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CHOICE OF TECHNOLOGY IN THE KENYAN FOOD
PROCESSING SECTOR, WITH PARTICULAR
REFERENCE TO THE SITUATION AND ORIENTA-
TION OF TECHNICAL CHANGE: A PROJECT
OUTLINE

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ABSTRACT

Four areas of policy are concerned in this project on the choice of technology and technical change in the food processing industry. These are:- (a) economic considerations (b) nutritional considerations (c) the orientation of technical change, and (d) the growth of an African industrial class. The choice of the food processing industry as the sector for study is explained and this is followed by a brief discussion of the products to be investigated. These products are chosen because they are the major processed foodstuffs consumed by the mass of the population. The methodology of the research is described and, finally, a number of hypotheses are stated.

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This research project is focussed on the food processing industry in Kenya. As wide a range as possible of techniques presently in use for processing foods consumed by the mass of the population will be surveyed and analysed. It is hoped that as a result of this research the nature of technical progress (which predominately takes the form of increased mechanisation) in this industry can be established, and the impact of this change on a number of key policy variables be gauged. There are four aspects of policy under consideration. These are:-

(a) The economic consequences of mechanisation. Mechanisation can affect a number of key economic policy variables such as the utilisation of foreign exchange, the creation of employment opportunities, the generation of savings which can be used for productive investment and the effect on regional equality. The research will aim to throw some light on the impact of mechanisation on these areas of policy.

(b) The nutritional consequences of mechanisation. Usually the degree of processing is directly related to the degree of mechanisation. There is evidence¹ to suggest that the nutritional properties of processed food-stuffs are affected by the degree of mechanisation and this will have an obvious relationship to policies on nutrition.

(c) Mechanisation and the orientation of technical change. Technical change in this industry is predominantly concentrated at the capital intensive end of the spectrum of techniques and has the effect of leading to greater capital intensity. This orientation increasingly works to the disadvantage of the more labour intensive, small scale rural techniques. In principle there is no reason why these latter techniques could not be subject to an increasing rate of technical change and one of the concerns of this research is to explore the relationship of the food processing sector to the capital foods sector in Kenya and abroad.

(d) Mechanisation and the growth of an African industrial class. The characteristic activity of African businessmen is in the commercial sector. However, for a more even pattern of development, a necessary condition will be the participation of African entrepreneurs in the industrial sector. This research will aim to analyse some of the past, present and future difficulties of African businessmen who are trying to establish themselves in the food processing industry.

1. See, inter alia, F. Stewart (21) with regard to maize flour, and R. Kaplinsky (9) with regard to gari.

Some idea of how the industry has changed over the years, and how it is likely to change in the future is essential if the various points mentioned above are to be properly understood. Although there are constraints in identifying these changes, it is by no means inconceivable that some clues can be obtained. In the case of the established large scale producers, their history can be traced in some detail.¹ Visits to the plants, where a variety of vintages of equipment are likely to be in use, can also provide some insights into the changing nature of technology used by particular firms. Finally, a snapshot of different vintages of technology ranging from the more modern capital intensive techniques in use in the Nairobi industrial area, to the older, less capital intensive techniques being used in some of the more isolated rural areas of the country, can be obtained. It is through this picture of different producers producing differentiated, but competitive, products that we hope to establish what is happening at the margin and how the picture has changed, and will change in the future.

The Choice of the Food Processing Sector: It is necessary to justify the choice of the food processing sector as a subject for investigation. The choice of a different sector would inevitably influence the nature of the research and the conclusions which would result from it. To begin with, the advantages of choosing this sector will be discussed briefly and this will be followed by a discussion of the disadvantages.

Advantages of Choosing the Food Processing Industry: There are basically four advantages to be gained by the choice:-

(a) The output of this sector is consumed by the mass of the population. The same cannot be said for any other sector using 'modern' equipment, with the possible exception of the textile industry. Insofar as "development" is concerned with consumption by the mass of the population, and not only with consumption by the richer elements of the society, there are advantages to be derived from studying the nature of production in the food industry.

(b) Most of the country's population is employed in the agricultural sector producing both final consumption and intermediate goods. The consumption goods are generally consumed directly in the home. The intermediate goods are of two types - the first is in the form of raw materials for processing locally or for export, and the second is foodstuffs which is to be processed before consumption. Because the research is focussed on this latter activity of food processing it is thus directly linked to the productive occupations of the mass of the population.

1. For example, through annual reports and other documents lodged with the Registrar General.

(c) There is reason to believe that production in this sector may be characterised by an unusually wide spread of techniques - wide in the sense of varying amounts of capital per head, wide in the source of technology and wide in the range of skills required to operate these techniques. There are a number of reasons which lead us to this conclusion:-

(i) Basically three types of foodstuffs are processed in Kenya. The first consists of those products, such as flour, which have a long history of production in the country, antedating contact with the "developed world".¹ The second sort of products are those which were originally introduced through contact with developed countries, but which now have a long history of production in Kenya and are consumed by a wide spectrum of the population. Examples of such products are bread, sugar and salt. The final type of product was more recently introduced into the country, and is generally consumed by the elite. Insofar as we are confining our investigation to foodstuffs which are consumed by the mass of the population, it is the first two sorts of foodstuffs which are relevant to the research sorts. Both have a long history of production in Kenya, and as a consequence there are a number of different types and vintages of productive technique available, some of which have 'traditional' counterparts and some of which are produced locally. This picture differs from that of other sectors (e.g. tin cans), where production for the mass of the population is a fairly recent phenomenon, and productive techniques are generally confined to the more capital intensive end of the spectrum.

(ii) For much of the population, both urban and rural, time does not have a high opportunity cost. Thus, where efficient alternative techniques which substitute labour for capital do exist, they will be used even though if labour time were to be priced at the 'going wage rate', production by these techniques would be sub-optimal. Where labour time does have a measurable opportunity cost, as it may during harvest time, the lack of cash income may prohibit the use of mechanised techniques even though it would lead to a more 'rational' use of the individuals resources. This suggests that there are reasons to believe that labour intensive techniques will be in use, particularly in the poorer, rural areas of the country.

1. In some cases this contact took place in the form of trade, while in other cases it reflected the consumption tastes of settlers.

(iii) The relatively poor communications in an underdeveloped economy such as Kenya will be a disadvantage to the large scale mechanised plants. Transport costs to some of the more distant rural areas of the country may be prohibitively high, and this may be an effective barrier protecting production by local, small scale labour intensive techniques.

(iv) The low density of population and low level of income in much of the rural areas of the country implies that if consumption is to be satisfied by the large scale, capital intensive techniques, either deliveries would have to be small and frequent, or large and infrequent. The high transport costs mentioned above acts against the former alternative. The perishability of foodstuffs, the losses due to pests and the large amounts of working capital required by the retailer, act against the latter alternative. For these areas, therefore, it would appear that the advantage may lie with the small scale local producer in areas distant from major towns.

It is probable that these four factors ensure that small scale, labour intensive techniques will be in use, particularly in the rural areas. With the exception of transport costs, all of these factors are of special relevance to the food-processing industry and it is believed that this bears out the earlier argument justifying the choice of this sector for study. Yet it is clear that in all of these cases, the trend of events is likely to mitigate these advantages of small scale local production. Already there is evidence that small scale firms are being displaced by large scale producers,¹ partly because technical change is concentrated on the latter group and partly because of the very strong product differentiating activities of the larger producers.

(d) It is probable that there is significant African participation (qua owners) in this industry, even though this participation may be confined to the more labour-intensive end of the productive spectrum. This contrasts with production in other manufacturing and processing sectors, where ownership and control is invariably held by Asian, European or foreign entrepreneurs. To the extent that the research is concerned with the emergence (or non-emergence, as the case may be) of an African industrial class, the spread of ownership will be of considerable interest.

Disadvantages of Choosing the Food Processing Sector: We have dwelt at some length on the advantages of choosing the food processing sector as the focus of the research; but what of the disadvantages? There are two main (inter-related) disadvantages both of which are likely to limit the policy conclusions arising from the research.

1. See Stewart (21) with regard to maize flour and Marris and Somerset (17) with regard to bread.

(a) The first problem arises with respect to the lack of direct foreign investment in the industry. Of all the products to be considered, foreign participation only occurs in the production of salt in the beer industry and in the oil/fat/ghee industry. This absence of direct foreign participation is probably rather atypical of Kenyan industrial activities and even more so when account is taken of the future participation of foreign firms in some of the more sophisticated leading industries which will be established in the future.

(b) This absence of foreign investment is partly explained by the relatively low technological barrier to participation, because the equipment used (e.g. in milling) is widely available on the world market, is relatively simple and has been in existence for a considerable period of time. This is not to argue that the food processing industry is competitive one - indeed the production of flour is highly concentrated - but it does suggest that the barrier to increased participation by an African industrial class is probably explained by factors which are other than technological. Even if it is argued that the technological requirements are nevertheless beyond the capacity of an emergent African industrial class, the atypical nature of this industry will probably limit any policy conclusions concerning increased African participation which is generalisable to other industries.

It is easy to underestimate the importance of these two disadvantageous factors, particularly as it is likely that future manufacturing investment will be of a higher technological level and will almost certainly have more significant participation by foreign investors. Yet the specific advantages derived from studying the food processing industry should also not be underestimated. Ideally, the two sorts of study (one of a largely locally owned, low technology sector, the other of a predominantly foreign owned, higher technology sector) should complement and not displace each other.

The Products to be Investigated: In this century the Kenyan elite have predominantly been made up of white settlers and some members of the Asian community. The consumption tastes of the farmer group have been heavily influenced by taste patterns existing in the developed countries. To an increasing extent this is also true of the Asian elite, although in their case, outside influences on taste preferences are not confined to developed countries, but include the South Asian continent. Similar factors are influencing the taste patterns of the emerging African elite.

In the early years the consumption of much of the more income elastic foodstuffs was satisfied by imports, but in later years there has occurred a considerable amount of import substitution of these products. For this project the more income elastic foods consumed by the elite are ignored, and the research will be directed towards the processed foodstuffs consumed by the wananchi. In order to do this we have used the report of The Nutrition Survey and Campaign against Malnutrition in Kenya (1964-68). While this report is dated, it does have the considerable advantage of basing its data on weighings of food consumed by the family, rather than information gathered by questionnaire (which is a rather dubious procedure). The main disadvantage of using this report are twofold. In the first case the data was gathered in three Kikuyu districts, two Luo districts, two Wakamba districts and one Nairobi suburb. This rather limits our perception of what foodstuffs are eaten in the more distant and less accessible parts of the country, as well as the Coastal Province. These less accessible areas are of particular interest to us, insofar as the processed foods are likely to be produced by more labour intensive techniques. The second drawback of this study, is that, aside from the investigation in the Nairobi suburb, no information is provided on the purchased component of the family's food consumption.

In spite of these two drawbacks the study, is valuable in providing information on the composition of the family's food consumption. From the family's food basket, the following products have been chosen for investigation — maize, wheat and possibly cassava and sorghum and millet flour; sugar and jaggery; bread; beer, muratina and buzaa; salt; rice; and oil, ghee and fat. Table 1 lists the consumption by families of these foodstuffs in the study mentioned above.

A number of points emerge from this table. The first is the regional difference in food consumption. The second concerns the difference in consumption patterns between Nairobi and the rest of the sample. For the rather obvious reason that food is purchased and not grown in Nairobi, we find the relatively widespread use of purchased staples such as rice and bread in Bondeni. The third striking point about the table concerns the ubiquitous use of flour (particularly maize flour) made from cereals and tubers. Fourthly, we find the widespread use of oil/fat/ghee, sugar and salt, most of which is almost certainly purchased and not produced in the home. A number of products not generally consumed or produced in the home are not detailed in

TABLE 1: % OF FAMILIES CONSUMING FOODSTUFFS IN ANY ONE OF 6 DAYS OF SURVEY

FOOD CONSUMED	CENTRAL PROVINCE			NYANZA PROVINCE		EASTERN PROVINCE		BONDENDI DIST.
	NYERI DIST. S. TETU DIV.	MURANGA DIST. KANGEMA DIV. 1	NYERI DIST. N. TETU DIV.	CENTRAL NYANZA NGANDO DIV. 2	CENTRAL NYANZA UKWALA DIV. 2	MACHAKOS DIST. EASTERN DIV.	KITUI DIST. EASTERN	
Posho	92	37	83	98	71	91	55	81
Sugar	67	52	75	35	33	50	38	100
Fat	50	41	71	37	25	72	24	100
Oil	25				19		2	
Rice	25	2	4			5		69
Millet Flour	25	4	4				71	19
Salt	62			88	65			100
Bread			17	4		18	2	69
Cassava Flour				35	60			
Sorghum Flour				8	50	9	26	
Yellow Posho				14	3		26	
Ghee					3		12	
What Flour						95	2	56

1 Average of 3 surveys

2 Average of 2 surveys

Source: Nutrition Survey and Campaign against Malnutrition in Kenya 1964-68. Report to the Ministry of Health of Kenya on the WHO/FAO/UNICEF Assisted Projects, M. Bohdal, N.E. Gibbs, W.K. Simmons.

the study, such as beer and spirits, cigarettes, sweets, etc. Of these only beer will be included in the research -- lack of courage forbids the inclusion of changaa and other such interesting products.

The Production of these Foodstuffs:

1 Flour: The major flours produced in Kenya are maize-flour and wheat flour. The production of these flours must be broken down into that which is produced in medium and large scale plants (upwards of 10 employees) and that which is produced in the home or in small scale plants. The now dated 1968 report on Who Controls Industry in Kenya, quoted a figure of 79 registered millers of maize. However the industry was (and is) a highly concentrated one and almost all of the major milling firms were controlled by the same holding company. The report estimated that this complex controlled the production of over half of the maize milled in Kenya and over 90% of the wheat milling. This figure on maize milling was presumably based on the fact that two of the enterprises together purchased over half of the Maize Board's crop. But their estimate of the control over the production of maize flour in the country as a whole is almost certainly an overestimate as it ignores that milling which occurs in the home and much of that which is done by small maize trinders. Nevertheless it is true that the same combine does control the overwhelming share of production of branded maize flour.

An incomplete attempt has been made to trace the changing picture since 1967, but the absence of certain vital information, and the confusion of that which does exist, in the Registrar General's office makes it a difficult task. This however an immediate priority of the research.

While some of the more recent information is difficult to ascertain the past is more open to investigation. Prior to independence the major share of the milling capacity was controlled by white settlers grouped into the Kenya Farmer's Association. Unga Limited (one of two major companies which is closely linked to the 2nd major firm) was for many years owned by the Kenya Farmers Association, and this remained the case after it became a public company in 1956. As recently as 1958, the Articles of Association of the company included the following clause ... "No transfer (of shares) shall be made to any person who is not of pure European descent or to any Company or Corporation any shareholder or member whereof is not of similar descent". More significantly, perhaps, the two most important directors since the second World War were both

directors of the KFA for many years and remained on the board until their deaths, respectively, in 1968 and 1974.

While the picture has undoubtedly changed since then (for one thing, they are African and Asian shareholders now), we would guess that control is still held by this body. More recently the 1972 Index of Manufacturers and Products lists only 14 maize millers. It is proposed that as many of these firms as possible will be visited as well as some of the smaller producers/^{who}were not caught up in this survey.

Unlike maize flour, wheat flour is more an intermediate product than a final consumption product. This probably explains why the industry is even more concentrated than the maize milling industry, particularly when account is taken of the fact that the largest bread manufacturer in the country is owned by the same milling combine mentioned earlier. The Index of Manufacturers refers to only 8 wheat milling plants, some of which are part of the maize milling plants mentioned above. These, too, will be visited in the course of the research.

Bread: Basically there are two types of bread -- the "tin-bread" of England and America and the "non-tin bread" of Europe and Latin America. The difference between these two types of bread lies not only in the fact that the English bread is produced in lidded-tins (thereby making it easier to handle and facilitating mass-production), but also in the type of flour which is used. The European bread is tastier, but has a shorter shelf life. Kenya bread, or rather that produced in the major plants in the urban areas is entirely of the British type. However, at the same time there do exist bakeries in Kenya which produce bread on a smaller scale, most of which approximates in production techniques to the smaller scale European plants.

The coexistence between these two types of bread manufacturers is an uneasy one. On the one hand there are small scale bakeries, catering for the more discerning urban elite (like us), which sell a differentiated product. And on the other, there are small scale producers (predominantly outside the major industrial areas of Kenya) which produce, either in direct competition with the larger bread producers, or in splendid isolation because they are protected by poor transport facilities. Where these small producers are in any sort of competitive situation, it appears to be a difficult battle to compete with the heavily differentiated bread (wrapped, sliced and advertised) produced by the major bakeries.

Somerset and Marris in their study of African businessmen conducted in the late 1960's, covered most of the recipients of ICDC support in industrial (i.e. non commercial) activities. Of the 47 recipients, six were bakeries. Since one of the major interests of this research is to examine the nature of the relationship between small and large scale enterprises which are in competition with each other, it is worth quoting directly from this study on the relationship between small and large scale bakeries.

The new difficulties which arise, once a business begins to look for a wider market than the local community, stand out with formidable clarity from the experience of African bakers. Suppose a hotel keeper has made a small income from selling bread and cakes in his home market. Seeing that bread is growing more popular, he applies to the ICDC for a loan to install a modern oven and a dough mixer to supply the shops and hotels round about. But as he opens up this new market, he also alerts competition. European or Asian bakers begin to extend their range into the neighbourhood, truck their bread even fifty or a hundred miles along the highways. These rivals have more sophisticated equipment and a much greater volume of production. Their bread is sliced, wrapped, more expertly baked - and cheaper. They can well afford to sell at below cost for a while to overwhelm competition. . . ALL BUT ONE OF THE BAKERS WE MET HAD EITHER FAILED OR WERE STILL STRUGGLING TO SURVIVE AND THEY COMPLAINED BITTERLY ABOUT THE COMPETITION. (Our emphasis)

Bread, therefore, seems an interesting product for investigation and analysis, particularly as the largest bakery, Elliots, is controlled by the same combine which dominates the flour industry. Small scale bakers do manage to coexist with large ones in Europe and West Africa, so it does appear as if bread is one product which allows for both small scale and large scale production. At the same time, it is an industry where a wide range of production techniques do exist and it will be of interest to see what will be the interrelationship between these types of firms.

Sugar: Sugar is an interesting product to study, not only because there is evidence from India that a range of efficient techniques does exist (one of the 'intermediate' Indian techniques is to be installed in Kenya soon), but also because there are a variety of differentiated products which can be extracted from the cane. The major interest of sugar in this study lies in this link between products and technology.

While granulated sugar is available in a variety of forms, reflecting colour and texture as well as taste, the most interesting difference is found between granulated sugar and jaggery. Jaggery is a solid, sticky substance also derived from cane. Its major use in Kenya is for making liquor and it is seldom used as a sweetener. While the cost per thousand mg of calories and Iron in Kenya is lower than that of sugar, this occurs in spite of a lower cane conversion ratio.¹

The interest of this contrast in products is not so much that jaggery may be substituted for sugar as a sweetener as imported taste preferences are too strong for that, and in addition it is the taste for sugar and not jaggery which is being strengthened. But if it does turn out that it would be socially optimal to substitute it for sugar (as occurs in India), it would be an interesting case evidencing the costs of imported, inappropriate taste preferences. If on the other hand, it turns out that social optimality lies in the consumption of granulated sugar, this may well be because of the higher cane extraction rate of sugar. This lower cane extraction rate might not be inherent in the production of jaggery, but largely because all the forces of technical change have been concentrated over the years on sugar production. Since one of the interests of this research is to look at the nature and orientation of technical change, the product difference remains of great importance.

Beer, Muratina and Buzaa: The choice in this product partly arises from the observation that one of the more "disturbing" trends in Africa is the increasing consumption of bottled Western beer, low in nutritional content and high in alcoholic content.² Evidence from other parts of the continent (notably South Africa) suggests that one of the main reasons for the spread of bottled, Western beer has been the positive discrimination in its favour by the state in the interests of the beer industry. It would be of considerable interest to establish whether the same pattern exists in Kenya.

Beer is thus another case where we expect that the differentiation between products produced by widely different techniques of production will lead to the displacement of the product which is not being 'forced' upon the not-so-sovereign consumer. The contrast in production techniques is also unusually extreme, with bottled beer being made in relatively capital

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1. See M. Harper (7).
 2. See R. Dumont (6).

intensive plants in the city and traditional beer being made with the use of little fixed capital, other than an empty calabash. The product may be more appropriate, it may have a lower resource cost (per unit of What?), its production is more likely to spread income to poorer parts of the community it may create more employment and will certainly have a lower import content. Nutritional content of the alternative products is likely to be less decisive than Dumont suggests, but this will only emerge from further analysis. Finally, as we have seen, the beer industry is one of the industries in our sample where foreign investment does exist.

Rice: Kenya is not yet self sufficient in rice production, and although it is a widely eaten staple foodstuff, it is a relatively new, imported crop. For this reason we do not anticipate that there will exist a wide range of rice-milling techniques outside of the large Mwea irrigation scheme. It is best to remain agnostic until research has revealed a more complete picture, but note that the absence of alternative techniques may in itself be of interest. The 1972 Index of Manufacturers list a total of six mills.

Salt: Not much is known of the salt industry at present, except that the major producer is a wholly owned foreign subsidiary. The Index of Manufacturers and products lists only two other producers, but it is believed that since this survey was undertaken, there have been attempts by African producers to enter the industry.

Fats, Ghee and Oils: These products are widely eaten through Kenya, although there is no history of their consumption in a similar processed form. It is believed that the traditional forms of fat (sour milk, and natural, unprocessed fats from animals,) have been supplanted by the more processed industrial products in most of the country's cash economy. Where this has not happened, the product is consumed in a relatively unprocessed form. The main interest in this product lies in the alternative techniques of production which exist in the industrial areas of the major towns. Like the production of flour, it is a relatively low technology industry which has been long established and the equipment for producing it is widely available on the world market. It is likely, therefore, that a range of vintages and types does exist in Kenya and it may be that some of these techniques are imported from other underdeveloped economies. It is one of the few basic foodstuffs in the foreign investment occurs, notably by Unilever and Olijanto.

Other Foodstuffs: Should time permit, research will also be conducted into the industries producing canned and bottled foodstuffs. These foods are predominantly produced for elite-consumption, or for export, and are consequently of less interest. The major advantages of studying these industries are the existence of export-oriented foreign investment and the interaction between export-quality requirements and production techniques. An earlier study of the canning industry in Kenya illustrated this point well.¹ Cans were being produced in a relatively labour intensive way and were being supplied to Del Monte to be used for canning pineapples for export. Complaints from Europe that the cans had a tendency to leak led to Del Monte's insistence that the can manufacturers use a more mechanised technique, producing a product which was comparable to that produced in Europe, even though there was some evidence that the more labour intensive techniques could make acceptable cans. It would be interesting to see to what extent the product specifications for export production had similar effects on the technique of production which is used.

Methodology: At the outset of this working paper, four areas of interest were identified. The method of analysis of each of these areas will be briefly outlined.

(a) The Economic Consequences of Mechanisation: Having established the range of techniques available for the production of particular processed foods, analysis will be directed towards examining the impact of mechanisation on a number of important economic variables. These are the utilisation of foreign exchange, the creation of employment opportunities, the generation of savings which can be utilised for productive investment and the contribution to regional equality.

The first step in this analysis is to establish whether there exists a range of efficient techniques, or whether some of the techniques available are clearly inefficient. Having done this it is then necessary to identify the most optimal of the efficient techniques. The major costs in this estimation of optimality are generally considered to be unit capital, unit labour and unit power costs. However to this list will be added unit working capital costs and unit transport costs. These two added items are of particular importance. In the case of the former, it has already been shown that labour intensive techniques may have relatively large working capital requirements,² and the reasons why transport costs may be particularly

1. See Cooper, C, Kaplinsky, R, Bell, R, Satyarakwit, W.

2. See A.K. Sen (20)

important in this study have already been discussed. It is also hoped that the predominantly empirical bias of this research will enable a clearer insight into differential factor costs to different producers.

The final stage of this analyses will be to shadow price the key variables of foreign exchange, regional income weightings, employment and generated investable surplus.¹ Here use will be made of sensitivity analysis in an attempt to establish the boundary lines of choice i.e. at what combinations of shadow prices there may be a switch in optimality from one technique to another. Consideration will also be given to the impact of capacity utilisation in this sensitivity analysis.

(b) The Nutritional Consequences of Mechanisation: There is evidence both from Kenya and other parts of the world² that the degree of processing (which is usually directly related to mechanisation) will effect the nutritional properties of a foodstuff. Arrangements have been made with Dr. Blanckhardt / ^{to analyse} samples of particular foodstuffs to establish their chemical composition thus providing further evidence concerning this problem.

For each technique which is studied, a sample of the output will be collected and passed on to Dr. Blankhardt for analysis. In this way it will be possible to establish in a more systematic way than has generally been the case, whether or not there is any direct link between the degree of mechanisation and the nutritional properties of a selected group of processed foodstuffs. It may also be possible to establish whether there exists any common pattern in the nutritional deficiencies of processed foodstuffs and and what policy measures should be introduced (if any) such as enforced enrichment in the more mechanised plants.

(c) Mechanisation and the Orientation of Technical Change: It has been argued in an earlier part of this paper that it is probable that a range of efficient techniques does exist in the food processing industry. One of the problems in this study, however, is the difficulty in obtaining a dynamic perspective of the industry and this is particularly true when we consider technical change. The difficulty is that while we may have a reasonably accurate picture of what exists at the present time, our view of the past is largely confined to the spectrum of dated vintages which are currently in use. But even this partial picture of the past is considerably clearer than our perspectives on the future, largely because

1. Here use will be made of the Unido Guidelines(22) in the derivation of Pinv.

2. See footnote 1.

the capital goods industries which serve the food processing industry (particularly the more capital intensive units of the industry) are situated outside Kenya. The domestic capital goods industry is probably more closely linked to the labour-intensive, rather than the capital intensive techniques. This is partly because the developed country capital goods industries are generally concerned with the more capital-intensive techniques, and the competition from international machinery producers is consequently less intense for these small-scale techniques. For example small roller and hammer mills for the flour industry are produced locally, while larger mills are generally imported. The method for exploring these links between the food processing and capital goods industries will be through interviews conducted with producers. When each plant is visited to obtain information on efficiency and optimality, producers will be questioned with regard to their access to new techniques of production, their attempts to increase the productivity of their existing equipment and whether this has led to links with local and foreign equipment suppliers. It will be of interest to establish whether technical progress has also emerged through 'troubleshooting' activities and repair and maintenance. Although these latter activities have not traditionally been considered as 'carriers' of technical change, this may well be the case in both underdeveloped and developed economies alike.

Visits will also be paid to the local equipment producers. It is likely that this will prove to be a particularly fertile area of investigation, and that it will yield empirical evidence on the backward linkages arising from investment in the food processing sector. The role of the Rural Industrial Development Centres will be considered in the light of their contribution to increasing the productivity of rurally based techniques. It will also be interesting to see whether these Rural Centres, which are supposed to be servicing both agriculture and rural industries, have an effect in linking and harmonising production in these two sectors.

One final aspect to be considered concerns the type of skills which are generated by backward linkages. The different types of skills generated in the so-called 'formal' and 'informal' sectors have already been considered in a different context concerning the production of final consumption goods.¹ But these differences in apprentice-systems are likely also to occur in the capital goods sector, where production for capital-intensive, 'modern' techniques and for labour-intensive, intermediate techniques may result from capital goods firms utilising different techniques, skills and training systems.

1. See King (12, 13, 14, 15).

(d) Mechanisation and the Growth of an African Industrial Class: It has already been observed that emergent African businessmen are concentrated in the commercial sector.¹ For reasons discussed earlier it is likely that some African businessmen in the productive sector will exist in the food processing industry. This research will also be concerned to establish the extent of African participation in this sector, as well as to identify some of the major constraints on their expansion.

The entrepreneurial history of the larger firms can be obtained from company records. This will be supplemented by information obtained in the course of visits to the plants. In the case of small scale production there is likely to be an absence of recorded data and more reliance will have to be placed on data obtained during visits to the plants. An attempt will also be made to follow-up some of the earlier studies made on these businesses, such as the Somerset and Marris study cited earlier. These studies provide an important source of research material because the follow up will lead to some insights into changes over time in the industry.

Conclusions: It is intended that a lot of ground will be covered in this project and it will be indeed fortunate if it can be covered in sufficient detail. Obviously it will be impossible to survey the full range of techniques for all the products, but it should be possible to identify and analyse the major techniques for each product. The main anticipated difficulty lies in obtaining cooperation from the large scale producers particularly the flour milling industry. This is a highly concentrated industry and is still apparently predominantly controlled by the KFA interests which dominated it prior to Independence. It will be fortunate if their cooperation can be obtained.

No attempt will be made to provide a complete list of hypotheses as it is still too early in the research. This is not to argue that no plausible hypotheses exist, as without them it would not have been possible to frame this outline. A number of general hypotheses are therefore provided:-

(1) Although a range of efficient techniques may be in existence, the orientation of technical change will act to supplant those small scale, rurally based techniques by more mechanised, large scale urban based techniques.

1. See R. Marris and A. Somerset (17).

(2) Different techniques will produce differentiated products and the nature of consumption tastes and the factors which influence these taste patterns, will act in favour of the more mechanised techniques. Where less mechanised producers produce a lower cost, and possibly more nutritious product, the power of the larger firms to influence taste patterns will counteract these advantages.

(3) The shelf life of the output produced by the more mechanised techniques will be longer than that of the less mechanised techniques, and this will be one factor influencing consumer, retailer and wholesaler preferences.

(4) Nutritional content of the output produced by the more mechanised techniques will be inferior to that emanating from the more labour intensive techniques.

(5) The domestic capital goods sector will be largely concerned with the more labour intensive techniques, and will not be a major initiator of technical progress.

(6) Emergent African businessmen are largely producing with small scale techniques. Because these techniques are being displaced there will also be a tendency for these businessmen to be displaced from the industry, or be incorporated into the larger scale firms.

(7) Different producers will be faced with different factor prices and differential access to these factors. The consequence will be to reinforce the capital intensity of the more mechanised plants (due to their easier access to lower cost capital), and the labour intensity of the less mechanized plants (due to their access to cheaper labour).

(8) Transport costs will be an effective barrier (although of diminishing importance) protecting small scale rural producers, particularly in areas not easily accessible from the major towns.

(9) Because it is a low technology sector, the major contributions of foreign partners and investors, will be to provide export markets and to supply brand names which will assist the firms in the process of product differentiation.

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