

This work is licensed under a  
Creative Commons Attribution-NonCommercial-  
NoDerivs 3.0 Licence.

To view a copy of the licence please see:  
<http://creativecommons.org/licenses/by-nc-nd/3.0/>

(832)  
RESERVE

MACHINERY MANUFACTURE IN THE  
FORMAL SECTOR OF KENYA<sup>(1)</sup>

By

INSTITUTE OF  
24 SEP 1986  
DEVELOPMENT STUDIES  
LIBRARY

R.G. Matthews  
WORKING PAPER NO. 425

5//

INSTITUTE FOR DEVELOPMENT STUDIES  
UNIVERSITY OF NAIROBI  
P.O. BOX 30197  
NAIROBI, KENYA

April, 1985

Views expressed in this paper are those of the author. They should not be interpreted as reflecting the views of the Institute for Development Studies or of the University of Nairobi.

This paper has protection under the Copyright Act, Cap. 130 of the Laws of Kenya.

MACHINERY MANUFACTURE IN THE  
FORMAL SECTOR OF KENYA

Abstract

For the majority of African countries the problem with the notion of 'appropriate technology' is that in the absence of endogenous technological capacity there is an almost total reliance on the acquisition of capital-goods from external sources, which in terms of configuration and capital-intensity are most likely to be inappropriate to the African industrial scenario. This is only half the story, however. Integral to the successful internalising of machinery manufacturing competence in any country is the ability to evolve the 'know-why' rather than simply the 'know-how' in mechanical engineering art. Kenya, perhaps more than most other African states, possesses a modern and expanding technology producing sector that has the potential of furnishing the workforce with an insight into the 'guts' of technological operation, so affording the capability to press ahead with local adaptations and innovations. Unfortunately, though, such a stage stands in abeyance as the majority of machine building activities are associated with the assembly rather than the manufacture of capital-goods. Although small, the 'mechanical' machinery industry provides the one exception to this situation. A seedbed for indigenous technological capability may well thus exist, having been nurtured and moulded to serve the agricultural and light industrial needs of the Kenyan economy.

MACHINERY MANUFACTURE IN THE  
FORMAL SECTOR OF KENYA<sup>(1)</sup>

Introduction

The search for ways and means of 'evolving' technology so that it relates more closely to the requirements of the developing countries is a primary issue in the policy-making fora of international development agencies. Actuating this search has been the recognition that straight-forward emulation of western production techniques and practices has not led to the high rate of growth in employment and output that was at first thought possible. A major plank to the argument that the transference of advanced foreign technology is beneficial to the developing countries was based on the premise that latecomers to the industrialisation process were at an advantage because they could exploit the technical progress that had already been accumulated elsewhere. There is a crucial weakness to such reasoning, however, in that successful industrialisation is not achieved simply through the transfer of advanced machinery; the acquisition of the ability to originate and sustain appropriate technological progress is also required.

There are three main reasons why the developing countries should attach a high priority to the possession of indigenous machine-making capacity:

Firstly, the machine building industry may be looked upon as constituting a reservoir of skills and technical knowledge employed throughout the the entire machine-using sector of the economy. The machine tool industry is perhaps the most important component in this process: described by Rosenberg (1976) as a 'transmission centre' in the diffusion of new technology as it deals with processes and problems common to an increasing number of other machine building industries. However, even in an economy where no local machine tool capacity exists, the other 'second-generation' machine builders still have an important role to play in the transference of new ideas, designs and enhanced productivity to their diverse machine-using customers.

Secondly, developing countries possessing a local capital goods industry are in a position to control the product-mix to suit domestic factor requirements. As most third world states suffer from chronic



unemployment it follows that the encouragement of indigenous machinery production provides a country with the capability to manufacture appropriate, labour-intensive technology. This is particularly important when it is considered that the majority of world machinery exports today consist of highly capital-intensive technology.

Finally, it is important to realise that a capital-saving mode of development, arguably the most appropriate for the developing countries, should have regard to more than just producing labour-intensive technology; capital will also be economised if this technology is manufactured efficiently. This notion of producing capital-goods efficiently is of critical importance. Its significance can be explained, thus: in the initial stages of industrialisation the demand for machinery will be positively correlated to both the level of mechanisation and also to the rate of growth of the economy; and as these variables are, in turn, affected by the attractiveness of investment, the promotion of efficiency in the 'core' machine building sector will be of paramount concern. Improvements in the operating efficiency of machinery manufacture should, through an 'economic cascading' effect, raise the marginal efficiency of capital in the other machine-using sectors of the economy.<sup>(2)</sup> This process will have favourable repercussions on investment opportunity and hence also on the pace of industrialisation.<sup>(3)</sup>

Even though the beneficial impact of indigenous technological capacity in the process of industrialisation has been recognised in the economic literature the subject on a country basis has received only limited detailed investigation. The paucity of such empiricism applies generally to countries of all developing regions, but in particular to the African states south of the Sahara. This paper is a modest attempt at redressing the situation by providing an appraisal of the development experience of Kenya's embryonic capital-goods sector.

#### Focus of the Study

Rarely heard of, but even less seen, the Kenyan machinery producing sector continues on its crypto-industrialising course; and even though not impervious to the enumerable constraints which dog

the local market the industry survives and indeed, in pockets, prospers. The success stories are few, however. It would indeed be surprising if this were otherwise considering the nature of the economy in which the sector operates. Industrialisation is constrained not only by the obvious limits of the domestic Kenyan market but also by the preference given by the authorities to the development of the traditional exports sector. The emphasis given to these exports has had the effect of turning the screw even tighter on machine-making activities since the intensity of the industrialisation drive has become progressively reliant on the foreign exchange earning capacity of cash crops.<sup>(4)</sup> This increasing dependence is ironic in view of the fact that the stimulus for this kind of industrialisation is often precisely to diversify the economy away from reliance on traditional primary exports. (Hopcraft, 1972, p.1).

Although the local market for Kenya's industrialists is not a kind one, the fact remains that Kenyan industry is often lauded as being one of the most sturdy in Africa. Even during the difficult period subsequent to the closing of the border with Tanzania, 1977-82, the manufacturing sector still managed to sustain a healthy 6.6 per cent rate of output growth, increasing its share of gross domestic product from 12.1 to 13.3 per cent. (World Bank, 1984) This performance is clearly remarkable given that Kenya belongs to a Continent where almost every sub-Saharan state suffers, to a greater or lesser extent, from industrial stagnation, declining commodity export revenue, substantial foreign debt repayment, wayward population growth, food insufficiency leading to malnutrition and starvation, and in some cases, imminent national bankruptcy. The examination of Kenya's machine-building sector is conducted against such a back-drop and critical appraisal, as a consequence, needs to be tempered by the minimal comparative performance of fellow African countries.

Albeit that Kenya, in its efforts to industrialise, cannot be expected to emulate the strategies of the Soviet Union, India, China and more recently Korea and Taiwan, it has nevertheless paid scant attention to one of the primary goals common to the development strategy of these states, that of technological self-sufficiency.<sup>(5)</sup> In this respect little has changed since independence. Manufacturing activity has continued to evolve along a Western technological frontier sponsored

by the transnationals which dominate the broad spectrum of operations in this sector, importing the majority of their process technology.<sup>(6)</sup> Unlike the successful industrialising countries elsewhere, Kenya has failed to promote the technology producing industries as even a partial catalyst in the pursuit of local machinery innovation. The 'mechanical' machinery producing branch, however, represents the one exception to this generalised picture. Within this industry's particular sphere of activity an industrial structure has been created which is conducive to the generation of indigenous technological progress. The objective here, then, is to examine and describe the economic status of this small but strategically important industry, providing perhaps the first insight to its contribution in the technological development of Kenya.

The focus of this paper is wide-ranging. It begins by defining what is meant by the term capital-goods in the context of the present study. The origins of the sector are then described which act as a historical introduction for an examination of the present productive structure of capital-goods production in Kenya. Attention is here directed to the nature of the demand for machinery; the development of the supplier industries; and the implications of high underutilisation of capacity. Analysis of the country's progress towards reducing its import dependence on technology and its efforts to promote machinery exports bring the study to a close.

#### Scope

The definition of capital goods and, therefrom, a capital-goods industry represents an unresolved controversy amongst economists. The diversity and heterogeneity of this form of commodity is simply enormous. An indication of this can be found in an estimate that put the number of different goods that could be classified as 'Capital goods' at close to 4 million. These goods differ from each other with regard to their process of production; the structure of production and degree of finish when moving downstream in the production process; their degree of complexity; the functions they perform (e.g. supplying energy, transmitting control and regulation, and structure); their use (the whole spectrum from multipurpose universal machines to machines performing very specific and specialised tasks); and their end-use destination (all sectors of the economy from agriculture to service are serviced by capital-goods of varying types in one way or



another). (UNIDO, 1983, p.1). A suitable classification of capital-goods producing activity is thus important for operational reasons as the construction of sectoral policy necessarily hinges on workable definitions.

The contentiousness of the topic has led to there being almost as many definitions as there are treatises on the subject. The broadest interpretation of capital-goods belongs to Joan Robinson (1953-4) who ascribes to the belief that all goods in existence count as capital-goods. It is an intellectually stimulating proposition, though clearly one without pragmatic application. A conceptually more satisfying approach is that which views capital-goods as being commodities that are not demanded in their own right but as inputs, combined with others, for the purposes of rendering further production. The Marxian dichotomy of economic activity is an elaboration of this classification, and represents the most generally accepted framework for analysis of the capital-goods sector. Marxian theorising is well-known, but briefly the total production of society is split into two components: Department I, the means of production, having commodities in a form in which they must, or at least may, pass into productive consumption, and Department II, the articles of consumption, relating to commodities having a form in which they pass into the individual consumption of the capitalist and the working class. Even Marx's classificatory system, though moving nearer to a water-tight definition of capital goods, exhibits two major deficiencies. Firstly, from a theoretical perspective, both the consumption goods of, for instance, food and clothing which service the needs of human capital can by maintaining physical capability be viewed as providing for the potential of further production.<sup>(7)</sup> Secondly, there are practical inconsistencies. Convention has dictated that the products of the chemical industry are apportioned to the capital-goods sector, and Marx himself lumped raw materials into Department I activities. Notwithstanding that definitional rigour associated with Marx's analysis can be criticised, the approach has nevertheless been operationally recognised through its incorporation into country models of planned economic development.

The Soviet and Indian two-sector growth models are the most notable examples of development strategy based on the Marxian separation of economic activity.<sup>(8)</sup> The promotion of capital-biased growth



in these two countries was aimed primarily at the expansion of producer-goods' manufacturing capacity on the assumption that the existing low level of capital accumulation was the critical restraining factor in their push for rapid industrialisation. Emphasis within both the Soviet and Indian paradigms was thus given to the encouragement of growth of the heavy engineering sector. This direction in their development efforts was due to the explicit recognition that machine-making is an essential element in the building-up of overall capital-goods capacity; the first rung on the ladder of non-dependent technological development.

The significant role that machinery manufacture plays in the process of economic development has been reinforced by contemporary empiricism which has tended to concentrate research on this activity to the exclusion of other types of capital-goods production. Authors over quite recent times, possibly as a response to the definitional opacity of capital-goods, have developed the facility of classifying them in relation to the specific focus of their studies. Cheng (1972, p. 19), for instance, in his Communist China study on what he termed the machine building industry employed a definition of 'capital-goods' which emulated that used by Rothstein (cited in Gerschenkron, 1951, pp 332-33) in his work on the Soviet machinery sector. Aside from obviously including mechanical equipment within their ambit, both authors interpreted telecommunications, transport and electrical machinery as being composite to the analysis of machinery production. By contrast, Leff (1968, p.4), in his study of the Brazilian capital-goods sector utilised the definition used by the country's industrial census classification which encompasses sections of the metallurgical, mechanical, electrical material and transportation equipment industries. Passenger automobiles were, however, excluded from his analysis. Each of the above studies limited its attention to activities associated with machinery manufacture, with Cheng in particular stressing its strategic significance in the process of capital formation. More recently, Pack (1980, p.1), in a World Bank study, narrowed the perspective even further by defining capital-goods as including industrial and agricultural machinery but excluding vehicles and electrical equipment.

In the context of country analyses, two factors can be pinpointed as being of considerable importance in the contribution the sector makes to industrialisation. There is, firstly, the part that

technology performs within the general framework of development policy. For the larger Asian and Latin American nations and also the smaller South East Asian states the characterisation of capital-goods production connotes a degree of technological complexity, diversity and differentiation that, although below Western and Japanese levels, is veritably light-years ahead of African state-of-art capability. Current status and expectations concerning technology application are naturally less sophisticated amongst the African countries where formal capital-goods capacity has reached only a relatively primitive stage.<sup>(9)</sup>

Not alone amongst African states, Kenya has pursued a growth strategy that has not directly encouraged the creation of indigenous capital-goods manufacturing capacity.<sup>(10)</sup> It is in the nature of economic development that where preference is given to the production and export of agricultural surpluses in commodities, such as tea and coffee, then little industrial incentive will exist for the emergence of a heavy engineering sector. There is no gain saying the obvious that the development of a producer goods sector will be influenced in the early period by the complementary mechanisation of the economy in which it resides. A minimum level of demand for production equipment will be a vitally important variable in the growth equation. This simple but fundamental axiom applies a fortiori to capital-goods manufacture than to industrial development via the more traditional path of promoting consumption goods production.

The second important aspect of a machinery sector, in its impact on industrial growth, has to do with the stage of development it has reached. It may be held, from a rough approximation of historical industrial development, that developing economies must pass through four stages before technological maturation is attained.<sup>(11)</sup> On the basis of complete and endogenously developed technological capability Kenya is at the first of these: the mechanical era. But through the consolidation and appropriate advancement of this mechanical engineering base the later electrical, chemical and electronic phases of the technological cycle may be incorporated into the Kenyan 'model'. A seedbed for indigenous technological capability may well exist, then, having been nurtured and moulded to serve the agricultural and light industrial needs of the Kenyan economy.

Within mechanical engineering industry the following sub-areas of activity are, it has previously been observed, generally regarded as being the most important for rendering the means for further production: transportation, electrical and non-electrical machinery. In deciding which of these activities is of significance or indeed relevance from a Kenyan standpoint, it can be stated immediately that the domestic manufacture of all modes of transport equipment is minimal. The relatively high value of output in this sector, over K.sh.86 million for all establishments in 1982, derives from the assembly of motor vehicles.<sup>(12)</sup> The electrical machinery sector, on the other hand, is involved to quite a considerable degree in the bona fide manufacture of electrical artefacts. The problem here, however, is that the great majority of output is more clearly identifiable as being consumption-oriented rather than that of a capital nature.<sup>(13)</sup> The activities of this sector are characterised by the assembly of television sets, gramophone records, sound recorders, electric irons, refrigerators, switches, batteries and the assembly of telephones and radios. The remaining sector, non-electrical machinery, represents a good example of an agriculturally differentiated producer goods industry in a technologically immature, first-stage mechanical economy. The non-electrical machinery sector of Kenya, within the three digit economic classification, 382, covers the multifarious activities associated with the manufacture of mechanical machinery. It is this sector more than any other that represents endogenous capital-goods production. This study therefore follows the classification of capital-goods proposed by Pack. Thus, the parameters of the Kenyan capital-goods sector are delineated to include industrial and agricultural machinery but excluding vehicles and electrical equipment.

#### Historical Development

Kenya's machinery manufacturers have been around for longer than is generally realised. A notable proportion of producers pre-date independence in 1963 and indeed the roots of a sizeable and tenacious minority can even be traced back to the late 1940s. It was the Asian entrepreneurs who comprised this hardy core and provided the origins to machinery production in Kenya. Several of these pioneers had served their engineering apprenticeship in the railway workshops before identifying opportunities to set themselves up in business.<sup>(14)</sup> The Asian flair for mechanical undertaking induced the others to establish basic workshops for vehicle repair to serve the rapidly growing post-war market for imported



transport equipment. In the rural towns such as Kisumu and Eldoret this form of specialisation began to dilute over time to encompass other more agriculturally related mechanical activities. This included repair and maintenance of tractors and farm equipment. There finally came the evolvement to fabrication of agricultural machinery for the specific needs and requirements of the farming region in which the manufacturer was situated.<sup>(15)</sup> Thus, Kisumu houses machinery builders specialising in sugar-cane crushing machinery whilst in the Rift Valley ploughs and harrows are produced as an initial response to the needs of a more large scale diversified arable farming community. Nairobi, is the home for many of the tea and coffee machinery manufacturers.

Kenya's independence seemed to represent the locus around which many of the larger machinery organisations, especially those from Britain, decided to establish manufacturing facilities in Kenya. Loss of a hitherto captive market for British companies was the obvious galvanising force for their interest in creating local productive capacity. For the majority of these companies the commencement of a productive capability in Kenya was the first step in the penetration of the wider East African market and thence to the largely untapped agricultural equipment market in the remainder of Africa. The multinational companies' progress to this objective has, however, been spasmodic. The collapse of the East African community, the persistent severe droughts and the lack of political stability and economic development in numerous African countries all strove to dampen such activities. But despite the lack of major growth opportunities thus far open to these larger companies few have 'pulled up sticks' and departed. It can only be surmised that the old dog-in-the-manger oligopolistic tendencies of cornering whatever market there is continues to dictate an essentially defensive commercial strategy.

Although the large companies dominate the production of machinery, at least in terms of value, all firms have contributed to the rich diversity that has evolved in the composition of machine building output. There is, in point of fact, a highly refined degree of specialisation within the industry's structure of production. The following list is not exhaustive but conveys in a quite revealing way the enormous range of skills and technical expertise present. Productive activities embrace such disparate and unrelated final products as



cotton-ginnery machinery; agricultural sprayers; concrete block-making machinery; air-conditioning and ventilating equipment; press-stamping soap machinery; saw mill machinery; compressed tanks and air equipment; wood-working machinery; soil-testing machines; textile machinery; sugar-cane crushing machinery; folding machines; hoists; germ-separators; planer machines; posho (maize) mills; coffee and tea machinery; tea drying equipment; sial machinery; and not least, a broad range of ploughs, hoes and harrows. Apart from this impressive array of specialised competence the majority of manufacturers offer associated services in respect to uncomplicated fabrication and welding operations. These jobs would typically relate to customised production, against order, for such items as boilers, storage tanks and agricultural trailers.

In similarity to the historical processes that occurred in the development of the now industrialised countries, Kenya's machinery manufacturers have emerged as a response to the perception of viable commercial propositions; they have mostly entered into the production of equipment to satisfy a demand that existed prior to the provision of its supply.<sup>(16)</sup> The process is likely to have been uncoordinated, fragmentary and of modest beginnings. However, it is generally acknowledged that during the course of the early phase in the development of machinery <sup>production</sup> the meagre proportion of national resources employed as inputs to the industry and the equally small value of its output to total industrial production belies the sector's strategic quality in the pursuit of non-dependent technological progress.<sup>(17)</sup> The initial epoch of Kenyan machinery production exemplifies this general pattern. Table 1 details the growth characteristics of the machinery producing sector. The industry is small, accounting for less than one per cent of total manufacturing output value.<sup>(18)</sup> Net output, in real terms, has nevertheless grown at a salubrious pace since independence of 7 per cent per annum, even given the lean commercial environment in which the sector operates.<sup>(19)</sup> It can be readily seen, moreover, that whilst physical labour and its associated employment costs experienced conservative rates of growth between 1964 and 1980 the expansion of value-added has been more in consonance with the industry's potential role as a leading sector in the growth of industrial economy.<sup>(20)</sup> The table also indicates an important factor in the development <sup>process</sup> relating to the measure of profit being earned by companies. The index of operating surplus has noticeably the fastest rate of growth amongst all the variables, though the profits earned are not excessive. The proportion of gross surplus to sales produces acceptable and comparable earnings ratios which over the latter portion of the period represent shares approximating to 13 per cent.<sup>(21)</sup> Things started to go awry, however, after 1980. The progressive decline in employment and value-added since then appears to flag a serious deterioration in the market prospects for equipment. Indeed, the current degree of excess capacity amongst machinery manufacturers lends weight to this observation.

Table 1  
Growth Characteristics of the Machinery  
 Producing Sector (1964, 1976-82)

Year	Employment (nos)	Labour Costs (index)	Gross Output (index)	Sales (index)	Value Added (index)	Operating* Surplus (index)						
1964	316	82	161	102	242	25	245	29	159	73	-2	-
1976	386	100	299	100	1831	100	1584	100	413	100	114	100
1977	528	137	360	112	2401	122	2385	140	439	99	79	69
1978	591	153	486	139	3588	168	3241	176	671	139	185	162
1979	586	152	549	148	3669	162	3160	161	1000	195	451	396
1980	825	214	779	188	5240	206	4998	228	1466	256	687	603
1981	736	191	871	190	6401	228	6171	254	1562	247	691	606
1982	539	140	697	140	-	-	-	-	1238	179	-	-

Source: Industrial Production Survey (Ministry of Finance and Economic Planning) 1965 Statistical Abstracts (Ministry of Economic Planning and Development) 1977-82 Industry Summary Files of the Central Bureau of Statistics.

\* Operating surplus is defined as gross profit less labour costs. Kenyan pounds are shown in current values. The index has been constructed as per a deflator for manufacturing detailed by J. Vandemortele (1984).

### The Machinery Demand Function

The biggest single obstacle to the continued growth and development of the industry is undoubtedly the constraint of low demand. This issue lies at the heart of the current problems affecting the machinery manufacturers and represents an economic 'girdle' to the expansion and future prosperity of the industry. In stating this it must again be emphasised that an important asymmetry exists between the minimum market size requirements of the machine builders and those of the consumer-goods industries; for specialisation to be effective in the former, a large market, possibly greater in size than that required to achieve all the economies of scale in the consumer-goods industries, is essential.<sup>22</sup> The crux of this distinction between the demand curves of capital- and consumer-goods firms rests in the unique characteristic of producer-goods output: it has the effect of 'stocking-up' the market, so that the amount of machinery sold now will influence the amount that can be sold later. This feature has been, and continues to be, the cornerstone to machine building enterprise in the Western countries. A paradigm can be formulated which crystallises around the idea that the demand for the products of the machine-building industry is limited by the specialised nature of the constituent firms' product range. Once the saturation of the market has therefore taken place attempts to increase or maintain demand can only be achieved, as the theory goes, by creating a fresh market. This would occur by the development of a new, invariably increased capital-intensive, design offering an improved and hence more efficient mode of operation, so vital in a highly competitive industrial milieu. Under such a scenario, the machine-builders deliberately seek to render obsolete the equipment held by customers; more significant than this however, is that they actively seek the ability to hasten the pace of its obsolescence. To increase demand, then, capital-using innovation must occur.

If such reasoning proximates to reality, and there exists empirical evidence to suggest that it does,<sup>23</sup> then the paucity of options available for the poorer countries to increase demand in the production of unchanged capital-goods will be severely limited in the long-term. Reliance on foreign designed technology, moreover, will do little to ease the problem because the capital-using nature of innovation taking place in the equipment supplying industries of the West is inappropriate to the

conditions operating in such countries as Kenya. In a capital-scarce economy, innovation is much more likely to be calibrated towards reducing the degree of complexity involved in the final product rather than to upgrading models in an attempt to induce manufacturers to replace fully depreciated but still productive capital equipment.

Inadequacies in demand during the formative years of a capital-goods industry will stultify progress towards industrial maturity. Important in this sense will be the synergistic relationship between an increasing level of demand and the degree of efficiency-inducing division of labour achieved. Indigenous equipment capacity is a vital element here because of the implausibility that vertical disintegration in Third World machine building industries will take place merely through transplantation of foreign technology. More likely, an 'evolutionary' process is required whereby existing patterns of production are gradually transformed to incorporate those firms which emerge to specialise in the various vertical sequences of production that are common to metal-using industries. Amongst the most important of the operations conventionally undertaken by these supplier industries relate to the provision of components, steels, castings and forgings. Kenya, however, has made only modest progress in these areas. As a consequence, a mixture of imports and vertical integration continues to characterise the input sourcing structure of machinery manufacture in the country. The achievement of cross-integrated horizontal industrial specialisation thus still remains a distant ideal.

#### Input-Sourcing

##### (1) Components

The productive structure of Kenya's capital-goods sector simply has not advanced to accommodate the refined levels of interdependence exhibited by the industries of the developed countries. The absence of a fully diversified sub-structure of component manufacturers, for instance, means that the majority of the complex items which are classified under this heading are either assembled, from imported kits with the resultant loss of most of the value-added, or imported in their entirety. Typical in this context is the case of electric motors. A subsidiary of an Indian engineering company has been assembling electric motors up to 20 h.p. since 1980. However, the firm does not wish to



become involved in local production unless tariff protection is awarded by the government: the import of the parts for an electric motor attracts the same 25 per cent rate of duty as the import of the complete motor.<sup>24</sup> To the manufacturer, the levying of similar rates of duty on the import of the complete engine as on the parts and components which go into its production provides no incentive for domestic production to take place.<sup>25</sup>

The supply of steel as a substantial input in the fabrication of machinery also continues to originate from abroad. As such, the situation represents a further hiatus in the network of backward linkages which traditionally derive from capital-goods production. There are, in fact, a number of steel rolling mills in operation in Kenya though they apparently suffer from considerable underutilisation of capacity due to the shortage of scrap metal available for melting purposes.<sup>26</sup> At the beginning of the 1980s a project for the construction of a mini-integrated steel mill was proposed with the objective of establishing viable steel production in Kenya. The plans for the mill are seemingly no longer 'live', however, as its construction depended on a set of circumstances which no longer prevail. Most importantly, in this context, the international recession led to a buyers' market for steel and related products. Steel producers the world over are racked by severe excess capacity and are readily prepared to offer heavy discounts to potential purchasers in order to obtain some contribution to fixed costs. But the international recession also hit Kenya's ability to earn foreign exchange through the export of its cash crops. This meant in turn that the funds necessary for the construction of a modern steel mill were not available.<sup>27</sup> A final difficulty had to do with the scarcity of local factor resources. The mill had been planned to employ a charcoal energy process and this would have required the development of a man-made Eucalyptus forest. For that purpose 256,000 hectares of coastal land would have had to have been acquired to facilitate charcoal production. Even if suitable land could have been obtained at a suitable price there was then the still formidable obstacle to be faced that the Eucalyptus forest project would have been based on a 10 year cycle; that is, a decade would have had to have passed before the complete cycle of trees to charcoal could have taken place, and steel production commence. To any government, though especially one at the helm of a capital-scarce economy, this is an inordinately long time to have substantial amounts of capital sunk into a commercial venture before any return could be expected.

Castings and Forgings

The domestic production of components and steel are not the exclusive elements required to encourage the expansion and development of the machinery producing industries. The availability of foundries and forging shops is also a significant variable, playing an essential role in this process. Here again, however, there are problems. At present there are only eight foundries in the whole of Kenya; the largest of which is located in the railway workshops in Nairobi. These foundries together employ around 500 workers and possess a capacity to produce 7000 tons of castings annually. These are either self-contained foundry units to undertake job work for the secondary industries or to produce spares for sugar and textile mills. There is still not a single modern mechanised foundry in the private sector for producing heavy as well as thin and precision castings.<sup>28</sup> This lack of specialist foundries has led, as table 2 shows, to over 50 per cent of the machinery producers integrating basic casting and forging operations into their productive processes. Even in the smallest workshop primitive casting and forging facilities are often to be found. This will be especially true if the machinery manufacturer is located in the rural areas some distance from Nairobi. Aside from the non-proximity of specialist foundries and forging shops to the customer-industries there are other

Table 2 Policy on Sourcing of Castings,  
By Company Size

Source	Company		
	Firm Size	Medium	Large
Bought-Out		8	2
In-House		10	3

Source: Survey of Machinery Manufacturers

reasons which act as justifications for the internalisation of casting and forging activities. Non-dependence on suppliers,<sup>29</sup> cheapness and the ability to monitor quality are all considerations that can be cited in this respect. The latter factor, that of quality, stands out as an imponderable issue. In particular, the castings produced from the machinery firms' rudimentary facilities are far from being precision, quality pieces

of work; the majority of them are rough, pitted with blow-holes and invariably out of alignment.<sup>30</sup> This is not unexpected, however, when often the sand used in the moulds is not the correct material, or is so clogged and lumpy as to seriously impair the possibility of producing quality castings. One manufacturer of coffee machinery has been forced to obtain the castings for his bean crushing discs from a foundry in Britain. Although the company has tried, castings of the required precision and 'trueness' cannot be obtained in Kenya.

#### Capacity Underutilisation

Insufficiency of demand is the primary constraint in evolving a sub-sector of specialist ancillary producers serving the needs of the capital-goods producers; it also represents the primary limiting factor in the movement of a country's capital-goods sector from a rudimentary stage to a specialised and integrated industrial entity.<sup>31</sup> For those developing countries still at the frontiers of industrialisation, possessing only a low level of capital accumulation, the fugacious minimum size of machine building output necessary to capture economies of scale and to lead to the progressive specialisation in mechanical activities is likely to be far from being reached.

It is in this respect that the dictum of Adam Smith that - 'the division of labour is limited by the extent of the market' - has been dolefully relevant to Kenyan and other similarly placed Third World machinery producers. Smith was reasoning on the basis of two interrelated, though nonetheless distinct, economic concepts: the division of labour and the extent of the market. For the purposes of clarifying these two concepts it is helpful to mention the contribution of Allyn Young in an article written in 1928. The thrust of his paper was to place Smith's division of labour concept into a technological context by arguing that it is associated with the use of specialised machinery. Thus,...'with the division of labour a group of complex processes is transformed into a succession of simple processes, some of which at least lend themselves to the use of machinery. On the further issue of what is meant by the 'extent of the market', Young broached the question ...'but just what constitutes a large market? Not an area or population alone but buying power, the capacity to absorb a large annual output of goods.' (Young, 1928, p. 532) clearly, the author's interpretation of the extent of the market was not in terms of physical or geographical size but rather on the degree of

effective demand. Thus, even low income India with an extremely large land mass, population and industrial market possesses a machine building sector with quite profound and well-documented inefficiencies resulting from underutilisation of capacity.<sup>32</sup> For the much smaller and even poorer African economies the problems connected with excess capacity will obviously be that much more attenuated.

The realities of the present situation are that capacity utilisation levels amongst Kenya's machinery manufacturers, as shown in table 3, are cripplingly low: only 17 per cent of the firms are operating above 80 per cent of capacity; well over half are working at below 60 per cent, and a sizeable minority, 25 per cent, operate at less than 40 per cent of capacity.<sup>37</sup> The reasons for this are diverse.

Table 3: Utilization of Capacity in Machinery Firms

Capacity Utilisation (%)	Company Size	
	Medium	Large
	(nos)	
1-19		
20-39	5	1
40-59	11	3
60-79		
80-100	4	

Source: Based on manufacturers' estimates.

Demand deficiencies may relate to either general or particular circumstances. Those factors of a generalised nature first and foremost have regard to both the original trade policies of the government which had a pernicious effect on the efficiency of domestic production and, ironically, also to the more recent trade liberalisation policies which have allowed an influx of cheaper but good quality imports onto the market. The collapse of the East African Community and the closing of the border with Tanzania were also events that did nothing to reduce the tardiness of export opportunity. Lack of suitably skilled labour is yet another problem, as is the relatively high costs associated with its



employment. There were also the manifold reverberations which ensued from the 1982 tremor to governmental stability. It has been suggested that the attempted coup had a debilitating effect on the buoyancy of market perception held by foreign companies operating in Kenya, precipitating a decline in capital investment. The psychological shock to market confidence caused by the coup is also reported to have undermined property prices. As property is the major, perhaps only, asset that can be used by small to medium sized companies as collateral in bank loan applications it is not difficult to see how the ability to raise fixed or working capital could have been impaired through deflated property values. Furthermore, the associated deterioration in the property construction business has had a damaging chain reaction on the cement-block and cement-block making machinery industries. This is, in fact, a good example of how particular segments of the machinery producing industry can be sensitive to generalised market factors. The fall in world commodity prices provides another example.<sup>34</sup> Kenya's sugar growers have been seriously affected by the worsening cash inflow from exports. Such conditions, of course, only serve to diminish the sales prospects of the sugar-cane crushing machinery producers who over recent times have been relegated to repair and maintenance engineers. Moreover, the sub-Saharan drought which has brought enormous human suffering in its wake also has implications for the less headline-catching affairs of the agro-related manufacturers. The loss of farm income as a direct result of the drought affects the replacement of agricultural equipment. A one to two year time lag is usual with such developments before sales begin to decline. Plough, harrow and hoe manufacturers in Nairobi are, however, already badly hit by the effects of the drought, with many companies operating at levels of excess capacity approaching 60 per cent.

These demand constraints clearly militate against the economic development of the machinery sector. The serial production of equipment does not take place anywhere in the country. For the large firms batch production predominates, but the smaller concerns produce only against customer order. Indeed, although the fabrication of machinery was the *raison d'etre* for the establishment of these smaller enterprises their efforts are now directed very much more to the repair and service of equipment previously supplied. The coffee machinery producers, for instance, are kept working by the annual renovation of their machines installed at the coffee processing plants; they are in

particular demand to clean or replace the rotary pulpers subject to the constant wear and tear of crushing coffee beans. Other companies facing problems associated with idle manufacturing capacity have sought to diversify production. One company, for example, has shifted the focus of its productive operations away from the fabrication of general farm machinery to instead the manufacture of 'Singer' sewing machine stands and the re-conditioning of liquid petroleum gas cylinders on a contract basis for locally based foreign companies.<sup>35</sup>

#### Technological Self-Sufficiency

It has previously been pointed out that a major tenet of the industrialisation strategies of the Soviet Union, India and China has been the emphasis given to technological self-sufficiency. As a means for focussing attention on the goal of lowering the threshold of technological dependence of domestic industry the objective serves a useful purpose. But no country is, or indeed ought to be, totally self-sufficient in its technological needs. The very character of contemporary international intra-industrial trade connotes a degree of specialisation that is far more conducive to the achievement of efficiency gains than for individual countries to attempt to produce all machine models and types themselves. The question is, however, what determines the balance between foreign supply and domestic demand?<sup>36</sup> In the final reckoning, this will probably hinge on government policy, either directly through public investment programmes or indirectly via tariff and tax concessions to the private sector.

The conventional conduit for developing countries to secure reductions in technological dependency is through the policy of import substitution. Kenya's efforts have also been in this direction, though Francis Stewart (1976, p. 88) argues the results have been more in tune with import reproduction than simply substitution. In other words, the goods previously imported have not merely been replaced by locally produced items fulfilling more or less the same function but rather have been 'cloned' so that they are the exact replicas of previously imported goods. Such a policy argues that the technology required to produce these replicated foreign goods will need to be identical to the production technology employed abroad. This process has all manner of unsavoury

implications for the Kenyan market. Some of the more commonly cited factors include the serious effects on the balance of trade which suffers because heavy imports of machinery ensue; import-biased technological change occurs and its inappropriateness to the domestic conditions is alleged to be reflected in the low levels of labour productivity and capacity utilisation leading to high unit costs of production; the unequal distribution of income is perpetuated to support the imposed alien tastes designed for rich countries; <sup>and</sup> the formal sector wage structure becomes distorted due to the need to make economic rent payments for the scarce skilled labour able to operate the capital-intensive technology.

The Kenyan economy is exposed to these ills due to the foreign dominance of Kenya's manufacturing sector. This is attested by Leys (1982, P. 179) who estimated that the share of African private capital in manufacturing and repairing in 1976 was of the order of only 5 per cent. The extensive involvement of transnationals in Kenyan industry is a major reason why Kenya exhibits a high dependency on foreign technology. The extent of the country's dependence on imported technology is shown in table 4. The table shows quite clearly the high degree of market penetration of technology imports. It is also evident that during the period 1976-82 both domestic capital formation and imports stagnated. But given that the rate of technological self-sufficiency dipped somewhat in 1982, no trend is discernable. Thus, it would seem that the expansion of local capital-goods production in Kenya is simply not taking place.<sup>37</sup>

Table 4 Imports of Machinery and Equipment as  
per cent of Aggregate Demand (1976 -82)

(Current Prices)

YEAR	Aggregate Demand (K£'000)	Imports (K£'000)	Imports as per cent of Demand (%)	Self-Sufficiency Rate (%)
1976	102,670	72,521	71	29
1977	128,340	90,356	70	30
1978	156,110	108,518	70	30
1979	118,730	86,880	73	27
1980	127,870	97,856	77	23
1981	133,420	89,358	67	33
1982	95,160	71,855	76	24

Source: Statistical Abstract 1983.

When the analysis is made more specific, as in table 5 and the growth of solely mechanical machinery production is pitted against total capital formation for machinery a definitive pattern can then be observed. Even though the contribution of local machinery production in absolute terms is not sizeable its growth is positive and the trend moreover is promising. The analysis shown in the table is interesting because it provokes speculation as to why the machinery industry is increasing its share of a fairly static total demand for equipment. The explanation almost certainly rests on the fact that the agriculturally-oriented machinery market in Kenya is much closer to being a captive one.<sup>(30)</sup> Recalling the structure of the industry's output, described earlier, it is evident that the majority of the equipment manufactured relate to agricultural processing activities that tend to be associated with tropical countries. Thus, if there is growth in this market within the total market for machinery then the probability is that much of the expansion will be accommodated by local production units.

This state of affairs has important implications for the character of the process of production in the branch. Whilst the pervasiveness of advanced foreign technology represents the norm in numerous of the industries involved in manufacturing,



Table 5 Demand For Capital Investment in  
Non-Electrical Machinery (1977-81)  
(K£'000)

	<u>Capital Formation - Machinery</u>			<u>Gross Output</u> <u>of</u> <u>Machinery</u> <u>sector</u>	<u>Share of</u> <u>Machinery</u> <u>sector in</u> <u>Total Demand</u> <u>%</u>
	<u>Private</u>	<u>Public</u>	<u>Total</u>		
1977	98,440	29,900	128,340	2,230	1.7
1978	127,570	28,540	156,110	3,078	2.0
1979	84,330	34,400	118,730	2,960	2.5
1980	97,120	30,750	127,870	3,781	3.0
1981	96,600	36,820	133,420	4,180	3.1

Source: Statistical Abstract 1983.

particularly the food processing sector, it is not evident that it has touched the machine building industry to the same degree. In the cases where it has, then the production technology of the large foreign-owned manufacturers will clearly be similar to the techniques employed by the parent company with the attendant consequences described previously. The number of foreign firms engaged in the local production of 'mechanical' machinery is, however, extremely small.<sup>(39)</sup> For the remainder of the companies belonging to the industry the technological state of play in both product design and process configuration stands in close conformity to local factor conditions; the explanation for the former aspect has to do with the nature of the machinery produced, in that the basic design of the broad spectrum of standard agricultural equipment is not amenable to extensive changes in design, whilst the equipment employed in the production process, generally speaking, conforms to the universal, standard machine tools to be found in most small engineering workshops the world over. It is far from the capital-intensive technology adduced to be inappropriate for the labour-surplus countries of the south.

Even so, the absence of a domestic machine tool manufacturing capacity has meant that Kenya's medium sized machine

builders, in symmetry with their larger foreign-owned counterparts, must look externally for the supply of their fixed capital. Surprisingly, the numerous Asian entrepreneurs that form the backbone of the firms in this size range have not been attracted to the 'appropriate' technology produced by the Indian machine tool industry. Very few of Kenya's machine builders have invested in machine tools from the Sub-Continent, and those that have complain vigorously about the quality of such equipment.

The fact that all machine tools and most other industrial, electrical and transport equipment, including total dependence on foreign supplied tractors,<sup>(40)</sup> have to be imported would appear to indicate the superficiality of import-substitution efforts in this area. The nub of the problem, however, has more to do with the nature of the dependency-reducing policies implemented. A sizeable cross-section of Kenya's machinery-building branch is in fact embroiled in a multitude of quasi-productive activities which are directly responsible for the fragility of the underlying technological base. The structure of production in the electrical machinery industry is a worthy example in this respect. The majority of the components possessing the lion's-share of value-added are imported from parent companies. Local industry tends to be concerned solely with assembly operations for products oriented toward the consumer goods market. The development of the transport machinery industry has followed a similar pattern. No vehicle is currently being produced locally. Production is instead based on domestic assembly of foreign produced knocked-down kits. Thus, although the Kenyan Government is involved in efforts to increase the local content of vehicle production it is nevertheless the case that the machinery components incorporating the greatest share of value-added continue to be manufactured abroad. Limited market demand is the major constraining influence in achieving more integrated auto-mobile manufacturing processes. These problems are not isolated to Kenya, however. India, in the early development of its vehicle production facilities also struggled to improve the level of local content in manufacture; this was the case even though there was both a long history to engineering practices and a population running to hundreds of millions.<sup>(41)</sup>

The empirical evidence justifying the assertion that import-substitution programmes have failed in their objective of lessening Kenya's technological dependence is offered in Table 6. The table represents an economic biography of the development of self-sufficiency in aggregated machinery production. In the initial stages of industrialisation imports of machinery are indispensable. This technology represents the foundation to the gradual replacement of imported engineering items. In the context of Kenya, however, the latter stages of this process have not occurred. During the period 1974-82, when statistical data are readily available, the import-substitution effect in the indigenous machinery industries was found to be non-existent. Import-substitution in this sense refers to the difference between actual imports at the end of the period and what they would have been if the proportion of imports in total machinery consumption had been the same as at the beginning of the period. In other words, if the import ratio in 1974 is applied to the aggregate demand for machinery and equipment for the whole period between 1974 and 1982 and the results compared with the actual imports of machinery and equipment during this period, it is possible to gauge the impact of import-substitution. The change in imports from a base to a current year can be expressed as:

$$\Delta M = M_1 S_1 - M_0 S_0$$

Where M represents the import-proportion of machinery supplies, S denotes total machinery supplies, the subscripts 0 and 1 referring to the base and current periods, respectively. This change can be divided into two elements.

$$\Delta M = S_1 (M_1 - M_0) + M_0 (S_1 - S_0)$$

where the first term represents import-substitution and the second the expansion in imports due to the increase in domestic demand. (42)

The results of the analysis indicate that during the period 1974 - 78 when industrialisation was occurring, *pari passu*, with the growth in gross domestic product the technology demand expansion effect was substantial. Moreover, in conjunction with the increase in general mechanical activity there was an expansion in domestic machinery production. Import-substitution in machinery,

**Table 6**  
**Effect of Import-Substitution and Expansion**  
**in Demand on Imports of Machinery (1974-82)**  
 (K£'000)

YEAR	Machinery Supply	Imports	Import-Substitution Effect $S_1(M_1 - M_0)$	Demand Expansion Effect $M_0(S_1 - S_0)$	Total Change Imports $(M_1(S_1 - M_0)S_0)$
1974	91,299	67,231			
1975	99,400	82,213			
1976	102,670	72,521	-6,439	47,726	41,287
1977	128,340	90,356			
1978	156,110	108,518			
1978	156,110	108,518			
1979	118,730	86,880			
1980	127,870	97,856	5,706	-42,369	-36,563
1981	133,420	89,358			
1982	95,160	71,855			
1974 - 1982			1,781	2,843	4,624

Source: Various Statistical Abstracts



as a result, amounted to over 13 per cent of the increase in demand. This was indeed a creditable performance. The slowing of economic growth due to the effects of the international recession and the closing of the border with Tanzania meant that progress in import-substitution was not, however, maintained. Demand strank, producing instead a contraction effect for the period 1978-82 by almost as much as the previous period's expansion. Although this led to a considerable decline in the imports of machinery compared to the level operating in 1978 none of this fall could be apportioned to the policies of import-substitution. In fact, the converse, the influence of import-substitution weakened indicating that the import ratio was greater in 1982 than it was in 1978. Reviewing the results of the entire 1974-82 period makes for lugubrious reading. Efforts at import-substitution have been ineffectual; there has even been some deterioration in the progress that was initially made. Thus, over the whole period there was an enhancement of dependency rather than its reduction. The minimal demand expansion effect signals the reason why: the build-up of indigenous industry suited to the needs of consumer-goods production provides little incentive for the encouragement of domestic machinery capacity. (43)

#### Export Performance

If progress towards the goal of technological self-sufficiency has become locked into an enduring stationary phase then the export of machinery has by contrast gone into reverse. This may seem a harsh indictment but the fact is that exports of mechanical machinery in 1982, an admittedly recessionary year, were lower in real terms than they were in 1977. Table 7 lists the figures.

Table 7 Exports of Non-Electrical Machinery  
(1977 - 1982)

YEAR	Current Value (K£'000)	Constant 1974 prices (K£'000)	Index (1977 base year)	Exports as per cent of output (%)
1977	1,228	1,023	100	51
1978	1,489	1,172	115	41
1979	1,510	1,049	103	41
1980	2,481	1,723	168	47
1981	1,967	1,253	122	31
1982	1,590	878	86	18

Source: Statistical Abstract 1983.

Even though exports of machinery represent less than 1 per cent in value terms of all exports they did until the beginning of the present decade account for between 40 to 50 per cent of total machinery output. But even during a recessionary period, exports in 1982 still amounted to almost one-fifth of machinery production value. Clearly, then, the export of agricultural equipment to contiguous African countries which are involved in the production of similar crops is of significant potential value to the development of the Kenyan machinery industry.<sup>(44)</sup> Moreover the prospects appear healthy that this export potential can be realised to a much greater extent than in the recent past. Government and political events have combined to provide the appropriate underlying conditions for Kenya's machinery builders to make an increasing impact on the export scene.

There are several factors to this judgement. In the first place, although the Government's Export Compensation Scheme has been in operation now for several years the bugs are at last beginning to be ironed-out and the programme's biggest criticism, that of delay in recompensing exporters is gradually being rectified. In addition to the attempts at making Kenya's exports more competitive there have also been encouraging political and diplomatic developments which lead to much optimism

that the trading front can be expanded. Thus, in late 1984 the border with Tanzania was re-opened to trade for the first time since February 1977. Drought and related aspects apart, it was the closure of the border, effectively blocking Kenya's exports to not only Tanzania but also Rwanda, Burundi, Zaire, Zambia and other southern African states which precipitated the disappointing export performance of the machinery sector since that date.<sup>(45)</sup> The removal of this physical trading restriction will do much to rekindle export trade. There has, however, been an equally significant trading development in the emergence of the Preferential Trading Area (PTA).

The Treaty for the establishment of the PTA for Eastern and Southern African states, signed in Lusaka on 21st December 1981, was designed to reduce tariff and non-tariff barriers to trade between its signatories over the ensuing decade. There were originally nine member countries but this was later increased to fourteen when five further countries acceded to the Treaty. The member nations include Burundi, Comoros, Djibouti, Ethiopia, Kenya, Lesotho, Malawi, Mauritius, Rwanda, Somalia, Swaziland, Uganda, Zambia and Zimbabwe. Six other countries involved in the PTA negotiations were Angola, Botswana, Malagasy, Mozambique, Seychelles and Tanzania and although they did not accede to the Treaty they have a standing invitation to do so whenever they feel able.<sup>(46)</sup> The PTA's timetable is a tough one. It became operational on the 1st July 1984 with the immediate objective of becoming a sub-regional common market by 1992. The ultimate objective, though no date is specified for this, is the transformation of the PTA into a fully fledged economic community. The initial tariff reductions were calculated from the basic rates of duties as applied by member countries on 30th September 1982. For capital-goods this implies a quite huge tariff reduction of 70 per cent.<sup>(47)</sup> Such a tariff concession should do much to encourage trade in a region that has a market of approximately 150 million people with a collective GDP estimated at 55 billion US dollars. Moreover, the fact that only 9 per cent of the PTA's total arable land is under cultivation and only 4 per cent of the available water supply is currently utilised suggests that unlimited potential exists for the

development of the region's agricultural sector and the related agro-processing industries, including machinery manufacture.<sup>(48)</sup>

The difficulties associated with regional economic cooperation schemes are well-known, and the collapse of the East African Community indicates vividly that they are real enough. Over recent times though, there has been an increasing recognition that regionalisation is an essential element in loosening the long-term development constrictions which engulf African countries.<sup>(41)</sup> More importantly, perhaps, there is a general realisation by all concerned that success in such initiatives will be finely balanced unless there is an acceptance by the participants of an equitable distribution of the benefits which are at the outset both unambiguous and certain.<sup>(50)</sup> The PTA has been constructed on such foundations; its binding solution being the realism that seemingly little alternative exists to secure 'truly' indigenous development.

The PTA Treaty complements two existing multilateral arrangements aimed at promoting integrated areawide development within Africa. There is, firstly, the Union Douaniere et Economique de l'Afrique Centrale (UDEAC) treaty which sets forth a standard incentives law for all member countries. The Economic Community of West African States (ECOWAS) provides the other treaty, established in 1975, it holds similar aims to the PTA. The formation of the PTA is an important enough event by itself but perhaps its real significance lies in the trading developments which it could foreshadow. Viewed from this perspective, the emergence of the PTA marks a further step in the movement towards the realisation of what has been termed the 'Monrovia Strategy'. This approach, also referred to as the Lagos Plan of Action, is a position taken in favour of the creation of an African Economic Community by the year 2000. The Lagos Plan's basic premise is that African development cannot be the automatic by-product of the World economic system. Kenya's machinery manufacturers being somewhat more developed than those of other African countries will welcome, and undoubtedly benefit from, the continent's progression towards the attainment of this free-trading bloc.



Notes

1) This paper was written whilst I was a Research Associate at the Institute for Development Studies, University of Nairobi. The study is based on a sample survey of 37 'mechanical' machinery manufacturers, representing a cross-section of the (ISIC 382) companies listed in the government's CBS files. The sample comprised 11 large firms, the total population of units employing more than 50 workers, and some 26 medium-sized companies, which are the 20-49 employee group of firms, being identified from the 1977 Government of Kenya industrial census. The response rate to the survey was 76 per cent. In support of the field-work, I am indebted to the World Bank for the generous financial assistance provided through an award from the Robert S. McNamara Research Fellowship Programme. A debt of gratitude is owed to Dr. N.G. Clark, Sussex University, for his insights regarding the theoretical importance of capital-goods capacity in LDCs. I have received helpful criticisms and comments on the working paper itself from various quarters but notably from Dr. P. Coughlin, Dept. of Economics, Jan Vandemoortele, ILO Economist, and R. Hughes, a fellow Research Associate at the IDS. Appreciation is not only expressed to these academics, however, but also to Mr. S. Ita, chief executive of the Kenyan Association of Manufacturers, and to the numerous machinery producers who have willingly and often enthusiastically agreed to cooperate in the study. Finally, it hardly needs to be said, but, in the event of errors of analysis or of fact, the usual disclaimer applies.

2) An appreciation of the centrality of price in the decision to purchase capital equipment may be gained by reference to conventional investment theory which compared the marginal costs of capital to its marginal efficiency. It suggests that the price elasticity of demand for producer goods can only be elastic for if the supply price falls then, ceteris paribus, there will be an automatic improvement in the marginal efficiency of capital (MEC) thereby making prospective investment by the entrepreneur a more attractive proposition. The Keynesian MEC conceives producer equipment as possessing elastic demand schedules because both the MEC and investment demand are in positive relation to one another; that is, a rise in the MEC will lead to a rise in demand. Thus, at any given rate of interest a decline in the price of capital-goods must improve the level of investment.

3) In support of this argument, it is worth quoting Rosenberg directly: "in underdeveloped countries, the investment decision is likely to be heavily weighted by an unfavourable relative price structure which acts as a serious impediment to investment activity. The investment decision after all, involves computation of a prospective rate of return which is determined by the present price of capital goods and the anticipated future price of consumer goods. But it should be clear that the relative inefficiency of the capital goods industries in underdeveloped countries and therefore the high price of capital goods is responsible for yielding low or even negative rates of return on a wide range of prospective investments. A major handicap of underdeveloped countries, then, is located in their inability to produce investment goods at prices sufficiently low to assure a reasonable rate of return on prospective investment." (1963, p.226).

4) The country's dependency on the foreign exchange earning capacity of cash crops is highlighted by the fact that the long-term trend shows an increased reliance on just two types of export, coffee and tea. These two commodities made up 27 per cent of total exports in 1964 and 45 per cent in 1983 (Economic Survey, 1984, p. 95).

5) Taking the case of India's machine tool industry as an example, the country's degree of self-sufficiency advanced from a position in 1955 where it could supply only 11 per cent of total consumption to one where twenty years later, in 1975, it accounted for 78 per cent of India's demand for machine tools. (Matthews, 1982, p.20). Self-sufficiency was also one of the development goals for the machine building industry of Communist China. For a discussion on this, see Chu-Yuan Cheng (1972, p.212).

6) Fred Nixon (Fransman, 1982, p.49) appraising the lessons of import-substitution for Africa drew the following conclusions, which seem particularly apposite to the development circumstances of Kenya, ... "ISI has not, in practice, significantly alleviated the balance-of-payments constraint; it has led to a growing dependence on a largely imported, capital-intensive technology and has thus not created extensive employment opportunities or indigenous technological development; the process has been heavily dependent on foreign capital and has emphasised the establishment of consumer goods industries at the expense of investment and capital-goods industries; it has led to what many would regard as an undesirable redistribution of income and in general it has failed to generate a sustained process of economic growth."

7) Defining capital-goods as those goods that are used to produce other goods comes up against the problem of exclusivity: both the food and clothes of production staff indirectly aid production and could thus be classified as capital-goods.

8) The Soviet model being associated with Fel'dman whilst the Indian model was based on Mahalanobis' theorising.

9) Africa's share in world output in the leading sectors of metal and engineering products remained unchanged at 0.2 per cent between 1955-70. The share of metals and engineering products in total industrial production seems to have declined. Africa has the lowest ratio of engineering production to engineering imports of all developing nations (sic) (UNIDO, 1981, p.35).

10) Moreover, it looks as though governmental emphasis on agriculture will continue. On this point, Professor Saitoti, Minister for Finance and Planning, recently stated that ... "agriculture will have to produce enough surplus to continue as the mainstay of our economy. So first in our priorities comes agricultural development." The Daily Nation, (8 March 1985).

11) See, Cooper, (1980, p.26) for an expanded discussion on these technological stages.

12) Provisional data from the Statistical Abstract (1983).

13) It is for this reason that there is limited correspondence, and therefore operational practicality, between the 'metal-converting' capital goods industries and the world industrial and trade statistics classification schemes (ISIC and SITC). Capital goods are concentrated in ISIC class 38, 'Manufacture of Fabricated Metal Products, Machinery and Equipment', with five sub-classes. In the trade statistics, capital goods are concentrated in SITC 69, 7 and 87. Contained within this scope are products relating to consumer goods (automobiles, domestic electrical appliances, and mass consumer electronics) - see UNIDO (1983, p.2).

14) This seems to be supported by Bennell's (1981, p.20) observations when he noted that ... "The skilled artisans (of the engineering sector) were predominantly Asians who were either poached from the railways or other government departments or directly imported from overseas. Engineering skills were mainly manual requiring little theoretical knowledge and were acquired as a result of prolonged in-plant experience."

15) Note Kongstad's (1980, pp.99-100) comments on the importance of the Asian influence on the industry: ... "In metalworking industries the Asians operate most of the 200 small or medium-sized factories near to Nairobi, Mombasa, Nakuru and Kisumu. It may be argued that general engineering is a key service industry on which the maintenance and increase of productivity in agriculture (and other industries) ultimately depends. While the exact location of agricultural processing industries is less important to peasants and farmers in a country like Kenya where transportation is cheap and abundant, the service industries providing repair facilities and general mechanical competence certainly must be within reach of the productive sectors to which they are linked, or should be linked."

16) The industrial revolution which took place in Britain during the eighteenth century would most emphatically have been still-born without the emergence of early machine tool technology. It is well-known that James Watt built the first workable machine - the steam engine, but its successful arrival was delayed for years as he was unable to obtain sufficient compression from the fit between piston and cylinder: that is, until John Wilkinson solved the problem by inventing the first effective machine tool - a horizontal boring mill. For a discussion on this point, see Hine (1971, p.2).

17) The argument is that mechanical engineering acts as a catalytic force in catapulting a country forward in its drive for economic and technological maturity. In support of this assertion Rostow (1959, p.8) has argued that ... "after the railway take-offs of the third quarter of the nineteenth century - with coal, iron and heavy engineering at the centre of the growth process - it is steel, the new ships, chemicals, electricity and the products of the modern machine tool that come to dominate the economy and sustain the overall rate of growth." That the smallness of the initial size of the machine building sector relative to the host economy clouds its strategic importance is shown by the fact that in China the sector grew from a 2.7 per cent share in 1949 to one of 12 per cent in 1966 (Cheng, 1972, p.1), and in India from 4.5 per cent in 1946 to 23 per cent in 1974 (Matthews, 1982, p.6). Machine building in these two cases relates not only to mechanical but also to electrical and transport equipment.

18) Machine tool production is usually seen as a principal component of the mechanical machinery sector. Yet, even as late as 1960, machine tool manufacture accounted for only 0.3 per cent of total manufacturing output in India (Matthews, 1982, p.57).

19) Thus, even though the authorities have not given overt emphasis to the promotion of a capital goods industry its rate of growth has nevertheless kept pace with the growth of the manufacturing sector (7.4 percent) over the same period of time. In fact, over the more recent time span 1976-82 the 10.2 per cent growth of the machinery sector has been faster than that of manufacturing at 8.1 per cent.



- 20) Under the wider definition of machine building, Communist China's industry grew at 18.6 per cent between 1952-66; it was 26 per cent for the Soviet Union between 1927/8-1937; 15.6 per cent for India between 1951-67; and 15.1 per cent for Japan between 1952-66. (Cheng, 1972, p.228). According to this classification of capital goods which defines them as encompassing electrical, non-electrical and transport machinery, Kenya sustained a rate of output growth between 1964-80 of 13 per cent.
- 21) This ratio corresponds almost exactly to the gross profit/sales figure of 13.6 per cent found by Lall in his sample survey of the profitability of (non-MNC) Indian manufacturing firms in 1968-69. See Lall (1976, p.718).
- 22) Of course, the relevance of this comparison applies only to the consumer goods industries involved in the production of non-durable goods.
- 23) For a complete exposition of this theory, and a review of the evidence on which it is founded, see Brown (1957).
- 24) See, The Second Schedule of The Finance Bill (1984).
- 25) There are two points here: firstly, the government has to ensure that prior to granting tariff duty relief there will be an increase, or at the potential of one, in local production activities. There seems little justification for tariff concessions if, in the example cited, electric motors were to be imported in C.K.D. form simply to be assembled in Kenya. Secondly, the prejudices of the manufacturers regarding the height of the protective tariff wall may indicate a level of nominal protection that departs from the level of effective protection warranted. Effective protection is defined as measured domestic value-added minus world value-added expressed as a percentage. From an economic perspective the effective rate of protection is a more useful measure because it gauges protection given to the domestic factors of production and therefore the attractiveness of the activity. See the World Bank (1975, pp. 318-21) for an extended discussion of the distinction between the nominal and effective rates of protection.
- 26) Ship-breaking has been introduced as a means of alleviating the shortage of local scrap but as yet the industry is still in its infancy. The higher quality speciality steels all require to be imported and, when available, usually have extremely high prices. It has been reported that in some instances the local importers/wholesalers add 100-400 per cent to the C.I.F. Mombasa port prices. See Coughlin (1983, p.6).
- 27) This was suggested by S.S. Ali, UNIDO Team Leader, Nairobi office.
- 28) Drawn from Ali (1983, p.92).
- 29) Non-dependence on principally foreign suppliers was the rationale behind Taiwan's reliance on vertical integration during the early development of machine tool manufacture ... "This has been both the cause and effect of the dearth of many types of support industries such as foundries, forges, heat treatment, electro plating, and tools and dies. Early on when production was getting under way, machine tool builders were faced with the choice of either importing their inputs or making them where possible. The small size of the market, however, as well as a critical shortage of foreign exchange, made a reliance on dispensable imports unthinkable." Amsden (1977, p.222).



- 30) The history of the Korean machinery industry shows that its development was hampered by similar foundry/forging deficiencies: inadequate treatment, cleaning and processing of sand for moulds, poor composition of sand, poor plant layout, wastage of materials at the forging stage which imposes costs at a later stage of machine finishing. Cited from Mitra (1979, p.16).
- 31) The major conclusion to Jack Baranson's (1967, p.xi) study of the Cummins' diesel plant in India was that "...contrary to widely held beliefs among development economists about capital deficiencies, the evidence seems to indicate that the basic difficulties lie in limitations imposed by the scale of local markets and overall deficiencies in supplier capabilities."
- 32) For instance, see Bhagwati and Desai (1970) and Matthews (1984).
- 33) The large company operating at below 40 per cent of capacity is a manufacturer of industrial compressors. The foreign parent company manufactures approximately 2500 units per annum which compares to 50 per month in the Kenyan subsidiary's heyday. Currently, production is down to one unit a month. This low level of capacity utilisation is widespread across the engineering sector. A separate study found that foundries in Kenya presently use only 23 per cent of their capacity, and metal engineering workshops only 34 per cent. See Coughlin (1983, p.2).
- 34) According to the OECD's Economic Outlook (1984) non-oil commodity prices are in real terms, after allowing for OECD inflation, now 50 per cent below their 1974 peak, 8 per cent below their 1960s average and at about the same level as their 1971 low.
- 35) As a means of alleviating the difficulties associated with slackness in demand, various of India's machine tool manufacturers pursued similar objectives of diversification of output. One producer of lathes had parallel manufacturing activities taking place in the same workshop which were directed to the stamping of components for the local scooter factory. See, Matthews (1981).
- 36) This is certainly not an easy question to answer, indeed, if there is an answer to be found at all. Bearing comparative advantage in mind, perhaps the best approach for gauging potentially efficient and therefore profitable domestic production capabilities is to take notice of the advice once given by the King of Hearts, "Begin at the beginning, and go on until you come to the end: then stop." (Carroll, 1982, p.xxv). The problem, however, is knowing when you come to the end. In this context, Little, et al (1970, p.11) have argued that "...A determination to pursue import-substitution too far results in a neglect of comparative advantage. There are many examples of enterprises set up by governments, and of industries being encouraged by heavy protection, with little or no thought given to the costs, or to alternatives."
- 37) The problem with this judgement and the analysis from which it derives is that nowhere in the government publications are the data for total demand and imports of machinery and equipment defined. But due to orders of magnitude it is, nevertheless, reasonable to assume that the figures have regard to the broader definition of capital-goods, incorporating transport and electrical machinery as well as the products of the non-electrical branch.

38) Kenya's direct imports of agricultural equipment in 1983 covering ploughs, and parts thereof, cultivators, weeders, hoes, harrows, soil preparation equipment, and tea processing machinery amounted to just slightly more than Kf500,000. This needs to be compared with the direct imports of metalworking machine tools alone, which in the same year came to more than Kf3,750,000. Data calculated from Annual Trade Report (1983).

39) There were 3 foreign firms in the survey of machinery manufacturers, representing some 8 per cent of the sample. All of these companies were classified as large, however, so that foreign firms constituted around 27 per cent of the total population of large enterprises.

40) Kenya imports tractors from at least 15 countries, and the consequential lack of standardisation in spare parts perhaps suggests why hardly 40-50 per cent are operational. See, S.S. Gill, Development of Agricultural Machinery in Kenya, Industrial Survey and Promotion Centre, Kenya Ministry July 1980) p.7. Cited in Coughlin (1983, p.21).

41) Even though only Ashok-Leyland Ltd., of the five civilian motor vehicle manufacturers, was formally under foreign control during the early development of Indian vehicle manufacture, the industry as a whole was very much dependent on foreign collaborators: "of the few passenger models manufactured in the country in 1958, only one had an indigenous content of over half; the others ranged from 30-37 percent. Commercial vehicles were in a like state, ranging from 9 to 58 per cent indigenous content and averaging about 37 per cent. By the end of 1961 the position had improved, but in no case was the import content less than one-fifth, and it still ranged up to one-half." (Kidron, 1965, p.200). Assembly of commercial and pick-up vehicles currently takes place in Kenya. The vehicles assembled cover Datsun, Toyota, Volkswagen, General Motors and Peugeot. Local content for the Toyota models has reached 30 per cent whilst for the Isuzu and Bedford trucks in the General Motors range local content has touched 55 per cent.

42) This analytical technique is borrowed from Maizels (1963, pp. 150-52); its exposition is drawn from Cheng (1972, p.212).

43) The character of Kenya's post-independence industrialisation has centred on the development of final consumption good industries through the encouragement of multi-national investment. Such a strategy inhibits the growth of domestic machine-making capacity as the foreign companies prefer to import their process technologies from the west, conforming the practices and product standards already obtaining at the parent plant. In addition, local capital goods producers have been handicapped by the negative tariff protection afforded to machinery manufacturers in Kenya. Zero sales tax on certain categories of imported capital goods further reduces the viability of local production.

44) It has been reported that the African market for agricultural equipment is between US\$1 and \$1.5 billion annually. Less than 10 per cent of this is supplied by local producers. (East Africa Report on Trade and Industry, 1983, p.25).

- 45) That Kenya's machinery producers were badly affected by the closure of the border with Tanzania in early February 1977 can be evidenced by an examination of the trade statistics (Statistical Abstract, 1983). In 1976, Kenyan exports of machinery and other capital equipment amounted to Kf6.6 million; in the following year they had shrunk to Kf1.2 million.
- 46) Tanzania officially joined the FTA in April 1985.
- 47) Sourced from the Kenyan Association of Manufacturers' Information Sheet (1985a, p.3). This document is based on the Treaty for the establishment of the FTA for Eastern and Southern African States.
- 48) See, Kenyan Association of Manufacturers' Information Sheet (1985b, pp. 6-7).
- 49) For informative reading on this point, see Ndegwa (1985).
- 50) This does not mean to say that problems do not exist; they do. The PTA was launched in July 1984 but Kenya by the close of January 1985 had made virtually no trade transactions within the organisation's framework. The slow start to trade within the PTA is not confined to Kenya. The majority of the member countries are yet to establish the necessary legal machinery to facilitate trade within the region. Furthermore, by the end of December 1984 only six of the members - Ethiopia, Malawi, Mauritius, Swaziland, Zambia and Zimbabwe had started using the PTA clearing mechanism, which is meant to minimise the use of foreign exchange through increased use of local currencies to settle trade transactions (foreign exchange would only be used in the settlement of trade deficits between member states). The effectiveness of the clearing system has been largely hampered not only by the limited number of member countries which have actually started using it but also by the huge trade imbalances existing between some of the trading partners. Such trade imbalances are already reported to have caused considerable friction between the neighbouring Central African states, Zambia and Zimbabwe due to the former country running up a huge trade deficit of US\$12 million which had to be paid for in foreign exchange. Zambia was annoyed by Zimbabwe's failure to make efforts to import more from her. For a fuller discussion of these and other points, see The Daily Nation newspaper (31 January 1985, p.10).



- Ali, S.S. (1983), Strategy and Development Programmes for the Fifth National Plan of Kenya, UNIDO, March.
- Amsden, A. (1977), 'The Division of Labour is Limited by the Type of Market: The Case of the Taiwanese Machine Tool Industry', World Development.
- Annual Trade Report (1983), Customs and Excise Dept., Ministry of Finance and Planning, Government of Kenya.
- Barcnson, J. (1967), Manufacturing Problems in India: The Cummins Diesel Experience, Syracuse Uni. Press.
- Bennell, P. (1981), 'The Formation of Engineering Labour Markets in Kenya 1918-79', IDS/WP 379, February.
- Bhagwati, J. and Desai, P. (1970), India : Planning for Industrialisation, Oxford, Clarendon Press.
- Brown, W. (1957), 'Innovation in the Machine Tool Industry', Quarterly Journal of Economics, August.
- Carroll, L. (1982), Alice's Adventures in Wonderland and Through the Looking Glass, Oxford University Press.
- Cheng, C.Y. (1972), The Machine-Building Industry in Communist China, Bainbridge University Press.
- Cooper, C. (1980), 'Policy Interventions for Technological Innovation in Developing Countries', World Bank Staff Working Paper, December.
- Coughlin, P. (1983), 'Converting Crisis to Boom for Kenyan Foundries and Metal Engineering Industries: Technical Possibilities Versus Political and Bureaucratic Obstacles', IDS/WP 398, August.
- East Africa Report on Trade and Industry (1983), October.
- Economic Outlook (1984), OECD, Paris.
- Economic Survey (1984), CBS, Ministry of Finance and Planning, Government of Kenya.
- Gerschenkron, A. (1951), A Dollar Index of Soviet Machinery Output 1927-28 to 1937, Santa Monica: Rand Corporation.
- Hine, C.R. (1971), Machine Tools and Processes for Engineers, McGraw Hill Inc.
- Hopcraft, P.N. (1972), 'Outward Looking Industrialisation, The Promotion of Manufactured Exports From Kenya', IDS Discussion Paper No. 141.
- Kenyan Association of Manufacturers' Information Sheet (1985a), A Guide-line on PTA Protocol on Reduction and Elimination of Trade Barriers.
- Kenyan Association of Manufacturers' Information Sheet (1985b), Preferential Trade Area for Eastern and Southern Africa.



- Kidron, M. (1965), Foreign Investment in India, Oxford Uni. Press.
- Kongstad, P. (1980), 'Kenya: Industrial Growth or Industrial Development'. in Industrialisation and Income Distribution in Africa (Ed.) J.F. Rweyemamu, Codesria.
- Lall, S. (1976), 'Financial and Profit Performance of MNCs in Developing Countries, Some Evidence from an Indian and Colombian Sample', World Development.
- Leff, N. (1968), The Brazilian Capital Goods Industry 1929-64, Harvard University Press, Cambridge, Mass.
- Leys, C. (1982), 'Accumulation, Class Formation and Dependency: Kenya', in Industry and Accumulation in Africa (Ed) M. Fransman, Heinemann.
- Little, Scitovsky and Scott (1970), Industry and Trade in Some Developing Countries - A Comparative Study, Oxford Uni. Press.
- Maizels, A. (1963), Industrial Growth and World Trade, Cambridge University Press.
- Matthews, R. (1981), The Techno-Economic Development of the Indian Machine Tool Industry with Special Emphasis on Aspects Affecting Efficiency, Ph.D. thesis, University of Glasgow.
- Matthews, R. (1982), 'Industrial Strategy and Technological Dynamism in Machine Tool Manufacture - Comparative Perspectives on India and Japan', Technology and Culture Series, No. 7, Research Policy Institute, University of Lund, Sweden.
- Matthews, R. (1984), 'Initial Growth Pains in the Development of the Indian Machine Tool Industry', The Indian Economic Journal, October-December.
- Mitra, J. (1979), 'The Capital Goods Sector in LDCs: A Case for State Intervention', World Bank Staff Working Paper, No. 343, July.
- Ndegwa, P. (1985), Africa's Development Crisis, Heineman Education Books, Nairobi.
- Nixon, F. (1982), 'Import-Substituting Industrialisation' in Industry and Accumulation in Africa, (Ed) M. Fransman, Heineman.
- Pack, H. (1980), 'Fostering the Capital Goods Sector in LDCs: A Survey of Evidence and Requirements', World Bank Staff Working Paper, No. 376, March.
- Robinson, J. (1953-4), 'The Production Function and the Theory of Capital', Review of Economic Studies, Vol. XXI. Quoted in Frances Stewart, 'Capital Goods in Developing Countries', Technology and Underdevelopment, MacMillan Press (1977).
- Rosenberg, N. (1963), 'Capital Goods, Technology and Economic Growth', Oxford Economic Papers, Vol. 15, November.
- Rosenberg, N. (1976), 'Technological Change in the Machine Tool Industry 1840-1910', in Perspectives on Technology, Cambridge University Press.

Rostow, W.W. (1959), 'The Stages of Economic Growth', Economic History Review, August.

Statistical Abstract (1983), CBS, Ministry of Economic Planning and Development, Government of Kenya.

Stewart, F. (1976), 'Kenya: Strategies for Development', in Development Paths in Africa and China (Ed) U.G. Damachi et al, MacMillan Press.

UNIDO, (1981), 'Industrial Technology in Africa', Technology Programme, UNIDO/IS222, April.

UNIDO, (1983), 'Capital Goods in Perspective : Definition, Importance and Analysis of Factors Affecting Demand with Special Reference to Arab Countries', WP. No. 11, UNIDO IS420, December.

World Bank, (1975), Kenya : Into the Second Decade, J. Hopkins Press.

World Development Report 1984, (1984), the World Bank, Oxford University Press, Annex World Development Indicators.

Young, A. (1928), 'Increasing Returns and Economic Progress', Economic Journal, December.

Vandemoortele, J. (1984), in 'Kenya Data Compendium', IDS, Occasional Paper 44, April.