenyan bakery firms. It has not, however, provided leadership in technological innovation in terms of raw materials and local technologies. As mentioned in Chapters 3 and 6, shortage of wheat flour is one of the persistent problems of the bakery industry in Kenya. Although, research has indicated that up to 30% of sorghum can be combined with wheat in production of bread, Elliot has not adopted such techniques. All of the processing equipment is imported. One area where we find local initiative is packaging. Elliots bakery processes its own wrapping papers, basically in order to minimize the cost of production of such papers. These papers carry its trade name and the brand of the bread for marketing purposes.

In contrast, the other five firms are characterized by equipment of lower capital investment, less than 14% as compared to Elliots, in the case of Kahama and Sitima bakeries. Although with considerable variation, operations in these firms are not integrated, which demands relatively greater use of labour between the production phases, as compared to operations at Elliots. In addition, the potential output is constrained by lack of other equipment, the most important being proving devices that match the potential of the ovens.

9.2.2 Pangani bakery

Essentially, equipment used at the Pangani bakery is secondhand, having come from the previous owners. Expansion of the production capacities in 1985 involved limited additional equipment, mainly one oven and two final provers, supplied by Service Scope Ltd. which apparently supplied the older equipment. In October 1990, the cumulative equipment being used was as follows:

Table 9.2.2 Baking equipment at Pangani Bakery, 1980 to 1990

	equipment	value (Kshs)
(1)	2 Tom Chandley ovens (4 deck, @84 loaves)	350,000
(2)	one Dahlen Peel oven (3 deck, @36)	74,000
(3)	One mixer (Sottoriva 150kg, 2 speed)	72,000
(4)	one cake mixer (Sottoriva, 2 Beaters)	32,600
(5)	one divider (Robertson, 9 PCs, bread)	115,000
(6)	one divider (Robertson, 36 PCs, Scones)	16,000
(7)	one moulder	24,000
(8)	two final provers (2 rack model)	28,000
(9)	200 sets of four-bread tins	24,800
(10)	40 trays	3,600
(11)	5 baking tables	6,750
	sub-total	708,150
(12)	one vehicle (two ton van)	180,000
	total	888,150

source: Pangani Bakery and Servicescope Ltd.

In contrast with production operations at Elliots, equipment indicated above is characterized by semi-automated production operations at Pangani bakery. The output of the three deck ovens is 444 loaves in an average time span of 30 minutes. As can be noted in respect to its overall capacity utilization, such output has not been realized, partly because of its contracting market and partly because of technical arrangement. Mixing and proving were characterized by largely manual operations, with the use of dough activators (ADD) to accelerate the fermentation process. In addition, labour was used for additional mixing operations and for handling moulding operations. Although warm and humid cupboards were used, proving was manually performed and required considerable time for bread to undergo the fermentation process.

9.2.3 Kahama Bakery

One of the interesting characteristics of Kahama bakery is that it started production with manual techniques. As its market share expanded, it shifted to relatively capital-intensive operations. Aspects which influenced selection of the equipment acquired in 1984 were (a) anticipated production level given a sales target of 90,000 loaves per day, (b) technical evaluation of the technological requirements by the agent of the bakery equipment, Servicescope Ltd., and (c) the bank demand for equipment with assured capability to meet the projected output and to have a guarantee for the duration of the five years loan. The interaction of these factors resulted in agreement to acquire the following equipment:

Table 9.5 Additional equipment acquired by Kahama bakery in 1984

	equipment	value (Kshs.)
(1)	one big fuel wood oven	450,000
(2)	one medium fuel wood oven	285,000
(3)	one large electric oven, G.E.C.	425,000
(4)	one small electric oven, G.E.C.	175,000
(5)	one large mixing machine, electric	150,000
(6)	one small mixing machine, DK6	103,000
(7)	one dough divider	150,000
(8)	one large electric werner	95,000
(9)	one scone moulding machine	75,000
(10)	one cake mixing machine	45,000
(11)	one slicing machine, electric	50,000
(12)	one freezer, Kelvinator	17,000
(13)	one freezer, Kemco	8,000
	total	2,383,000

One significant feature in the selection of equipment at Kahama bakery is the combination of modern imported and traditional equipment. The fuel wood ovens were upgraded versions of the traditional brick ovens. As with the case of Pangani, production at Kahama is semi-automated. The use of labour, however, involved shifting pieces of dough from one piece of the processing equipment to another.

9.2.4 Sitima Bakery

In contrast to Pangani and Kahama, Sitima bakery renewed its operations with new market projections and acquisition of new equipment. Equipment adopted was recommended by the consulting firm in collaboration with Servicescope Ltd., dealers in bakery equipment. Equipment acquired from Sweden are as follows:

Table 9.6 Baking equipment purchase by Sitima bakery, 1988

	equipment		value (Kshs.)
(1)	Two FN rack ovens (B-1330)		1,130,440
(2)	one mixer (high speed, SP160 capacity 160 kg)		336,064
(3)	one long moulder (LR 67)		181,248
(4)	one divider/scaler (SD21)		179,927
(5)	one bun divider (TW 11)		108,466
(6)	one conical rounder (CR 21)		149,247
(7)	one elevator (type E)		53,676
(8)	one steam generator (for proving)		61,172
(9)	one bread slicer (gravity feed)		73,160
(10)	one wrapping & dating machine		79,296
(11)	water metering unit (B-43)		33,701
		sub-total	2,386,338
(12)	300 trays (@ Kshs 150)		45,000
(13)	320 sets of baking tins (@ Kshs 160)		51,000
(14)	8 racks (@ Kshs 2750)		220,000
(15)	new Isuzu vans (for transport)		853,400
(16)	building renovation		700,000
(17)	electrical installation		40,000
(18)	working capital		707,000
		sub-total	2,616,400
		total	5,194,344

source: Sitima bakery

While the cost of expansion was Kshs. 5,194,344 in new investment for both equipment and infrastructure, imported equipment amounted to Kshs. 2,386,338. Of the total overall costs, the owner raised 24% (Kshs. 1,246,643) and a local financial institution provided 76% (Kshs. 3,947,702).

9.2.5 Wama Bakery

Whereas Wama bakery is based in the rural areas, competition which arises from Elliots and Batian bakeries, both large scaled operations based in the same area, encouraged the adoption of relatively modern equipment. A loan of Kshs. 1,000,000 and 2,263,788 from SEFCO and KCB respectively were used to acquire equipment, which was supplied by M/S Dahlen International through its local agent, M/S D.K Engineers. Table 9.7A below presents equipment acquired in 1986, and table 9.7B shows equipment added in 1989.

Table 9.7A Baking equipment acquired with loan from SEFCO by Wama bakery, 1986

	equipment		cost (Kshs.)
(1)	one fuel wood oven (2x2.5)		150,000
(2)	one Dahlen peel oven (5 deck 36 tins per deck)		250,440
(3)	one Dahlen mixer (one speed)		206,500
(4)	one moulder		181,248
(5)	one divider/scaler (9 pcs model)		90,927
(6)	one steam generator (for proving)		61,172
(7)	one bread slicer		33,160
		total	973,447

source: Wama bakery and SEFCO report 1987

Table 9.8B Additional baking equipment acquired by Wama bakery, 1989

	equipment		cost (Kshs.)
(1)	four Dahlen peel oven (5 deck 36 tins per deck)		793,000
(2)	one Dahlen mixer (spiral/sprint)		413,000
(3)	one moulder		181,248
(4)	one divider/scaler (9 pcs model)		90,927
(5)	one conical rounder		149,247
(6)	one bread slicer (gravity feed)		73,160
(7)	two polythene baggers (@ Kshs. 33,600)		67,200
		sub-total	1,767,788
(8)	one steam generator *		32,000
(9)	one elevator *		33,400
(10)	bread crates		15,000
(11)	Furniture & fixtures		20,000
(12)	two vehicles (@ Kshs 400,000)		800,000
(13)	building renovation		271,000
(14)	water metering unit *		15,400
(15)	working capital		475,000
		sub-total	1,661,800
		total	3,413,788

source: Wama bakery and Kenya Commercial Bank report 1990

Wama bakery combined a fuel wood oven and peel ovens for bread baking. This combination was influenced by two factors. One was the need to enhance the capacity of production. The electric oven of 5-decks each with 36 tins can bake 6,480 lpd in 18-hours day which actually met the required capacity. However, the entrepreneur wanted to exceed the planned capacity by 50% in order to enable him to repay the loan in a shorter time. The other reason, as he puts it, was "to have capability to vary the taste and to have a back-up security in the event of the electricity failure or any breakdown of the electric oven". This strategy is understandable since electrical failure is more frequent in rural areas.

There are also innovations in technologies identified and adopted. The steam generator, elevator and water units were designed at the plant. This is not as a result of the management skills or support from the co-sponsoring institutions. It is as a result of the interaction between the entrepreneur and the technical consulting firm, M/S D.K. Engineers, which designed and constructed the units.

9.2.6 Muhoroni Bakery

Selection of equipment at Muhoroni bakery was influenced, in addition to the projected market demand, by Kenya Industrial Estates and dealers of the bakery equipment—through financing and consulting. While the total cost for establishing the bakery was Kshs. 1,708,000, the cost of the baking equipment was Kshs.1,055,240, provided by the Kenya Industrial Estate in the form of a loan to be paid over a five year period. Equipment acquired in 1986 is shown in table 9.9 below.

Table 9.9 Baking equipment acquired by Muhoroni bakery, 1986

	equipment		cost (Kshs)
(1)	Tom Chandley electric oven (4 deck model, 84 loaves per deck)		390,000
(2)	one mixer (Sottoriva 150kg, 2 speed)		60,000
(3)	one cake mixer (Sottoriva, 3 beaters)		50,000
(4)	one divider (Robertson, 9 PCs, bread)		205,000
(5)	one divider (Robertson, 36 PCs, Scones)		31,680
(6)	one moulder		55,000
(7)	four final provers ([illegible] rack model)		80,000
(8)	250 sets of four-bread tins *		50,000
(9)	60 trays *		9,000
(10)	3 baking tables *		9,000
(11)	one Polythene Bagger		15,400
		sub-total	
(12)	one-ton vehicle		150,000
(13)	land & building		200,000
(14)	initial working capital		303,000
		sub-total	653,000

* locally acquired components

source: Pangani Bakery and Servicescope Ltd.

The owner raised 38.2%, Kshs. 653,000, from the savings which were put into the purchase of the vehicle, construction of the premises, electrical and water installations and initial working capital as represented in table 9.9 above.

In all six firms, selection of equipment was influenced by five factors: (1) actual and potential market; (ii) actual and anticipated competition; (iii) entrepreneurial capabilities in organization and management; (iv) capital requirements; and (v) consulting firms. In the case of Elliots bakery, additional equipment was considered in relation to changes in market demand—usually increase in demand and competition—, and actual selection was done by its technical personnel and expatriates who are usually attached to the firm for one or two years.

Similar factors influenced selection of additional equipment at Pangani bakery. However, in their case, entrepreneurs combined the role of management and technical expert. In addition, the firm was characterized by limited organizational capability. With regard to financing of the equipment, Elliots, Pangani and Sitima raised the required capital from their savings. In contrast, Kahama, Wama and Muhoroni raised the required capital through loans from the financial institutions. In such arrangements, while they provided required collateral, the size of the loans were influenced by the bakeries' organizational and managerial capabilities. In this respect, the nature of investment and selection of equipment was a compromise between required output, supply of capital and organizational capabilities of the entrepreneurs. In the actual selection of equipment, entrepreneurs relied on the recommendation of the financial institutions and engaged consulting firms.

9.3 PROMOTION OF LOCAL MANUFACTURING

One of the questions in the study concerned the way bakery firms have encouraged subsequent entrepreneurial activities through backward and forward linkages. Expectation with backward effects involved the way in which firms acquired equipment and components. While the six firms were characterized by the use of imported core processing equipment, Kahama and Wama purchased additional ovens which were locally designed and constructed. These ovens, however, have not been developed for general production and distribution.

It was the expectation of the study that bakery firms would be characterized by greater acquisition of local components as compared to core equipment. With the exception of Elliots bakery, all five bakeries acquired most of the peripheral components from local suppliers. In table 9.3.1 is a list of the type of equipment imported and peripheral components which were obtained locally.

Table 9.3.1 **Imported equipment and peripheral components acquired from local suppliers by five bakery firms**

imported equipment	components from local suppliers
1. mixers	1. Pans/tins
2. moulders	2. trays
3. dividers	3. wrapping material
4. provers	4. racks
5. ovens	5. bread crates
	6. furniture

Forward effects among the six firms were in distribution of bread through individuals or enterprises operating on commission. There were variations between the six firms, however, on the percentage of the total production distributed through agents.

Table 9.3.2 **Percentage of bread sold directly and through agents**

Firm	Percentage of Sales	
	direct	agents
Elliot	30	70
Pangani	85	15
Kahama	75	25
Sitima	78	22
Wama	90	10
Muhoroni	94	6

Pangani, Wama and Muhoroni—all small scaled operations— distributed most of their output directly as compared to Kahama and Sitima which distributed over 20% of their production through agents. In contrast to acquisition of the peripheral components, Elliot bakery distributed over 70% of its production through agents.

9.4 LABOUR REQUIREMENTS

9.4.1 Employment Levels

With regard to absorption of labour, the overall expectation was that entrepreneurs will influence the nature of investment which, in turn, determines labour requirements. The number of employees in the six firms is presented in table 9.4.1. As compared to the other firms, Elliots bakery was characterized by the largest number of employees with respect to overall employment and the various categories of skills. Whereas Kahama and Sitima bakeries were characterized by a lower number of employees as compared to Elliots bakery, their number was relatively higher as compared to Pangani, Wama and Muhoroni bakeries. These data support the hypothesis that the higher the level of capital investment, the larger the absorption of labour. In contrast to the Big Push and small scaled orientation in planning, employees of the five medium and small scaled operations constitute only 33% of the employees in Elliots bakery.

Table 9.4.1 Number of employees and skill levels in the six firms

	employees	skilled	artisans	unskilled
Elliots bakery	310	30	230	50
Kahama bakery	30	2	11	17
Sitima bakery	25	3	7	15
Pangani bakery	18	3	4	11
Wama bakery	17	3	5	9
Muhoroni bakery	13	1	3	9

9.4.2 Labour Wages

One of the predictions with regard to utilization of labour concerned the structure of the wages. The expectation was that, while the nature of investment will influence the level of wages, entrepreneurs and location of the firms were expected to have additional effects. In table 9.4.2A are the average wages in various categories of workers within the six firms. In addition, the national average wages for the same categories of workers is presented for comparative purposes.

With regard to a contrast between large and small scaled operations, the average wages at Elliots bakery is compared to those of the other five firms in table 9.4.2B. In relation to the other firms, average wages at Elliots bakery are consistently higher. In the case of Pangani, the difference with regard to semi-skilled labour is as high as 52%. A consistently higher percentage difference is found in comparison with Sitima and Muhoroni. One of the explanations for this consistent and relatively large difference is that these two firms had renewed operations with newly recruited employees, in addition to the fact that they are based in rural areas.

In terms of overall attraction of the required labour force in the national economy, the national average wages are compared to those of the six firms in table 9.4.2C. Elliots bakery is characterized by higher average wages as compared to the national averages. Indeed, in the case of the skilled and semi-skilled workers, the average wages at Elliots bakery range between 90% and 97%. Such a difference in national wages allows the bakery to attract the required workforce. While Kahama and Wama bakeries are different with regard to the scale of operations and location, their average wages are considerably higher as compared to the national averages. In the case of Kahama, this may be explained by accumulated obligations, over the years, to the workers. Relatively higher wages in these two firms, however, has been brought about by increased competition in their respective areas of operations.

Table 9.4.2A Average wages by skills/positions in the six bakery firms, Kenya, 1990**

position and skills	Elliot	Pangani	Kahama	Sitima	Wama	Muhoroni	national average
General Mana	20140						13854
Production M	15570						10715
Production s	6580		4720	3840	4580	3700	4296
Technicians	4420	2660	3940	2420	3540	2660	2332
Semi-skilled	2950	1420	2590	1850	2360	1730	1494
Unskilled	1220	890	1070	780	950	650	1167

Source: Bakeries and Central Bureau of Statistics
* National average wages in the bakery industry:
1985 Kshs. 1519; 1990 Kshs. 1824

Table 9.4.2B Percentage of difference in wages of five bakery firms from Elliot bakery, 1990

position and skills	Elliot	Pangani	Kahama	Sitima	Wama	Muhoroni
General Mana	20140					
Production M	15570					
Production s	6580		-28	-42	-30	-44
Technicians	4420	-40	-11	-45	-20	-40
Semi-skilled	2950	-52	-12	-37	-20	-41
Unskilled	1220	-27	-12	-36	-19	-47

Source: calculations from data in table 9.11A

Table 9.4.2C Percentage difference of wages in the six bakery firms from the national average, 1990

position and skills	Elliot	Pangani	Kahama	Sitima	Wama	Muhoroni
General Mana	45					
Production M	45					
Production s	53		10	-11	7	-14
Technicians	90	14	69	4	52	14
Semi-skilled	97	-5	73	24	58	16
Unskilled	5	-24	-8	-33	-15	-44
Clerk/supervisor	0	0				

Source: calculations from data in table 9.11A

9.4.3 Labour Skills

With regard to levels of skills, the expectation in respect to literature and small scale perspective was that small and medium sized operations will be characterized by relatively larger absorption of skilled workers as compared to large scale operations. In respect to absolute numbers, table 9.4.1, Elliots bakery was characterized by the largest absorption of both skilled and semi-skilled workers. It will be noted, however, that the majority of the workers at Elliots bakery were semi-skilled workers, as predicted with the Big Push model.

Table 9.4.3 Percentage of various skill levels to the total number of workers in the six firms

	skilled	artisans	unskilled
Elliots bakery	0.10	0.74	0.16
Kahama bakery	0.07	0.37	0.57
Sitima bakery	0.12	0.28	0.60
Pangani bakery	0.17	0.22	0.61
Wama bakery	0.18	0.29	0.53
Muhoroni bakery	0.08	0.23	0.69

When such comparison is undertaken with percentage of workers in various categories of skills to the total workforce, table 9.4.3, both small scaled and Big Push perspectives are supported by the data. Whereas Elliots bakery absorbed 10% of the skilled workers, three firm—-Sitima, Pangani and Wama—which are medium and small scaled operations, absorbed between 12% and 18% of the skilled labour. While Elliots bakery was characterized by employment of 74% semi-skilled workers, the other firms were characterized by much lower percentages of semi-skilled workers, i.e. between 22% and 37%. A much more interesting observation, however, which provides further support to the Big Push planning model, is the fact that Elliots bakery was characterized by a considerable low percentage, 16%, of unskilled workforce as compared to the other firms which were characterized by a considerable large percentage, i.e. between 53% and 69%, of the unskilled workforce. The overall implication of these data is that large scaled operations tend to generate more employment opportunities and absorb larger percentage of semi-skilled workers.

Workers involved in production of bread are organized as follows: production manager, production supervisor, skilled technicians, semi-skilled artisans and unskilled. With respect to this structure, other than the positions of the General Managers and specific areas such as finance, most recruitment takes place at the lowest level in order to develop work culture, competence and experience within the organization. Elliots is the only bakery that trained its staff through the facilities of the Directorate of Industrial Training (DIT). Table 9.4.4 below summarizes the training pattern, 1985 to 1990, at Elliots in collaboration with the DIT.

Table 9.4.4 **Training pattern at Elliot bakeries, 1985 to 1990**

staff cadre	1985	1986	1988	1989	1990
craft apprentices	6	0	0	0	0
technical apprentices	12	2	2	0	0
overseas training	0	2	3	0	0
local management	0	6	11	12	8
total	18	10	15	12	8

Source: Elliot bakery 1990 and Directorate of Industrial Training, 1990

With respect to the data in table 9.4.1, Elliots has not sponsored craft apprentices for any formal training since 1985. Whereas it trained 12 technicians in 1985, the number drops to 2 in 1986 and 1987 and to none in the last two years. Overseas training is undertaken occasionally at Elliots bakery. In 1986 and 1988, Elliots sent supervisors and technicians to England for training on the processing of bakery products. One of the reasons was preparation for upgrading their equipment both in Nakuru and Nyeri. However, the most interesting trend, from 1986 to 1990, with regard to training practices at Elliots bakery was the consistent emphasis on training of the local management. The other bakeries which provided occasional training to management—in this case entrepreneurs—were Kahama and Wama. Such training arrangements, however, were undertaken as part of the loan arrangements.

While the structure of the workforce at Pangani consisted of a clerk/supervisor, technicians, semi-skilled and unskilled workers, in contrast to Elliots, the supervisor was actually a multi-purpose clerk who did everything including basic accounting. Besides lack of structure for career progression, no formal training has been provided to the workers at Pangani bakery. Its main approach towards acquisition of the necessary skills was recruitment of workers who have worked in other bakeries and learning on the job. Such characteristic prevailed with respect to the other four medium and small scaled firms. At Kahama bakery, while employees acquired skills through learning-by-doing and supervised apprenticeship, six workers were employed with experience from other bakeries. Among the workers involved in production at Sitima bakery, twelve trained on the job, and three were recruited with experience and limited training from Mayfair bakery in Kisumu. Organization of workers is as follows: supervisor, technicians, artisans and unskilled workers.

Wama bakery organized in-house training for its employees and has systematic apprenticeship programme. Occasionally, the consultant D/S Engineers provided training to the workers involved in production and those intended to provide back-up support in maintenance of the equipments. In addition, Wama bakery sent some of the employees to other bakeries in Nairobi for understudy. Workers at Muhoroni bakery were provided with a six-week course, offered by Servicescope Ltd. in Nairobi, on operation of the equipment and management of bakeries.

10 SUMMARY AND CONCLUSION

The study reported on in this dissertation was an investigation of the nature of investment and types of production technologies in the bakery industry in Kenya during the decade of the 1980s and the ways in which firms adapt such technologies in efforts to expand their production capacities and to achieve self-sustaining operations. In this respect, two models of economic development were contrasted, namely the small-scale model which emphasizes investment strategy in which many firms are promoted simultaneously, and the Big Push model which emphasizes the promotion of fewer selected firms or industries for large-scale operations. It was my contention, however, that the two models are deficient essentially because of the apparent lack of treatment of attributes of the entrepreneurs as a major causal factor in relation to the nature of investment and adaptation of technologies. Consequently, a revised model incorporating entrepreneurs as one of the primary causal factors was proposed and presented in Chapter 4, Table 4.1.3. One of the principal purposes of this study, therefore, was to examine the extent to which this improved model can predict the empirical observations. Yet another objective of the study was to identify the relative advantages of the small-scale operations and the Big-Push model.

10.1 CHARACTERISTICS OF THE FIRMS

10.1.1 Entrepreneurs

In the sample of 82 bakery firms registered in Kenya in 1989, 51% were owned by Africans, 32% by Asians, 12% by a combination of Africans and Asians, and 5% by MNCs. Since the structure of entrepreneurs in the bakery industry in Kenya or East Africa has not been documented in any literature, this dissertation has provided first-hand data in relation to the firms in this industry. Data for Nigeria, which are not directly comparable to the present data, were provided by Kilby (1965). Further, while collaboration between MNCs and local entrepreneurs has been given attention, this dissertation has taken into account the dynamics of the collaboration between Africans and Asians that has not heretofore been recognized in the literature.

10.1.2 Location of the firms

In the sample firms, 58% were located in rural areas, 22% in semi-urban areas, and 20% in urban areas. The firms located in rural areas tended to be small-scale enterprises which serve limited enclaved markets, as compared to the firms located in urban and semi-urban areas.

10.1.3 The nature of investment

The census data presented in Table 3.4.1 which include seasonal bakery operations indicate that in 1988 small enterprises constituted 83%, medium 12%, and large 5%. Moreover, according to the registered firms, small operations constituted 68%, medium 21%, and large 11% which, as can be noted, showed relatively smaller variation in comparison with the distribution of the present sample firms, i.e. 60%, 23% and 17% respectively. In the present sample, however, small enterprises was split such that 15% are micro operations and 45% are small-scale establishments.

10.1.4a Equipment adopted

Interestingly, most of the bakery firms in Kenya at the time of this study were using relatively modern equipment. With regard to mixing of ingredients, 35% of the firms used manual operations, while 38% used modern equipment, and 27% have adopted advanced equipment. This pattern applies to the other phases of production of bread. With proving—a time- consuming phase of production—36% of the firms used relatively manual operations as compared to 64% which used either warm cabinets or tunnels fully equipped with instruments that control temperature and humidity. Further, most of the firms, 56%, used variation of peel, reel or rack ovens which are heated either with gas or electricity, while 12% had adopted high capacity baking tunnels. Still a considerable number, 32%, of the firms utilized traditional brick or deck ovens which are heated firewood.

10.1.4b Utilization of production capacities

In the case of the installed production capacities, the total for the sample firms was 7.81 million loaves of bread per day, while the actual production was 4.5 million amounting to an overall capacity utilization of only 58% in the bakery industry. Whereas the data reported lack of insight with regard to the trends in this industry, they are favourable as compared to the figures reported by Coughlin in 1988, which had indicated a much lower average of 21%. Nonetheless, this level of capacity utilization suggests that one of the problem to which attention should be given with regard to self-sustaining industrial operations is the expansion of utilization of the existing production capacities.

10.1.5 Promotion of local manufacturing

On this aspect of the study, the data from the sample firms indicated that bakery firms in Kenya have had limited impact on promotion of local manufacturing, especially with respect to the core production equipment. In fact, 36% of the firms imported their equipment, 46% acquired used, secondhand equipment which had been imported by other firms at previous times. Consequently, 72% of the firms imported the core equipment, while only 18% used equipment that can be considered as reflecting local initiatives.

However, one area in which bakery firms have tended to encourage local technological and entrepreneurial activities is the acquisition of components. Most firms, 82%, acquired their components such as wrapping papers, trays, tins, tables and, in some cases, moulding bars from local manufacturers. Although one firm processed its own wrapping papers, it does not extend this service to the other bakeries.

10.1.5a Labour requirements

In relation to the overall absorption of labour, the present sample of 82 firms employed 2,874 workers, a number which amounts to, and indeed is consistent with, that of the medium and large-scale firms in the census data presented in Table 3.4.3. As noted in Chapter 3, while micro operations have tended to generate an increasingly large proportion of employment in this industry, such employment in these firms tends to be short-lived. Indeed, when employment with informal sector enterprises are not taken into account, overall employment in the bakery industry has tended to remain stagnant.

10.1.5b Labour wages

The average wages in the sample firms was Kshs 1197. While this figure is relatively low as compared to the estimates of Kshs 1519 in 1985 (CBS, Statistical Abstracts 1989), its standard deviation of Kshs 533 puts the sample statistics well within the range of the statutory estimates. This large standard deviation indicates that wages in this industry are characterized by a wide variation. Indeed, in some firms it is as low as Kshs 650 and in others as high as 2950.

10.1.5c Productivity of labour

As pertaining to the productivity of labour, the data obtained from the sample of the bakery firms in Kenya indicated that productivity of labour ranged from 165 to 3600 bags per year for every worker, with an average of 907 and a standard deviation of 701. While these figures are comparable to those reported by Kaplinsky (1980:88), i.e 160 to 1,587 bags per year, they differ with respect to the average and the variation which was indicated to have been 780 and 221 bags per year respectively. Even though the average in the present sample suggests improvement in productivity, the relatively larger standard deviation reveals a considerable increase in variation.

10.1.5d Labour skills

As far as concerns the absorption of skills, the data from the present sample indicated that the category of workers with technical skills in relation to the total workers constituted 9%, that of artisan skills 41%, while for unskilled workers it was 50%. Clearly, these figures suggest that bakery firms in Kenya emphasize utilization of semi-skilled and unskilled workers. The interpretation given for this tendency (Masi 1988, Mikkelsen 1987) is that firms are not necessarily looking for workers with higher skills for innovative purposes but workers who can adapt to their production processing. In addition, a relatively less skilled labour force has the effect of keeping costs of production low through lower wages.

10.1.5e Training practices

While most firms in the present sample of the Kenyan bakeries recruited directly from the school leavers and encouraged learning by doing, a limited number sponsored their workers to take formal courses. It was noted from the case studies that such courses have been and still are provided to workers with technical skills and to those in supervisory positions as a way of developing a cadre of workers that would provide technical support in machine and management operations. Further, it was noted that 26% of the firms had benefited from external economies that arose from workers trained in other firms, as would be predicted by the two theories of economic development.

10.2 INFLUENCE OF DETERMINANT FACTORS

10.2.1 The nature of investment

The predictions that entrepreneurs and the location of the plants would influence the nature of investment were confirmed by the data obtained from the present sample of the Kenyan bakeries. Overall, firms owned by MNCs, mixed and Asian entrepreneurs exhibited higher production capacities, on average, in that order, with the firms of African entrepreneurs reflecting the lowest capacities of production. Relatively higher production capacities in the firms owned jointly by African and Asian entrepreneurs suggest that such collaboration brings about resources and skills not available to these entrepreneurs separately. Further, as expected, large production capacities were found in firms located in semi-urban and urban areas. This observation emphasizes the importance of the infrastructural services that are available in this areas. Nonetheless, of the 53% of the explained variation, impact of the entrepreneurs accounted for 48%, and the location of the plants accounted for only 2%. Clearly, as indicated by the model (Table 4.1.3), entrepreneurs is a crucial variable with respect to the nature of investment. Of course, the fact that the effects of the location are less important were anticipated with the model indicating such effects as indirect.

10.2.2 Equipment adopted

The expectations that entrepreneurs, location of the firms and the nature of investment would be associated with the level of equipment adopted were also given support by the data from the present sample of the Kenyan bakery firms. Indeed, the three determinant factors showed strong and significant association with the level of equipment adopted in five critical phases of production in this industry. n the case of the entrepreneurs, using correlation ratio (Eta) as a mea ure of the strength of the association, the coefficients ranged from 76% to 80%, while in the case of the location of the firms and the nature of investment, using Somer's D as a measure of the strength of the association, the coefficients ranged from 48% to 52 with the former, and from 68% to 74% with the latter. When overlapping effects were controlled, of the 85% explained variance in the differences in the type and sophistication of the ovens adopted, the influence of the entrepreneurs contributed 59%, location and the size 22%, while interaction between the factors contributed only 2%. Once again, these findings lend support clearly to the predictions of the model outlined in Chapter 4.

10.2.3 Utilization of production capacities

Although the overall explained variation in the present study is relatively small, the assumption in the model that entrepreneurs, location of the plants and the nature of investment would be associated with the level of the capacity utilization were given support by the empirical data. The three determinant factors exhibited a significant association with the percentage of utilization of the production capacities. When confounded effects were controlled, of the 36% explained variation, as expected, the impact of the entrepreneurs was 27%, location and size of the firms was 8%, and interaction between the factors was only 2%. The fact that the overall explained variation is relatively small indicated that other factors outside the model are effecting additional influence on this aspect. One such factor which was discussed is the frequent shortage of wheat.

10.2.4 Promotion of local manufacturing

The anticipation that entrepreneurs, location and the nature of investment would influence the ways in which firms promoted local manufacturing within the sector of this industry was affirmed by the data obtained from the present sample. Practically all the firms of the MNCs and 72% of large firms in general imported their equipment directly, while firms of Asian entrepreneurs (46%) and medium size operations (49%) acquired equipment through local agents, as compared to the firms of the African entrepreneurs (33%) and also small-scale operations which acquired their equipment from local manufacturers. One of the notable aspects from these data is the fact that firms of the Asians entrepreneurs and medium size operations which did not acquire equipment from local agents, used secondhand equipment which was imported by other firms previously.

One area which is rather promising is the acquisition of the components. On this aspect, most of the firms of African (97%) and of Asians (96%), as well as small and medium size operations, 100% and 96% respectively, acquired their components from local manufacturers, in contrast to the firms of the MNCs as well as large-scale operations which imported most of their components. More specifically, with respect to the percentage of the expenditure on local purchases of the packaging materials, of the 75% explained variation the influence of the entrepreneurs contributed 48%, and the location and size of the firms 27%.

10.2.5 Overall labour absorption

In the case of labour requirements—specifically, the absorption of the overall labour—the expectations that entrepreneurs, location and the nature of investment would influence the number of workers employed were confirmed by the data from the present sample of the bakeries in Kenya. The average number of employees changed systematically with the variation in the type of entrepreneurs, location of the plants and the size of the firms. Firms owned by MNCs absorb, on average, a larger number of workers. Indeed, such firms employ twice the average of the firms owned by mixed entrepreneurs, about 10 times that of the firms owned by Asian entrepreneurs, and about 16 times that of the firms owned by African entrepreneurs. Controlling for the confounded effects, of the 84% explained variation entrepreneurs were responsible for 69%, location and the size of the firms 5%, and interaction between the factors 9%.

10.2.6 Labour wages

Concerning wages, similar expectations were given support by the data from the present sample. The average wages of workers were highest with firms owned by MNCs and large-scale operations, as compared to the firms of the Asian and the African entrepreneurs as well as medium size and small-scale operations. One of the interesting aspects was the fact that firms owned by mixed entrepreneurs represented considerably higher average wages apart from the firms of MNCs and large-scale operations. Controlling for the confounded effects, of the 84% explained variation the impact of the entrepreneurs was 69%, while the location and the size of the firms accounted for 13%, and only 2% were effects of the interaction between the determinant factors.

10.2.7 Labour productivity

Further, similar predictions were given support by the data from the present sample in the matter of productivity of labour. On this particular aspect, the nature of investment exhibited greater impact as compared to entrepreneurs and the location of the plants. In fact, of the 43% explained variation, while entrepreneurs contributed 11%, location and the size of the firms contributed 32%, in which the effects of the size of the firms were highly significant.

10.2.8 Skilled labour

As regards the absorption of the skilled labour, the expectations were that entrepreneurs, location and the nature of investment would be associated with the number of the skilled workers employed. These assumptions were given support by the data. In fact, in as far as absolute number was concerned, firms of the MNCs and large-scale operations represented the highest number of skilled workers as compared to the firms of mixed, Asian and African entrepreneurs as well as medium and small-scale operations. Indeed, with respect to the absolute number, of the 95% explained variation entrepreneurs was responsible for 63%, location and the size of the firms 12%, while the interaction between the factors accounted for a considerable 20%.

However, a further insight with regard to this aspect in the utilization of labour is indicated by its ratio to the total work force. In this respect, the effects of firms of the MNCs and of the large-scale operations are negative as compared to those of the African entrepreneurs and small-scale operations. Specifically, of the 30% explained variation the impact of the entrepreneurs was 8%, location and size of the firms 19%, and the interaction between the factors 2%.

10.2.9 Semi-skilled workers

The expectations with similar predictions in the case of absorption of the semi-skilled workers were confirmed by the data from the present sample of the bakery firms in Kenya. Firms of the MNCs and large-scale operations represented the largest number of employed semi-skilled workers as compared to the firms of the mixed, Asian and African entrepreneurs as well as medium and small-scale operations. Specifically, of the 75% explained variation in the number of the employed semi-skilled workers, the impact of the entrepreneurs was 63%, location and the size of the firms 3%, and interaction between the factors 9%. However, in terms of the ratio of this category of the workers to the total work force, the firms of MNCs and large-scale operations exhibited negative impact, i.e. lower ratios. In this respect, of the 26% explained variation the influence of the entrepreneurs was 13%, while the location and the size of the firms accounted for 12%.

10.2.10 Training practices

With the component of training of the labour force, the expectations that entrepreneurs, location and the nature of investment would be associated with changes in the training practices were given support by the data from the present sample. Firms of MNCs (100%) and large-scale operations (64%) had courses organized within the firms as compared to the firms of the other entrepreneurs (81% in the case of the firms of the African entrepreneurs and 62% in the case of the Asian entrepreneurs) as well as medium (52%) and small-scale operations (80%) in which the principal method of training was apprenticeship and learning by doing.

10.3 CONCLUSIONS

Principally, the findings reported in this dissertation give substantial support to the predictions of the model presented in Chapter 4, Table 4.1.3, which incorporates entrepreneurs as the primary determinant in adaptation of the production technologies in pursuit of the self-sustaining industrial operations in the context of developing countries. In point of fact, the analyses in this dissertation indicated that the combination of the attributes of the entrepreneurs and the nature of investment can improve both the explanation and prediction of adaptation of the production technologies in the developing economies.

In such a model in which entrepreneurs play a crucial role in both the nature of investment and the adaptation of technologies, more attention would need to be given to the attributes of the entrepreneurs. Besides incorporating such attributes in the prediction models, efforts need to be given to the programmes will improve the capabilities of the entrepreneurs, especially those whose venture into industrial operations is relatively recent. In fact, the data reported in the present dissertation have indicated that one way of improving the capabilities of such entrepreneurs would be to promote cooperative endeavours and collaboration with entrepreneurs who had sustained experience in industrial operations.

In the matter of the application of the small-scale and the Big Push model, the data reported in this thesis indicate that both models have setbacks. In the case of the small-scale operations, they are inhibited to begin with by limited capabilities for adaptation of effective technologies. Whereas the firms in this category have tended to generate an increasing proportion of employment in recent years, such employment, as was noted in this study, is short-lived. Nonetheless, it was clear that small-scale operations adopted locally manufactured equipment and absorbed substantially higher ratios of skilled workers. In the case of the Big Push model, large-scale investment, the major constraint is the fact that, with the exception of the possibility presented by the state corporations, participation of the local entrepreneurs will be inhibited. Further, while they have adopted modern and technically efficient equipment, the large-scale operations have negative impact, as shown in the present study, on promotion of the local technical capabilities as shown by the limited ratio of skilled labour and the percentage of expenditure on local purchases.

In view of these limitations, emphasis should be directed to medium size operations that would offset extreme disadvantages of these two models of economic development. In point of fact, Stewart (1990) had hinted that medium size operations may have greater potentials in the context of developing countries. Such a model would be amenable to local entrepreneurs while preserving capabilities for the firms to undertake competitive operations and for the developing nations to achieve self-sustaining operations. The issue is not that small is beautiful, but that the potential for self-sustaining industrial capability and overall accelerated economic growth can be realized with medium-size operations.

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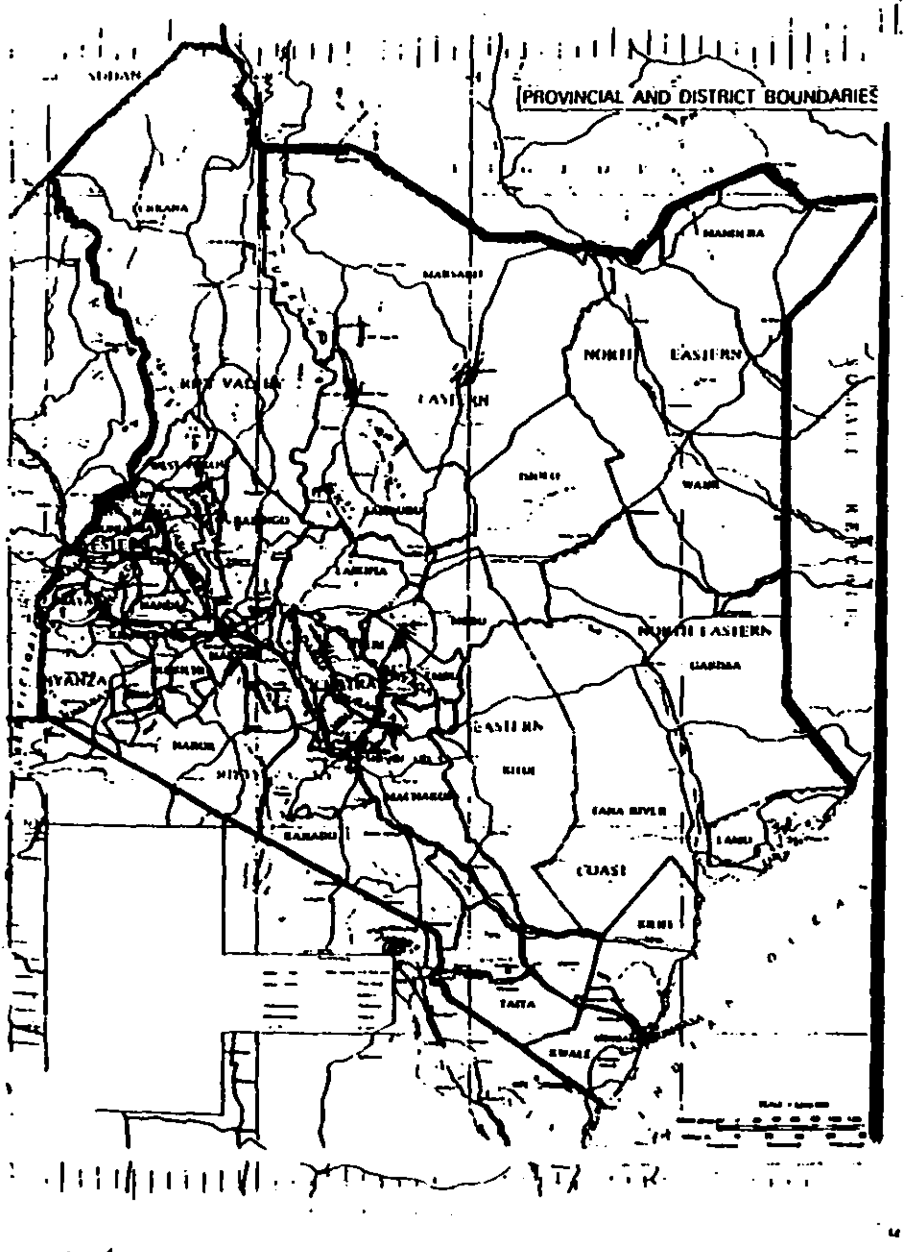
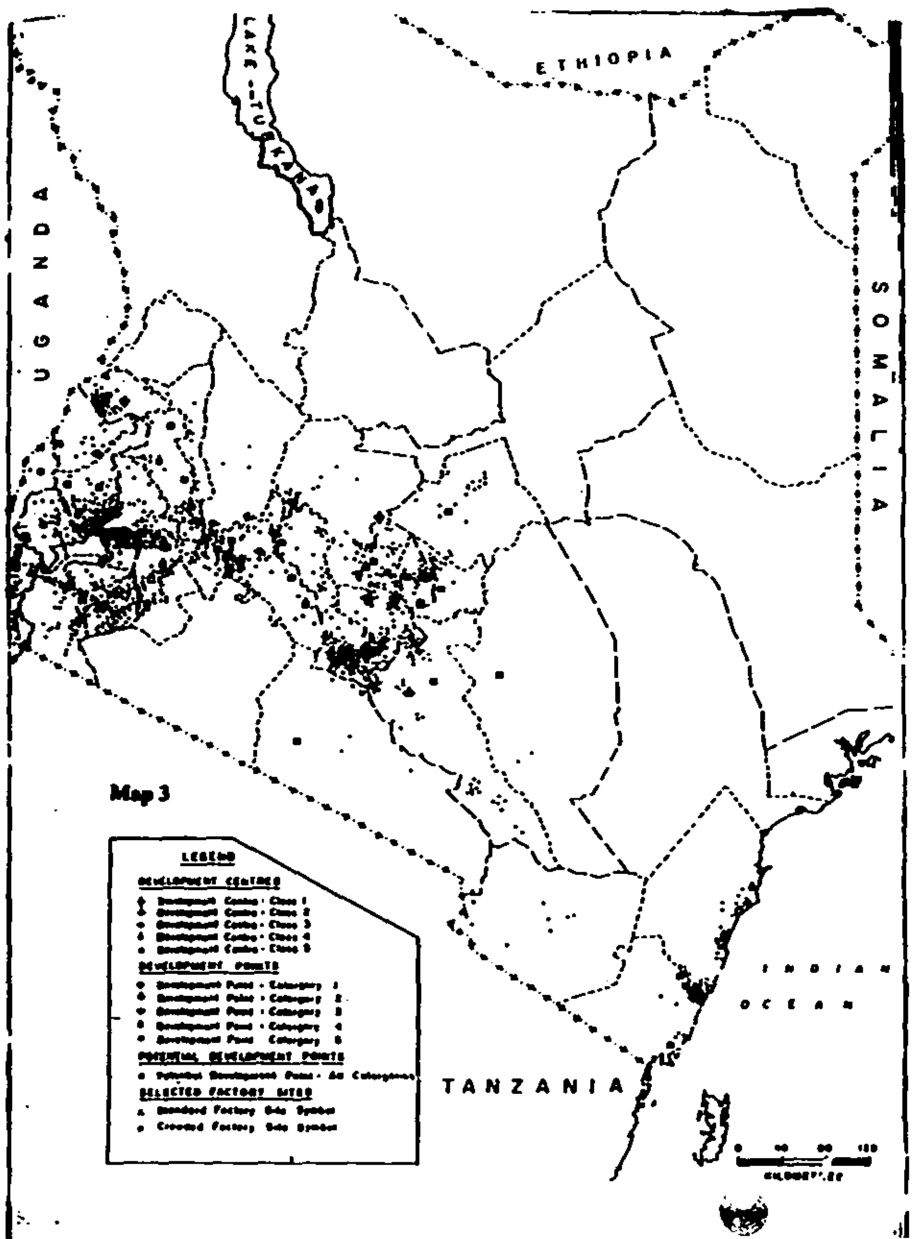
APPENDIX 1

MAPS OF KENYA

(Adapted from Official Kenya Handbook 1988,
Ministry of Information & Broadcasting, Nairobi, Kenya)





APPENDIX 2

Distribution of population in Kenya by provinces and districts, 1989

Province/ District	Population 1979 (000's)	Provisional Population 1989 (000's)	Intercensal Growth Rate (%)	sq.km.	Concentration of Industries
Nairobi	**828**	**1,346**	**4.86**	**684**	xxxxx
Central					
Kiambu	686	914	2.87	2,451	
Muranga	648	846	2.67	2,476	
Nyeri	486	613	2.32	3,284	
Kirinyaga	291	388	2.88	1,437	
Nyandarua	233	349	4.04	3,528	
Total	**2,344**	**3,110**	**2.83**	13,176	x
Coast					
Kilifi	431	611	3.49	12,523	
Lamu	42	57	3.05	6,814	
Taita Taveta	148	202	3.11	16,975	
Kwale	288	384	2.88	8,322	
Mombasa	341	467	3.14	275	xxx
Tana River	92	129	3.38	38,694	
Total	**1,342**	**1,850**	**3.21**	**83,603**	x
Eastern					
Embu	263	358	3.08	2,714	
Kitui	464	640	3.22	29,389	
Marsabit	96	125	2.64	78,078	
Isiolo	43	70	4.87	25,605	
Machakos	1,023	1,393	3.09	14,183	
Meru	830	1,138	3.16	9,922	
Total	**2,719**	**3,724**	**3.15**	**159,891**	x
North-Eastern					
Garissa	129	124	-0.40	43,931	
Wajir	139	125	-1.06	56,501	
Mandera	106	123	1.49	26,470	
Total	**374**	**372**	**-0.05**	**126,902**	
Nyanza					
Kisii	870	1,146	2.76	2,196	
Siaya	475	643	3.03	3,528	
Kisumu	482	674	3.35	2,660	xx
South Nyanza	818	1,095	2.92	7,778	
Total	**2,645**	**3,558**	**2.97**	16,162	
Rift Valley					
Kajiado	149	262	5.64	21,105	
Laikipia	135	213	4.56	9,718	
Nandi	299	440	3.86	2,745	
Baringo	204	286	3.38	10,790	
Samburu	77	114	3.92	20,809	
Turkana	143	179	2.25	64,048	
West Pokot	159	231	3.74	5,076	
Kericho	633	859	3.05	4,890	
Nakuru	523	862	5.00	7,200	xx
Narok	210	402	6.49	18,513	
E. Marakwet	149	212	3.53	2,722	
Trans-Nzoia	260	394	4.16	2,468	
Uasin Gishu (Eldoret)	301	440	3.80	3,784	xx
Total	**3,242**	**4,894**	**4.12**	**173,868**	
Western					
Bungoma	504	731	3.72	3,074	
Kakamega	1,031	1,389	2.98	3,520	
Busia	298	423	3.50	1,766	
Total	**1,833**	**2,543**	**3.27**	**8,360**	
National Totals	**15,327**	**21,397**	**3.34**	**582,646**	

Source: (1) Central Bureau of Statistics 1989, 1991

APPENDIX 3A

POPULATION OF KENYA BY RACE, 1948-1979

	1948	1962	1969	1979
Africans	5251120	8365942	10733202	15101540
Non-Africans	154846	270321	209503	225521
as proportion	.030	.032	.020	.020
Asians	97687	176613	139037	78600
as proportion	.020	.021	.013	.010
Europeans	29660	55759	40593	39901
as proportion	.010	.010	.004	.003

Source: Central Bureau of Statistics 1989

APPENDIX 3B

Goodness of Fit Between Registered and Sampled Firms

Province	Firms	Sample	Firms %	Sample %	Expected	Chi-square
Naironi	27	12	19.29	14.63	15.81	0.919977
Central	18	13	12.86	15.85	10.54	0.572667
Coastal	19	14	13.57	17.07	11.13	0.740895
Eastern	14	6	10.00	7.32	8.20	0.590244
Nyanza	10	10	7.14	12.20	5.86	2.930314
Rift Valley	34	18	24.29	21.95	19.91	0.184013
Western	16	9	11.43	10.98	9.37	0.014721
North Eastern	2	0	1.43	0.00	1.17	1.171429
Total	140	82	100.00	100.00	82.00	7.124260

χ^2=7.12, df=7, p<.50

Given df=7, p<.01, χ^2 > 16.8 would be needed for the sample and registered firms to be considered as different.

APPENDIX 4

Table A7.1.1 Crosstabulation of types of dough mixing technologies by the types of entrepreneurs

	african	asian	mixed	mnc
hand	45			
dough activator	19	8		
batch	31	65	10	
continuous	4	27	50	
high-speed			40	100
	100% (42)	100% (26)	100% (10)	100% (4)

χ^2=92.8, df=12 p>.0001, Eta=.77

Table A7.1.2 Crosstabulation of types of dough proving technologies by the types of entrepreneurs

	african	asian	mixed	mnc
paper	64	12		
cabinets	36	81	30	
tunnel		7	70	100
	100% (42)	100% (26)	100% (10)	100% (4)

χ^2=72.3, df=6, p>.0001, Eta=.76

Table A7.1.3 Crosstabulation of types of dough moulding technologies by the types of entrepreneurs

	african	asian	mixed	mnc
hand	64	15		
tools	36	85	30	
machines			70	100
	100% (42)	100% (26)	100% (10)	100% (4)

χ^2=82.9, df=6, p>.0001, Eta=.77

Table A7.1.4 Crosstabulation of types of dough dividing technologies by the types of entrepreneurs

	african	asian	mixed	mnc
hand	69	8		
tools	31	92	30	
machines			70	100
	100% (42)	100% (26)	100% (10)	100% (4)

χ^2=93.2, df=6, p>.0001, Eta=.80

Table A7.1.5 Crosstabulation of types of dough baking technologies by the types of entrepreneurs

	african	asian	mixed	mnc
brick	59	4		
tube	41	96	40	
tunnel			60	100
	100% (42)	100% (26)	100% (10)	100% (4)

χ^2=85, df=6, p>.0001, Eta=.77

Table A7.1.6 Crosstabulation of the level of automation by the types of entrepreneurs

	african	asian	mixed	mnc
manual	90	15		
semi-automated	10	85	50	
fully-automated			50	100
	100% (42)	100% (26)	100% (10)	100% (4)

χ^2=102.4, df=6, p>.0001, Eta=.87

Table A7.1.7 Crosstabulation of types of dough mixing technologies by the location of the firms

	rural centres	rural towns	semi urban	urban areas
hand	55	16		
dough activator	17	16	6	6
batch	24	47	27	63
continuous	4	16	45	12
high-speed		5	22	19
	100% (29)	100% (19)	100% (18)	100% (16)

χ^2=46.7, df=12, p>.0001, Eta=.67

Table A7.1.8 Crosstabulation of types of dough proving technologies by the location of firms

	rural centres	rural towns	semi urban	urban areas
paper	72	32	5	13
cabinets	28	63	56	56
tunnel		5	39	31
	100% (29)	100% (19)	100% (18)	100% (16)

χ^2=35.8, df=6, p>.0001, D=.48, Eta=.63

Table A7.1.9 Crosstabulation of types of dough moulding technologies by the location of the firms

	rural centres	rural towns	semi urban	urban areas
hand	76	31	6	13
tools	24	63	61	62
machines		6	33	25
	100% (29)	100% (19)	100% (18)	100% (16)

χ^2=36.3, df=6, p>.0001, D=.48, Eta=.63

Table A7.1.10 Crosstabulation of types of dough dividing technologies by the location of the firms

	rural centres	rural towns	semi urban	urban areas
hand	72	42	11	
tools	28	53	56	75
machines		5	33	25
	100% (29)	100% (19)	100% (18)	100% (16)

χ^2=35.6, df=6, p>.0001, D=.49, Eta=.63

Table A7.1.11 Crosstabulation of types of dough baking technologies by the location of the firms

	rural centres	rural towns	semi urban	urban areas
brick	72	21	6	
tube	28	79	61	75
tunnel			33	25
	100%	100%	100%	100%
	(29)	(19)	(18)	(16)

χ^2=46.5, df=6, p>.0001, D=.52, Eta=.68

Table A7.1.12 Crosstabulation of the level of automation by the location of the firms

	rural centres	rural towns	semi urban	urban areas
manual	86	47	28	19
semi-automated	14	53	44	56
fully-automated			28	25
	100%	100%	100%	100%
	(29)	(19)	(18)	(16)

χ^2=32.2, df=6, p>.0001, D=.46, Eta=.58

Table A7.1.13 Crosstabulation of types of dough mixing technologies by the size of the firms

	small	medium	large
hand	40	5	
dough activator	22		
batch	33	65	7
continuous	5	30	36
high-speed			57
	100% (45)	100% (23)	100% (14)

χ^2=77.1, df=8, p>.0001, D=.77, Eta=.74

Table A7.1.14 Crosstabulation of types of dough proving technologies by the size of the firms

	small	medium	large
paper	60	9	7
cabinets	40	78	21
tunnel		13	72
	100% (45)	100% (23)	100% (14)

χ^2=56.6, df=4, p>.0001, D=.64, Eta=.68

Table A7.1.15 Crosstabulation of types of dough moulding technologies by the size of the firms

	small	medium	large
hand	60	13	7
tools	40	83	21
machines		4	72
	100% (45)	100% (23)	100% (14)

χ^2=64.0, df=4, p>.0001, D=.62, Eta=.68

Table A7.1.16 Crosstabulation of types of dough dividing technologies by the size of the firms

	small	medium	large
hand	60	13	7
tools	40	82	21
machines		5	72
	100%	100%	100%
	(45)	(23)	(14)

χ^2=64.0, df=4, p>.0001, D=.61 Eta=.68

Table A7.1.17 Crosstabulation of types of dough baking technologies by the size of the firms

	small	medium	large
brick	53	9	
tube	47	87	36
tunnel		4	64
	100%	100%	100%
	(45)	(23)	(14)

χ^2=58.4, df=4, p>.0001, D=.61, Eta=.69

Table A7.1.18 Crosstabulation of the level of automation by the size of the firms

	small	medium	large
manual	80	21	7
semi-automated	20	74	36
fully-automated		4.3	57
	100%	100%	100%
	(45)	(23)	(14)

χ^2=61.3, df=4, p>.0001, D=.66, Eta=.72

Table A7.2.1 Crosstabulation of sources of equipments by the types of entrepreneurs

	african	asian	mixed	mnc
local	33	4		
second-hand	57	50	10	
local-agent	10	46	20	
direct-import			70	100
	100%	100%	100%	100%
	(42)	(26)	(10)	(4)

χ^2=82.3, df=9, p>.0001, Lambda=.22

Table A7.2.2 Crosstabulation of sources of equipments by the location of the firms

	rural centres	rural towns	semi urban	urban areas
local	52			
second-hand	45	63	39	37
local-agent	3	32	28	38
direct-import		5	33	25
	100% (29)	100% (19)	100% (18)	100% (16)

χ^2=48.2, df=9, p>.0001, Lambda=.06

Table A7.2.3 Crosstabulation of sources of equipments by the size of the firms

	small	medium	large
local	29	9	
second-hand	58	38	21
local-agent	13	49	7
direct-import		4	72
	100% (45)	100% (23)	100% (14)

χ^2=62.4, df=6, p>.0001, Lambda=.20

Table A7.2.4 Crosstabulation of sources of peripheral components by the types of entrepreneurs

	african	asian	mixed	mnc
local supplier	97	96	10	
direct-import	3	4	90	100
	100% (42)	100% (26)	100% (10)	100% (4)

χ^2=63.0, df=3, p>.0001, Lambda=.80

Table A7.2.5 Crosstabulation of sources of peripheral components by the location of the firms

	rural centres	rural towns	semi urban	urban areas
local supplier	100	79	61	75
direct-import		21	39	25
	100% (29)	100% (19)	100% (18)	100% (16)

χ^2=12.2, df=3, p>.007, Lambda=.15

Table A7.2.6 Crosstabulation of sources of peripheral components by the size of the firms

	small	medium	large
local supplier	100	96	
direct-import		4	100
	100% (45)	100% (23)	100% (14)

χ^2=75.6, df=2, p>.0001, Lambda=.54

Table A7.3.1 Crosstabulation of training methods of workers by types of entrepreneurs

	african	asian	mixed	mnc
experience	81	62	10	
colleagues	14	38	40	
inside courses	5		50	100
	100 (42)	100 (26)	100 (10)	100 (4)

χ^2=53.3, df=6, p>.0001, Lambda=.26

Table A7.3.2 Crosstabulation of ways training of the workers by the location of the firms

	rural centres	rural towns	semi urban	urban areas
experience	86	79	28	37
colleagues	10	21	39	36
inside courses	4		33	25
	100% (29)	100% (19)	100% (18)	100% (16)

χ^2=25.3, df=6, p=.0003, Lambda=.06

Table A7.3.3 Crosstabulation of ways training of the workers by the size of the firms

	small	medium	large
experience	80	52	22
colleagues	18	44	14
inside courses	2	4	64
	100% (45)	100% (23)	100% (14)

χ^2=43.9, df=4, p>.0001, Lambda=.19

Table A8.0 Factor loadings of the three entrepreneurs' dummy variables, location and the size of the sample firms: assessment of multicollinearity--see discussion in chapter 8

	F1	F2	F3	F4	F5	F6
MNCs	.00	.28	.23	.13	.09	.27
Asians	.02	.16	.02	.57	.16	.08
mixed	.00	.08	.27	.25	.10	.28
location	.01	.00	.00	.00	.98	.00
size	.00	.00	.00	.00	.00	.98

APPENDIX 5

List of Bakery firms registered 1987/88 with
Ministry of Industry
and Kenya Industrial Research Development Institute

3117 MANUFACTURE OF BAKERY PRODUCTS

Key

Code	Number of employees
A	5-19
B	20-49
C	50-99
D	100-199
E	200-499
F	over 500

Source: KIRDI 1987

SERIAL	NAME & ADDRESS	YEAR	LOCATION	SIZE	PRODUCTS MANUFACTURED
01	Aberdare Bakery Nyeri		Nyeri	A	Bread & Scones
02	Africanna Bakery Webuye		Webuye	A	Bread & Scones
03	Afro Bakers Ltd Kitale	1980	Moi St.	C	Bread
04	Ambae Ltd Nairobi	1962	Munyu Rd.	B	Bread, Pies & Cakes
05	Anglo Swiss Bakery Mombasa	1963	Mombasa	C	Bread, Cakes & Pastries
06	Aurora Baking Co.Ltd. Nairobi	1975	Nairobi	B	Bread & Scones
07	Azinia Bakery Mombasa	1945	Mombasa	B	Bread
08	Baraka Bakery Bungoma	1985	Bungoma	A	Bread, Scones & Cakes
09	Batchelors Bakery Ltd. Nairobi		Nairobi		Bread & Cakes
10	Batian Bakery Ltd. Nyeri	1982	Nyeri	B	Bread, Scones & Queen Cakes
11	Bavaria Foods Ltd. Mombasa		Mombasa		Bread & Scones
12	Bidii Bakers Ltd. Kitale		Elgon Rd.	A	Bread & Scones
13	Bondo Bakery Bondo		Siaya	A	Bread & Scones
14	Bradulin Popat Danyi Nairobi	1972	Bandari Rd.	A	Bread & Rolls
15	Broadway Bakery Ltd. Thika		Factory Rd.	D	Bread & Other Bakery Products
16	Butali Bakery Webuye	1986	Butali Mkt. KK	A	Bread & Scones
17	Californian Cookies Nairobi		Moi Avenue Nairobi	A	Cookies
18	Cheptongei Bakery Iten	1982	Tongei Mkt.	A	Bread
19	Cheskaki Bakery Bungoma	1984	Cheskaki	A	Bread & Scones
20	Continetal Bakery Mombasa	1980	Saramala Rd. Mombasa	A	Bread & Scones
21	Country Pride Ltd. Nairobi		Kiambaa	A	Bread
22	Delite Bakery Mombasa	1970	Muslim Rd. Mombasa	A	Bread & Cakes.
23	Duncans Ltd Eldoret	1951	Kenyatta Rd.	A	Bread, Cakes, Chocolates & Biscuits
24	Eldoret Bakery Eldoret	1984	Eldoret	B	Bread, Biscuits & Cakes
25	Electric Bakery Kericho	1965	Garage Rd.	A	Bread & Cakes

SERIAL	NAME & ADDRESS	YEAR	LOCATION	SIZE	PRODUCTS MANUFACTURED
26	Elgeyo Bakery Iten	1985	Iten Town	A	Bread
27	Elgon Bakery Kitale	1984	Kitale	A	Bread, Scones & Cakes
28	Elijah Kotut Bakery Eldama Ravine	1954	Eldama Ravine Baringo	A	Bread
29	Elliots Bakery Ltd Nairobi		Changamwe Rd Nairobi	E	Bread, Scones & Cakes
30	Elliots Bakery Ltd Nakuru	1970	Mathenge Rd., Nakuru	E	Bread, Scones & Cakes
31	EquatorBakery Ltd Nanyuki	1986	Nanyuki	A	Bread
32	Esmail Khamisi Bakery Mombasa		Mombasa	A	Bread, Cakes & Pastries Biscuits
33	Express Bakery Nairobi	1963	Ngara Rd, Nairobi	B	Bread, Cakes & Pastries
34	Fahari Bakery Kapenguria	1963	Makutano W Pokot	A	Bread
35	Fairview Bakery Nairohi	1962	Nairobi	A	Bread, Cakes & Biscuits
36	Fejowila Bakery Tala	1986	Tala	B	Bread
37	Fino Tradining Co.Ltd. Mandera	1981	Mandera	A	Bread
38	G.G.G. Bakery Gilgil	1969	Gilgil Nakuru	A	Bread, Cakes & Scones
39	Gakima Bakery Nyahurum	1969	Nyahururu Nyandarua	A	Bread, Cakes & Scones
40	Gakuu Nahashon Karatina	1964	Karatina Nyeri	B	Bread, Cakes & Scones
41	Gotaba Sanik Bakeries Kericho	1983	Garage Rd. Kericho	B	Bread, Cakes & Scones
42	Gulshan Bakery Mombasa	1974	Mombasa	B	Bread, Buns & Scones
43	Highway Hotel Marsabit	1981	Marsabit Town	A	Bread & Rolls
44	Hizo Bakery Malindi	1976	Kombo St. Malindi	A	Bread & Scones
45	HolaBakery Hda	1983	Hola	A	Bread & Scones
46	Honey Post Bakery Runyenjes	1986	Runyenjes Kirinyaga	A	Bread, Scones & Cakes
47	Hotel Safari Bakery Lodwar	1983	Kolokol Lodwar	A	Bread
48	House of Manji Ltd. Nairobi		Likoni Rd. Nairobi	E	Biscuits & Allied Products
49	Jabela Bakery Siaya		Siaya	A	Bread & Scones
50	Jambo Biscuits Nairobi	1987	Lunga Rd Nairobi	A	Biscuits & Confectionery
51	Jarnlech Kabuba Murang'a	1973	Murang'a	A	Bread & Scones
52	Jiwa's Bakery Malakisi	1986	Bungoma Bungoma	B	Bread
53	Jory Traders Ltd Nakuru	1982	Nakuru	B	Bread
64	Kabras Bakeries Kkunga	1985	Kabras Kakamega	A	Bread
66	Kahama Bakery Eldoret	1966	Eldoret	C	Bread
66	Kakamega Industries Ltd Kakamega	1966	Kakamega	C	Bread
67	Kalima Bakery Ltd Sultan Hamud	1984	S/Hamud Machakos	B	Bread & Scones
68	Karemu Bakery Nairobi	1984	K.I.E.	A	Bread & Cakes
69	Kenbread Ltd Kisumu	1975	Kendu Lane Kisumu	B	Bread, Cakes, Rolls & Buns

SERIAL	NAME & ADDRESS	YEAR	LOCATION	SIZE	PRODUCTS MANUFACTURED
60	Kencake Bakery Nairobi	1970	Ngong Rd. Nairobi	A	Bakery Products
61	Kenwafers Ltd Nairobi	1975	Likoni Rd. Nairobi	A	Wafers
62	Kilifi Bakery Kilifi	1986	Kilifi	A	Bread & Rolls
63	Kilimani Bakery Voi	1986	Mwatate	A	Bread
64	Kinga Bakery Eldoret	1985	Eldoret	B	Bread, Cakes & Pastries
65	Kisumu Bakery Ltd Kisumu	1970	Mumias Rd. Kisumu	B	Bread, Cakes, Pastries & Biscuits
66	Kitale Bakery Ltd Kitale	1949	Kitale	A	Bread, Cakes, Pastries & Biscuits
67	K'S Bakers Nairobi	1972	Nairobi	A	Bread, Cakes, Pasteries & Scones
68	Lodad's Sharoo Bakery Lamu	1972	Lamu	A	Bread
69	Loima Bakery Lodwar	1986	Lodwar	A	Bread & Scones
70	Lucky Star Hotel Lodwar	1986	Lodwar	A	Bread
71	Machakos C.Bakery Machakos	1949	Machakos	A	Bread
72	Mafuko Industries Ltd Meru	1982	Meru	D	Bread
73	Mahmoud Akadir Bakery Lamu	1947	Lamu	A	Bread
74	Maina Bakeries Ltd Kerugoya	1978	Kerugoya	A	Bread & Scones
75	Makatiat Ltd Kabarnet	1983	Kabarnet	A	Bread
76	Malaba Bakery Malaba	1982	Malaba, Busia	A	Bread
77	Malakisi Bakery Malakisi	1955	Malakisi	A	Bread
78	Manzo Enterprises Ltd Malindi	1986	Malindi	A	Bread
79	Marina Bakery Ltd Port Victoria	1984	P/Victoria Busia	A	Bread
80	Marina Bakery Ltd Nanyuki	1959	Nanyuki	A	Bread
81	Matecha Bakery Kitale	1987	Kitale	A	Bread & Scones
82	Mryfair Bakeries Ltd Kisumu		Kenyatta Hwy, Kisumu	B	Bread, Scones, & Pasteries
83	Mbila Bakery Machakos	1971	Machakos	A	Bread & Cakes
84	Meru Bakers Co Ltd Meru	1963	Meru	B	Bread, Cakes & Buns.
86	Milimani Bakery Busia	1983	Milimani	B	Bread
86	Mini Bakeries Nairobi	1985	Isiolo Rd.	C	Bread
87	Mini Bakeries (Mombasa) Mombasa		Sir Ali St. Mombasa	A	Bread, Scones & Cakes
88	Mohamedan Bakers Mombasa		Kericho St.	A	Bread
89	Mohaose Bakery Nairobi		Nairobi	A	Bread, Scones & Rolls
90	Mothers Pride Industries Nairobi	1983	Gatundu.	A	Bread
91	Musas Industries Luanda	1985	Luanda Kakamega	C	Bread
92	Mwiraria Bakery Isiolo	1983	Isiolo	A	Bread
93	Nairobi Home Bakers Nairobi		Taifa Rd. Nairobi	A	Bread & Allied Products

SERIAL	NAME & ADDRESS	YEAR	LOCATION	SIZE	PRODUCTS MANUFACTURED
94	Nakri Food Ltd Nairobi	1983	Naivash Rd. Nairobi	A	Bread & Round Cakes
95	Nakuru Pattisserie Nakuru	1969	Singh lane Nakuru	A	Bread, Buns & Small
96	Torong Women Group Lodwar	1985	Lodwar	A	Buns, Yellow Cakes & Straight Cakes
97	Nawoitorong W. Group Lodwar	1985	Lodwar	A	Bread, Scones & Cakes
98	Nduja Ltd Nyahururu	1980	Nyahururu Nyandarua	C	Bread & Cakes
99	New Shaban Bakery Kisii	1986	Kisii	B	Bread
100	Ngala Mwendwa Bakery Kitui		Kitui	A	Bread
101	Nyahururu Bakery Nyahururu		Nyahururu	A	Bread, Scones & Cakes
102	Oven Door Bakeries Nairobi	1983	Nairobi	A	Bread
103	Oswal Bakery Ruiru	1962	Ruiru	B	Bread & Cakes
104	Pangani Bakery Nairobi	1986	Pangani Nairobi	A	Bread & Brown Biscuits
105	Pejo Investments Ltd Kiambu	1982	Kiambu	C	Bread
106	Polo Bakery Homa Bay	1983	H/Bay	B	Bread
107	Pwani Bakery Mombasa	1985	Mombasa	B	Bread
108	Ray Sidney Bakery Mombasa	1987	Kilifi	A	Bread
109	Rift Valley Bakeries Nakuru		Nakuru	A	Cakes
110	Rige Bakery Webuye	1986	Bungoma	A	Bread
111	Safari Hamidha Bakery Moyale	1980	Moyale	A	Bread
112	Salama Bakery, Lodwar	1986	Lodwar	A	Bread
113	Samburu Bakery Maralal	1972	Maralal	A	Bread, Cakes & Scones
114	Sanguru Bakery Garissa	1986	Garissa	A	Bread, Cakes & Scones
115	Sansora Bakery Kisii		Kisii	A	Bread
116	Santa MariaBakery Narok		Narok	A	Bread & Scones
117	Shianda Bakery Kakamega	1986	Shianda	A	Bread
118	Sifia Super Bakery Siaya	1986	Siaya	A	Bread & Scones
119	Sirisia Bakery Sirisia		Sirisia Bungoma	A	Bread & Scones
120	Sitima Bakery Kericho	1978	Garage Rd Kericho	A	Bread, Scones & Cakes
121	Sunbeam Bakery Ltd Nairobi	1986	Ngara Rd Nairobi	B	Bread, Cakes & Pastries
122	Supa Bakery Nairobi		Bandari Rd. Nairobi	A	Bread, Roll & Scones
123	Sussex Bakery Ltd Nairobi	1964	Nairobi	B	Bread, Biscuits & Cakes
124	Swansea Bakery Kericho		Kericho	A	Bread, Scones & Rolls
125	Swiss Cake Ltd Nairobi	1957	Ghalib Rd Nairobi	B	Bread, Cakes & Pastries
126	Tala Bakery Ltd Tala	1970	Tala	B	Scones
127	Tasiri Bakery Bungoma	1984	Bungoma	A	Bread & Scones

SERIAL	NAME & ADDRESS	YEAR	LOCATION	SIZE	PRODUCTS MANUFACTURED
128	Terry's Bakery Meru	1985	Meru	A	Bread, Cakes & Rolls
129	Thika Bakery Thika	1981	Thika	C	Bread
130	Three Star Bakery Machakos	1981	Machakos	A	Bread
131	Nzoia Bakery Ltd Kitale	1970	Kitale	B	Bread, Buns, Cakes & Biscuits
132	United Arican Bakery Nyeri	1964	Nyeri	B	Bread & Scones
133	Voi Food Manufacturers Voi	1982	K.I.E. Voi	A	French Bread, Cakes & Buns Rolls
134	Wama Bakery Othaya	1986	Othaya Nyeri	B	Bread, Scones & Rolls
135	Wamae's Bakery Nairobi	1973	Nairobi	A	Cakes & Pastries
136	Western Bakery Kitale	1974	Kitale	A	Bread & Scones
137	Westlands Bakery Ltd Nairobi	1962	Westlands	A	Bread, Cakes & Pastries
138	Yala Bakery Yala	1985	Yala Siaya	A	Bread & Cakes
139	Yusuf Bakery Lamu	1981	Lamu	A	Bread
140	Zahra Industries Ltd Nairobi	1972	Butere Rd. Nairobi	D	Biscuits

APPENDIX 6

1. Name of the bakery: ______________________

2. Address of this bakery: ______________________

____

3. Year of establishment: ______________________

4. Who is the main share holder of this bakery?

(5) state corporation ______
(4) external corporation ______
(3) foreign businessman ______
(2) local Asian ______
(1) local African ______

5. Who is the manager of this bakery?

(1) owner ______
(2) share holder/director ______
(3) employed executive ______
(4) contracted firm ______
any other, specify
______________ ______

6. Location of this bakery is in which of the following category of areas?

	area		name
(4)	city	______	__________
(3)	municipality	______	__________
(2)	town	______	__________
(1)	rural center	______	__________

7. What is the total number of employees in this bakery? __________

8. How many <u>work-shifts</u> are undertaken in this bakery?

number of shifts	number of hours
__________	__________

9. What are the levels of qualification of employees in this bakery?

	<u>qualification</u>	<u>number</u>
(4)	college degree/diploma	______
(3)	certified technician	______
(2)	uncertified artisan	______
(1)	no qualification at all	______

10. What ways has this bakery taken <u>in the last two years</u> to improve qualifications and competence of the employees?

(1)	recruitment	______
(2)	training	______
(3)	any other, specify	
	________________	______

11. In recruitment for the last two years, which type of institution/ organization <u>has been the major source</u> of the present employees in this bakery?

(4)	university/college	______
(3)	polytechnic	______
(2)	school leavers	______
(1)	other bakeries	______
	any other, specify	
	________________	______

Explain the reason for your response:

____

____

12. In the last two years, what was the major method to train employees in this bakery in order to improve competence?

(4)	sponsored outside courses	______
(3)	sponsored inside courses	______
(2)	trained by colleagues	______
(1)	learned through experience	______

13. In the last two years, which institutions have undertaken outside training for the employees in this bakery?

	institution	number of employees
(1)	other bakeries	________
(2)	institute of technology	________
(3)	DIT sponsored	________
(4)	polytechnic	________
(5)	foreign institution	________
	any other, specify	
	________	________

14. How much of the following ingredients are used per day in this bakery?

	inputs	kg/relevant unit	cost
(1)	flour	____ ____	________
(2)	sugar	________	________
(3)	salt	________	________
(4)	cooking oil	________	________
(5)	yeast	________	________
(6)	baking powder	________	________
	any other, specify		
	________	________	________
	________	________	________
	________	________	________

15. How many of the following final products are made per day in this bakery?

	product	number	or	kg
(1)	white bread	________		________
(2)	brown bread	________		________
(3)	french bread	________		________
(4)	scones	________		________
(5)	cakes	________		________
(6)	biscuits	________		________
(7)	burns	________		________
	any other, specify			
	________	________		________
	________	________		________
	________	________		________

16. What is the <u>maximum level</u> that this bakery is meant to produce or can produce <u>in a day</u> for each of the following products? (when operating at full capacity)

	<u>product</u>	<u>number</u>	or	<u>kg</u>
(1)	bread	________		________
(2)	scones	________		________
(3)	cakes	________		________
(4)	biscuits	________		________
(5)	burns	________		________
	any other, specify			
	____________	________		________
	____________	________		________
	____________	________		________

17. How much of the above products are sold to the local markets by this bakery?

	<u>product</u>	quantity <u>(number or kg)</u>	unit <u>price</u>
(1)	white bread	________	________
(2)	brown bread	________	________
(3)	french bread	________	________
(4)	scones	________	________
(5)	cakes	________	________
(6)	biscuits	________	________
(7)	burns	________	________
	any other, specify		
	____________	________	________
	____________	________	________
	____________	________	________

18. How much of these products are sold to the markets outside Kenya by this bakery?

	<u>product</u>	quantity <u>(number or kg)</u>	unit <u>price</u>
(1)	white bread	________	________
(2)	brown bread	________	________
(3)	french bread	________	________
(4)	scones	________	________
(5)	cakes	________	________
(6)	biscuits	________	________
(7)	burns	________	________

any other, specify

______	______	______
______	______	______
______	______	______

19. What is the method used to mix baking ingredients in this bakery?

(1) hand ______
(2) hand & activator (ADD) ______
(3) Machine ______

20. What is the major type, model and cost, of the equipment used for mixing? (If it is not a manual operation)

	type		model & cost (Kshs.)
(3)	batch mixer	______	______
(4)	continuous mixer	______	______
(5)	high speed mixer	______	______
	any other, specify		
	______	______	______
	______	______	______

21. What is the method used to proof the dough in this bakery?

	method		cost (Kshs.)
(1)	space/polythene paper	______	______
(2)	warm cabinets	______	______
(3)	humid tunnel	______	______
	any other, specify		
	______	______	______

22. What is the method used to mould the dough in this bakery?

	method		model & cost (Kshs.)
(1)	hand & tables	______	______
(2)	machine & tables	______	______
(3)	machine alone	______	______

23. What is the method used to divide the dough in this bakery?

method model & cost (Kshs.)

(1)	hand & tables	______	______________
(2)	machine & tables	______	______________
(3)	machine alone	______	______________

24. What type of oven is used to bake the dough in this bakery?

	type		model & cost (Kshs.)
(1)	brick	______	______________
(2)	tube	______	______________
(3)	tunnel	______	______________
	any other, specify		
	______________	______	______________
	______________	______	______________

25. What methods are used in this bakery to undertake the following baking activities?

	activities	1 manual	2 equipment
(1)	cooling	______	______________
(2)	slicing	______	______________
(3)	wrapping	______	______________

26. How much is the use of equipments in this bakery from store, to mixing, baking and wrapping?

(3)	fully automated	______
(2)	half-automated	______
(1)	manual & some equipments	______

27. What is the main source of energy used for baking at this bakery?

wood	______
diesel	______
electricity	______

28. Of the baking equipments mentioned above (used in this bakery), which ones were made by the following organizations?

1 made by this bakery	2 by firms in Kenya	3 imported by dealers

(1) ____________ ____________ ____________

(2) ____________ ____________ ____________

(3) ____________ ____________ ____________

(4) ____________ ____________ ____________

29. What was the total amount of funds toward acquisition of all the equipments being used or are in this bakery? Kshs________________

30. How were funds obtained to acquire all of the above mentioned equipments, being used or in the bakery?:

(1) savings from the same business ________
(2) savings from other business ________
(3) directors' private contribution ________
(4) loan from financial institutions ________
any other, specify______________ ________

31. If loan was part of the funds toward initiating or improving the bakery, which organization provided the loan?

	organization	percent of total funds
(1)	KIE	____________
(2)	SEFCO	____________
(3)	DFCK	____________
(4)	IDB	____________
(5)	KCB	____________
	any other, specify	
	____________	____________

32. Apart from loan, what other assistance has this bakery received?

type of assistance	organization giving assistance
____________	____________
____________	____________

33. What are the major problems that inhibit operations of this bakery? Give five in order of importance.

34. What would you suggest need to be done in order to improve the operations of this bakery?

35. Any comments that you may want to make concerning problems in the bakery industry in Kenya.