UNIVERSITY OF NIGERIA, NSUKKA

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TECHNICAL CHANGE AND PRODUCTIVITY IN THE MANUFACTURING INDUSTRY IN IMO STATE OF NIGERIA.

BY

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DEDICATION

This research report is dedicated to the Holy Spirit of God. He is the author of knowledge, wisdom and understanding.

APPROVAL PAGE

This is to certify that this thesis is an original work of Nwa ru, Ndubuisi Marcellinus (Mar No. PG/Ph.D/97/24692) and has been approved for the award of Doctor of Philosophy (Ph. D) degree in Economic Theory of the University of Nigeria, Nsukka, Enugu State.

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ABSTRACT

The subject of this study is the impact of technical change on the productivity of the manufacturing industry in Imo State of Nigeria. The manufacturing industry is the leading sector in the industrialized countries. It is expected to stimulate and sustain the growth of the Nigerian economy.

The Nigerian economy is in dire need of development but the sectors that should produce this effect, particularly the manufacturing industry, has exhibited disappointing performance. The Nigerian economy has experienced stunted growth since independence in 1960, such that even during he "oil boom" era the country did not experience a positive growth rate consistently for an average of six years.

The objective of this study , therefore is, to investigate the impact of technological progress (Hick's neutral disembodied change) on the productivity of selected manufacturing firms in Imo State of Nigeria in 2005. With this result, a prediction of the effect on manufacturing industry in Nigeria will be made.

To achieve the set objective, we made a case study of the manufacturing industry in Imo State of Nigeria. Of the 104 firms that we gave questionnaires only 21 of them responded, even within the elongated period of four months of consistent visit and appeal. Some of the firms on the record had closed down due to shortage of raw materials and spare parts. Also none of the multinational corporations returned our questionnaires.

The data set collected from these 21 firms were 60 and we used the constant elasticity of substitution production function was used and Stata econometric package also was used to carry out the analysis. The model focused on Hick's disembodied neutral technical change, which emphasizes continuous improvement on existing capital assets.

The findings show that technical change did not make a significant contribution to the productivity of the manufacturing industry in Nigeria within 2005 in which the cross-section study was based.

It is recommended that technology policy should be separated from policies on science and technology and education and training. This policy should be based in the firms. It is also recommended that the capital goods industry should be fortified and that Nigerians working abroad and who have acquired skills in technology should be attracted home by the government and the manufacturing firms.

Furthermore, goods manufactured by these efficient firms that use improved technology should be exported. The export of manufactured goods, will in turn, yield technical change.

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CHAPTER ONE. INTRODUCTION

The growth of interest in technical change came after the Second World War. This interest was generated because of concern for economic growth in the developing countries.

Hitherto, capital was thought to be the engine of economic growth, but it has been realized that technical change plays this role instead.

This study takes a look at the impact of technical change on the productivity of the manufacturing industry in Imo State of Nigeria. It is divided into five chapters where chapter One is introduction.

Section 1.1 considers the Nigerian manufacturing industry to which firms in Imo State belong. The trend of growth of the Nigerian economy was considered next. These give wide background to the study and in chapter 3 the specific background of Imo State was discussed.

Chapter Two is literature Review, chapter Three is method of study, chapter Four shows the analysis of data and chapter Five deals with summary of findings, conclusion, and recommendations.

1.1 Background of the Study

The manufacturing sector is the source of rapid economic growth in the advanced economies. The potential of the manufacturing sector in these economies rests on the technological progress it attains. We would briefly look at the trend of growth of the Nigerian economy, the influence of the manufacturing sector on the growth of the Nigerian economy and the impact of technological progress on the productivity of the manufacturing industry in Nigeria.

1.1.1 Trend of Growth of the Nigerian Economy

The Nigerian economy has experienced stunted growth for the greater part of the period since political independence in 1960. Even during the period of 'oil boom,' the Nigerian economy did not experience a positive growth rate continuously for an average of six years. The first half of the 1990s was particularly bad, being characterized by negative rates of growth of Gross Domestic product (GDP). The negative growth rates indicate a depressed Economic situation partly caused by the worldwide economic recession of the period and partly by over-dependence on oil proceeds and gross mismanagement of the economy.

The GDP rose from a nominal value of ₦2.0842 billion in 1958/59 to ₦2.483 billion in 1960/61 (Olaloku, et al, 1979). This figure steadily rose to ₦3.147 billion in 1965/66 before it fell to ₦2.544 billion in 1968/69, as a result of the civil war. It recorded an average growth rate of 5.7 percent between 1958/59 and 1965/66, a decline of 0.38 percent during 1966/67 – 1969/70 and later grew by 11.35 percent for the period 1971/72 – 1973/74

(FOS, 1996:19). The nominal GDP increased from ₦5.621 billion in 1970 to ₦7.703 billion in 1972. It however, suddenly jumped to ₦18.81 billion in 1974 and ₦43.15 billion in 1979 because of the oil boom. By 1987 and 1994, it had risen to ₦708.885 billion and ₦987.498 billion respectively.

The real GDP which registered a value of ₦1.278 billion in 1970 gradually rose to ₦213 billion in 1977 (though with a decline in 1975). It later declined consistently from 1980 to 1984 and by 1990, a positive trend was recorded with an increase from ₦2.606 billion in 1990 to ₦2.913 billion in 1994. While the growth rates of 7.84, and 2.1 percents were recorded, respectively, for the period 1971-75 and 1976-80, for the period between 1981 and 1985, the GDP declined by an average of 0.18 percent. The trend was however reversed in 1986-1990 and 1991-1994 which registered positive growth rates of 6.6 and 2.8 percent respectively. The positive growth rate of GDP continued and reached a maximum of 10.2 percent in 2003. [See Table 1a, of the appendix].

1.1.2 Evolution and Contribution of the Manufacturing Industry in Nigeria

Early manufacturing activities before Nigeria's political independence in 1960 were limited to semi-processing of primary agricultural products as adjuncts to the trading activities of foreign companies. The agro-based manufacturing firms that were established included vegetable oil extraction and refining plants, starch-making, tobacco processing, pottery, raffia crafts, mat-making, wood-carving and saw-milling (CBN,2000:62). They were followed by textiles, breweries, cement, rubber processing, plastic products, brick-making and pre-stressed concrete products. The private indigenous entrepreneurs relied on crude technologies for the production of light consumer goods in the small-scale and informal firms that were scattered across the country. At the outset, domestic investment capital was very small and the indigenous private investors interested in large returns were pre-occupied with trading, transport and construction businesses. They lacked the technical know-how required in modern manufacturing activities. The share of manufacturing value-added in the gross-domestic product was 3.7 percent in 1959/60 [see table 2 in the appendix]. Besides the construction of roads, generation of electric power in regional capitals and maintenance of law and order which created a conducive environment for trade, no particular industrial policy was initiated by the erstwhile colonial administration to promote industrial development in Nigeria.

Post independence Nigeria saw the evolvement of national development plans, later replaced by the three-year national rolling plans [within the context of the Structural Adjustment Progarmme (SAP) which provided the conceptual framework for the development objective strategies for industrialization, government participation in the process of industrialization, and the fiscal and related policies for influencing industrial development. The principal features and set objectives of the development plans included, among others, the desire to lay an enduring foundation for future expansion of the productive capacity of the economy, achievement of high economic growth through increases in the share of manufacturing value-added, increase in export of manufactures, diversification of industrial activities and improvement in the standard of living of Nigerians. Their plans also sought to reorientate the Nigerian entrepreneurs away from trading into manufacturing and processing activities as well as promote even development of the country through industrial dispersal.

The high priority given in the development plans to the manufacturing industry was due to its role in maximizing net income growth and achieving a more balanced geographical distribution of the benefits of economic development. It was also to facilitate employment generation for the expanding labour force, technological transformation and diversification of productive activities, as well as the achievement of relative economic independence.

1.1.3 Ownership

The ownership of manufacturing firms in Nigeria is shared between the public and private sectors of the economy. In terms of number, the private sector-owned manufacturing units are predominant, while aggregate public sector investment dominate in the capital-intensive heavy enterprises. Publicly owned heavy enterprises accounted for 66.7 percent of total investments in intermediate and capital goods industries (UNDP, 1993). Moreover, the public sector (Federal and State Governments) was involved in many joint venture projects in the consumer goods industries involving domestic and foreign capital.

Private sector investment remains concentrated in the consumer goods enterprises and has grown faster than the intermediate and capital industries because of its relatively simple technology and low capital investment required for establishment. Most of the intermediate and consumer goods manufacturing units were sponsored by large foreign corporations and indigenous firms. The sole proprietorships accounted for 74.5 percent of total manufacturing enterprises followed by co-operative (joint ventures) and partnerships representing 16.6 and 7.3 percent of total manufacturing units, respectively. A proportion of the manufacturing enterprises operated by the sole proprietors are micro-enterprises employing between 5 and 10 persons (CBN, 2000:66).

1.1.4 Composition of the Manufacturing Industry

Nigeria's manufacturing sector comprises of a wide range of industrial activities which include large to medium and small-scale firms as well as cottage and handicraft units in the informal sector, using simple technology. Most large, medium and small-scale firms producing consumer goods are owned by the private sector. Their products include food, beverages, textiles, wearing apparels, plastic, rubber products, soap and detergents, wooden and metal furniture, chemicals, tyres, tubes and leather products.

The consumer goods firms dominate manufacturing activities in Nigeria, accounting for about 70 and 75 percent of value added and employment in the manufacturing sub-sector respectively. In terms of relative size, the bulk (about 65.2 percent) are the small scale and micro-firms while the medium and large scale firms represent 31.3 and 3.5 percent of total manufacturing units, respectively (CBN, 2000:65). The cottage and handicraft enterprises engage largely in the production of wearing apparels, light processing of foodstuff and pottery-making. The large-scale capital intensive manufacturing firms include the publicly-owned core industrial projects which produce basic inputs for the down stream industries. The capital-goods firms manufacturing machinery, tools and electrical equipment are few.

1.1.5 Performance of the Manufacturing Sector in Nigeria

According to CBN (2000:67) the factors that influence the structural change and performance of the manufacturing sub-sector since independence in 1960 include government intervention, low technological development, inward-looking strategy and protectionism. The main objectives set by the industrial planners in Nigeria include, the desire to achieve increase in the share of manufacturing contribution to the GDP, replacement of imports with locally produced goods, innovativeness, industrial dispersal and employment generation. The pre-structural adjustment programme era, spanning the 1960s to the 1980s, witnessed the adoption of various policy measures and strategies designed to promote industrial growth.

At the beginning, Nigeria as an inward-looking economy adopted the import substitution strategy which encouraged manufacturing units, but with heavy dependence on imported inputs. Thus, with huge inflow of direct foreign investment capital, massive returns from oil exports and liberal importation policy, a large quantum of essential industrial raw materials, machinery and equipment were imported to boost manufacturing activities in Nigeria. The net import requirement of the manufacturing sub- sector grew rapidly, as more than 60 percent of the raw materials consumed in the sub-sector were imported (CBN, 2000: 67). The high import dependence was more pronounced in the heavy capital intensive industrial sub-groups. Consequently, the contribution of the manufacturing sub-sector which was 3.9 percent in 1960/61 experienced steady growth during each sub- period; 1962/63 - 1972/74; 1973/74-1977/78 and 1981/82 - 1994 (see appendix 3). By 1982, its contribution to GDP had reached a peak of 11.21 percent. From a slight decline in 1984, the contribution of manufacturing went up again in 1985, though with another decline in 1986. Since 1989, the contribution of the manufacturing sub sector has stabilized at levels that are lower than 1985 level. Figure 1 shows the graphical presentation of Table 2.

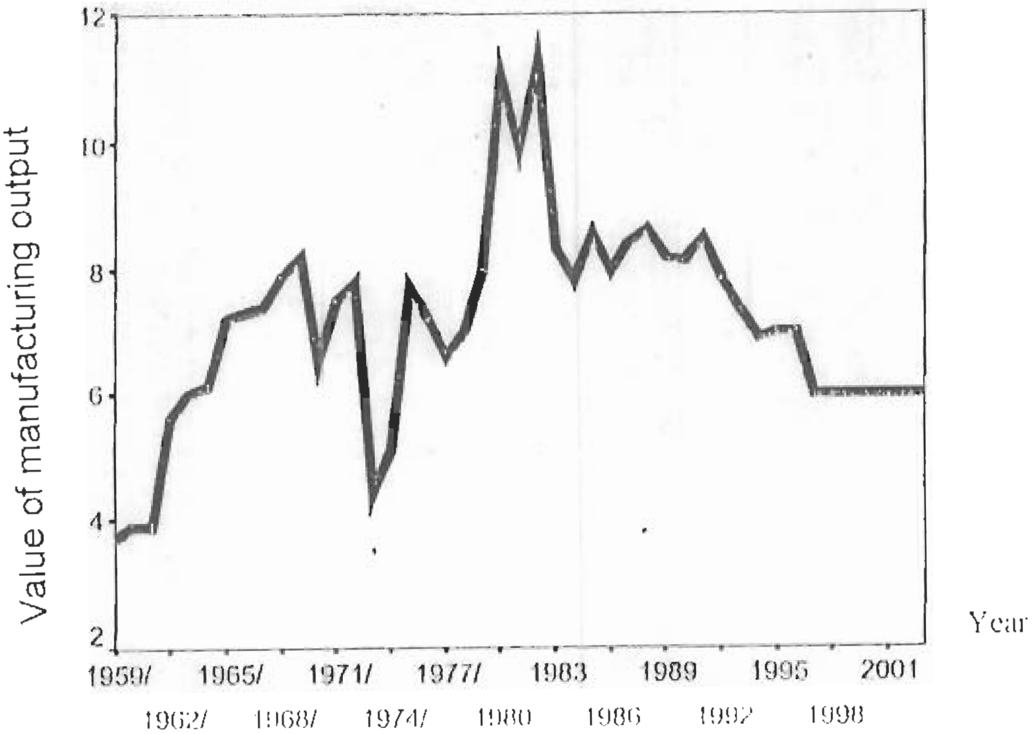

Figure 1: contribution of manufacturing sector to GDP, 1959/60 to 2001.

Manufacturing production from the mid-1970s up to 1981 reflected the incentive framework which favoured the supply of locally produced goods to the domestic market. Most investment incentives provided by government were target at achieving higher production and greater revenues in the medium to long run. The exchange rate system, as the basic factor affecting the cost-price structure and competitiveness of manufactured products, became a major determinant of the net incentives and the structure of the manufacturing sub-sector producing mainly for the domestic market. The macroeconomic policies implemented facilitated naira appreciation, thus giving protection to the import-dependent firms. Selective or directed credit policies for preferred sectoral investment programmes were implemented. In particular, the loan rate ceilings used in conjunction with import restrictions encouraged industrialization through import substitution.

The overall manufacturing capacity utilization as a result of the over-valued naira and the substantial supply of imported raw materials, under the protective regime, rose markedly but fluctuated between 75 and 70 percent in the period 1975 to 1980 (CBN), 2000:68) Many manufacturing enterprises including multinationals grew behind high protective fiscal barriers, making huge profits in the 1960s and 1970s.

The period 1982 to 1986, however, stood in sharp contrast to the earlier years as the growth of the import-based consumer goods and assembly oriented industries contributed little to domestic value added. With the collapse of oil prices in the international market, foreign exchange supply from oil export declined drastically during 1982-85. The oil revenues which accounted for about 90 percent of foreign exchange earnings fell from US $25.4 billion in 1980 to less than $6 billion in 1986. Although foreign exchange supply was rationed in favour of industrial raw materials, spare parts and semi-assembled products of selected industries, the quantity of imported raw materials and spare parts fell commensurately with available foreign exchange.

The performance of the manufacturing sub-sector, therefore deteriorated in the early 1980s. Manufacturing production fell by an average rate of about 1.5 percent per annum from 1980 to 1984. The substantial reduction in the sub-sector's gross investment and capacity utilization rate attributed largely to scarcity of foreign exchange, led to low value added, high production costs and low production for exports. Also, the improvement in manufacturing production, induced largely by output-boosting measures contained in the structural adjustment programme (SAP) could not be sustained.

The faltering domestic manufacturing production together with the low quantum and little diversity of Nigeria's manufacturing exports has been attributed largely to the prolonged implementation of import substitution strategy. This therefore, necessitated the restructuring of productive activities in the manufacturing sub-sector by a shift in industrial policy/strategy under the framework of SAP in mid 1986. SAP was introduced, among others, to revitalize the manufacturing sub-sector, diversify the economy away from its heavy reliance on oil revenues and improve the economy's future growth. The basic features of SAP that were extended to improve manufacturing performance include the removal of exchange rate over valuation and its subsequent determination by market forces, tariff reforms, removal of price controls to enable products operate competitively, public sector reforms including the privatization and commercialization programmes and fiscal prudence.

The adoption of SAP in mid – 1986 brought a modest revival in economic growth and renewed capital inflows. The SAP underscored the symbiotic relationships between the manufacturing industry and the agricultural sector, as it strengthened the inter- sectoral linkages between them and fostered production for export and trade orientation. The shift towards intensive use of local material resources and a more liberal foreign exchange allocation regime achieved temporary revival in growth. Moreover, SAP-based policies encouraged increased private sector participation and reduced government direct involvement in business enterprises.

Manufacturing production grew by an average of 8.1 percent between 1987 and 1992 (CBN, 2000; 70). The domestic resources based industries such as beer and stout, cotton, textile, cement and roofing sheets performed relatively well, while the reverse occurred for the import-intensive low value added units, exemplified by electronic products, vehicle assembly and machinery and equipment. The growth momentum in the sub-sector, however could not be sustained for long, as manufacturing production was seriously hampered by frequent breakdown of infrastructural facilities (particularly incessant electric power outages); increased production cost associated with market determined exchange and interest rates, and low effective consumer demand, resulting in huge stocks of unsold goods. The substantial devaluation of the naira during 1986-88 led to escalation of costs of imported inputs. In addition, the restrictive monetary polices of 1986 and 1987 reduced credit to the finished products. The rising costs of imports and private generation of electricity and other-vital infrastructures to sustain production processes resulted in high production costs, increase in product prices and consequent low consumer demand. Also, the persistent depreciation of the naira and its inflationary impact increased cost of production by adversely affecting both locally sourced materials as well as imported input. Arising from these developments, the manufacturing sub-sector which was expected to achieve 15 percent value-added contribution to the GDP, thus serving as the major source of growth, registered dismal performance instead. The share of manufacturing value added to the GDP averaged 7.4 percent between 1986 and 1995. Average manufacturing value-added reflected an average increase of 2. 74 percent between 1986 and 1995, I contrast to an average decrease of 1.3 percent between 1995 and 1997

However, manufacturing output, as measured by the production index decreased at an average of 0.73 percent, between 1995 and 1998. Average capacity utilization rate was 36.9 percent between 1986 and 1998, which was lower than the 65. 1 percent achieved between 1975 and 1985. (CBN, 2000; 72)

1.1.6 Export of Manufactured Goods

Inspite of the efforts to shift production and trade towards outward orientation, the manufacturing sub-sector is yet to make any significant contribution to export earnings. Export of manufactures were unable to take advantage of the sharp naira depreciation to widen the markets for manufacturing sub-sector owing to other overwhelming adverse factors. Aggregate value of manufactured exports comprising textiles, beer, cocoa butter, plastic, products processed timber, tyres, natural spring water, soap and detergent and fabricated iron rods, accounted for 1.9, 2.1, 7.1, 21.2, 16. 8, 0.2, 0.2, 0.2, and 0.4 percent of total non exports in 1987, 1988, 1989, 1990, 1991, 1994, 1995, 1996, and 1997, respectively (CBN, 2001: 72). It accounted for less than 1.0 percent of total exports. Manufacturing export is dominated by the textile group, which accounted for 59.8, 72.8 and 75.0 percent in 1987, 1988 and 1989, respectively, before decreasing to 22.9 percent in 1990. The poor performance of manufactured export is explained by low technological base, substandard export products, uneconomic scale of production, lack of diversification of export commodities and price uncompetitiveness.

1.17 Statement of the Problem

In the preceding section we reviewed the evolution and performance of the manufacturing industry in Nigeria. From the above discussion we observe the following points.

1 Firms in the manufacturing industry are still at infant stages relative to those in the developed economies such as Britain, U. S. A., Germany etc.

2 These firms used low technological base, and tried to improve on the acquired technologies through continuous maintenance.

3 Policies to improve the productivity of these firms have been put in place by various administrative regimes in Nigeria. But technological policy has not been separated from industrial and education and training policies.

4 Nigerian manufactured exports have performed poorly in the world market due to low technological base, substandard export products, uneconomic scale of production, lack of diversification of export commodities and price uncompetitiveness.

We tend to believe that the problem of low productivity, uneconomic scale of production, substandard exports and similar problems facing

Nigerian manufacturing industry could be alleviated through technical change.

In other words, we want to find answers to the following questions: Why has the productivity of the Nigerian manufacturing industry been fluctuating around very low levels of performance? Has technical change made appreciable impact on the productivity of the Nigerian manufacturing industry ?

1.8.1.Objectives of the Study

The objective of this study is to investigate the impact of technological progress (technical change) on the productivity of selected firms in Imo State in 2005. This will enable us make a probability statement on the impact of technical change on the productivity of manufacturing industry in Nigeria in general.

Other objectives include:

- to estimate the constant term in the production function;
- to estimate the capital –labour ratio coefficient;
- to estimate the efficiency parameter (A) of the production functions;
- to estimate the returns to scale parameter of the production function

Hypothesis of the Study

Consequent upon the two-step procedure for estimating the technical change using the constant elasticity of substation production function, five hypotheses were tested at the five percent level. These are:

H_{01}: Technical change does not affect productivity of the manufacturing industry in Imo State of Nigeria.

H_{02}: $\frac{\delta}{1-\delta} = 0$: The elasticity of substation equals zero.

H_{03}: $(\rho + 1) = 0$; The coefficient of the substitution parameter/capital - labour ratio equals zero.

H_{04}: $A = 0$; the efficiency parameter equals zero.

H_{05}: $(\mu/\rho) = 0$. The returns to scale parameter equals zero

1.9 Limitations of the Study

This study was constrained by time and financial resources. There was an attempt to use structured interview in addition to the questionnaire but this would have taken more time and money.

Furthermore, a national survey of the manufacturing industry in Nigeria would have expanded the scope of the study. But this could not be carried out for the reasons already mentioned.

The price of capital would have been ideal in the estimation of the production function, but such information seems to be impossible to obtain and hence the price of the product was used as a proxy. The average wage rate which was used for the estimation also affects the reliability of the estimation since an average wage rate is unrealistic. Different wage rates are paid to different skills and categories of labour.

The result may be affected by aggregation problem. The manufacturing firms surveyed ranged from micro, to small, to medium scale and to large scale firms.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Literature

The literature review was guided by two basic questions. First, what are the major causes of technical change? Second; does technical change have effect on the productivity of the manufacturing firm? We also reviewed the literature along different schools of thought, and we considered the supply of and demand for technical change.

2.1.1 Definition of Technical Change

Technology may be defined as scientific information (knowledge) applied for the solution of practical human problems for the purpose of making profit. In other words it is commercialized scientific knowledge. David (1992:219) observes that information is knowledge reduced to messages that can be transmitted to decision agents and that the essence is to cause some action or alteration in the subjective or objective state of the agent. Transmission of knowledge into information is a necessary condition for the exchange of knowledge as a commodity, he continues.

Kline and Rosenberg (1986) argue that for much of the world's history new technologies had little indebtedness to science. They cited the example of high "temperature super conductivity" which did not follow from applied scientific discoveries, but occurred well in advance of an understanding of the fundamental process governing the phenomena in question. They therefore argue that technological mastery may run far ahead of science and is in many cases both a stimulus to scientific inquiry and the means whereby such inquiries can be conducted.

Engineers or technologists are trained to apply scientific information in the solution of practical human problems. David (1992:219 – 220) gave characteristics of technical knowledge. He agrees that technology may occur accidentally or gained from systematic rational inquiry and observation. Technical knowledge is a distinct rather than a homogeneous good; it is indivisible and it is a joint good.

Technology may be transmitted through codification or in tacit form. Codification is a step in the process of reduction and conversion that renders the transmission, verification, storage, and reproduction of information especially easy. Codified knowledge typically is organized and expressed in a form that is compact and standardized to facilitate and reduce the cost of such operations. It is contained in papers, patents, blueprints, etc. Complementary to the codified knowledge is tacit knowledge (rules of thumb that are acquired only with experience and are embodied in people and institutions), which enhances the transmission and diffusion of technical information. Tacit knowledge makes it possible for codified knowledge to be understandable and productive. The transfer process of tacit knowledge includes demonstrations, personal instruction, and provision of expert knowledge (such as advice and consultancy) by those who possess the knowledge that remains in an uncodified form.

Technology inputs include: on the job training provided internally or externally. The external providers of training on the job include Universities, technology centers, research institutions, public training centers, private companies, industry association and chambers of commerce, and private training consultants. These show up in research and development. Other technology inputs include: use of imported equipment that employ new technologies, adoption of computerized technologies, purchases of foreign patents and technology lincenses. Included in this category is knowledge gained through exporting and effective maintenance and rejuvenation of old machines and equipment.

Technical change may be defined as continuous improvements in technological knowledge. It may be a discovery of new product or production process (invention), continuous improvements in existing (invention) technique or knowledge (this may be called innovation), adoption of techniques from other industries or economies and diffusion or imitation of improved techniques or products that are profitable in business.

2.1.2 Sources of Technical Change

The sources of technical change may be grouped into two broad categories; the supply-side and demand-side explanations. The supply-side model considers some schools of thought such as the neoclassicists, the institutionalists, etc.

2.1.3 Neoclassical Microeconomic Explanation of the Sources of Technical Change

The neoclassical school depicts technical change and productivity growth as the end result of a unidirectional causal sequence, often graphically represented by a series of boxes, each connected to the next by a single arrow pointing from left to right (David, 1992:216). The system flow chart tells us that:

(i) Fundamental science yields discoveries, which lead to;

(ii) Experimental findings of applied science, which lead to;

(iii) Acts of invention, which provide the stimuli and bases for;

(iv) Entrepreneurial acts of innovation (which is the commercial introduction of novel products and production methods), which incite;

(v) Imitation and so bring about;

(vi) Diffusion of the new technology into general use.

From diffusion will flow change in productivity and welfare improvements but also quite possibly profound alterations in market structure and untoward effects such as the displacement of workers, the downward valuation of assets rendered economically obsolescent, and demise of firms that fail to adapt to the competitive pressures unleashed by more efficient methods and better quality products. David observes that industrial nations are identified with the first four stages, while the interests of the developing nations fall into the last two stages of imitation and diffusion.

Bell and Pavitt (1992:259) summarize these six stages into two: the development and initial commercialization of significant innovation, and the wider application-or diffusion-of those innovations. They agree with David that the former activity is heavily concentrated in the industrial countries and that developing countries are involved primarily in the diffusion of technology or in the choice and adoption of existing technologies and creative innovation.

David (1992:215 - 218) observes that this idealized sequence of events by the neoclassicists vastly oversimplifies and distorts the working of the world. It is widely appreciated, he continues, that for much of the world's history new technologies had little indebtedness to science. Even today, inventions do not necessarily follow from applied scientific discoveries. Furthermore, important developments in applied science often occur well in advance of an understanding of the fundamental processes underlying the phenomena in question.

Most of the criticisms that are leveled against this neoclassical account focus on three glaring deficiencies. The first problem, which has been reviewed, is the inadequacy, at an epistemological level of the account it provides, of the evolution of the stocks of scientific and technological knowledge.

The second is the depiction of science as neatly separated into fundamental and applied compartments with the activities carried on in the first compartment being exogenous to the economy and therefore appearing in the role of the driver of the entire sequence of activities and events. The determinants of induced invention and the institutional conditions affecting market-oriented investments in research and development (R & D) thus receive no explicit notice. Instead of extending an influence backward into the search for scientific principles that will help guide a profit – motivated research in question of prespectific new products or production techniques, would-be inventors await their cues from the realm of autonomous science.

The third major distortion of reality is that changes in the technological opportunity set available to products are conceptualized as resulting from discrete advances or research breakthrough's. There is a great deal of evidence, however, that most long-run increases in technical efficiency and declines in the price-performance ratio of products in an industry are as the result of the accumulation of a myriad of small improvements. These incremental modifications are usually based on experience gained in actual production operations and in the repeated interaction between the users and the manufacturers and vendors of complex products. In short, endogenous experience-based learning, which is predicted on having gotten beyond the innovation stage, is an important source of the technical developments that the neoclassical view would ascribe to an anterior stage of invention.

Also Rosenberg (1976: 66 – 68) observes that the neoclassical model conceptualizes technological change as breakthroughs or discontinuities in scientific knowledge which bring with them whole new ranges of more efficient factor combinations for producing a commodity. He stresses that this biased view leads to the neglect of the analysis of small improvements. The consequences of this have been particularly serious in impeding our understanding of the origin and nature of technical change. The Schumpeterian system draws a sharp distinction between invention, innovation and imitation. In his emphasis upon the distinctive nature and social importance of leadership, Schumpeter (1954) placed great stress upon that charismatic figure, the entrepreneur, who possessed the character, courage and above all, vision, required to depart sharply from accepted routines and practices. The qualities of leadership required to innovate, Schumpeter argues, far surpass the requirements of subsequent imitations. For "as soon as the various kinds of social resistance to something that is fundamentally new and untried have been overcome, it is much easier not only to do the same thing again but also to do similar things in different directions, so that a first success will always produce a cluster".

Schumpeter was concerned to emphasize the discontinuous nature of innovative activity since the clustering of innovations was at the heart of his business cycle theory. As a result, he drew the sharpest possible contrast between invention and innovation: "The making of the invention and the carrying out of the corresponding innovation are economically and sociologically, two entirely different things". Within the sequence of invention, innovation and imitation, Schumpeter's theory had the result of focusing attention on the circumstances surrounding and influencing the act of innovation. Inventive activity stood as an exogenous factor outside of his framework. At irregular intervals, entrepreneurs selected certain of these inventions and carried out the introduction of a new production function with them. At this point, when the technological shape of the invention was such that it was already suitable for commercial introduction and success, it entered the economic arena and generated growth and instability.

But inventive activity itself is never examined as a continuing activity whose nature, timing, and special problems are relevant to the subsequent Schumpeterian stages of innovation and imitation. It is an activity carried on offstage and out of sight. Inventions come onto the Schumpeterian stage fully grown, and not as objects or processes the development of which is a matter of explicit interest, nor are subsequent improvements or modifications of the invention typically treated as significant. The consequence of this sequential isolation of invention and rigid segregation of the technological and economic realms is the failure to exploit technological factors in furthering our understanding of innovation and diffusion. Accordingly, economists who accept this conceptualization are cut off from technological factors which can account for the timing of innovations, link specific innovations with the resulting growth in resource productivity, and accounts for both the rate and direction of diffusion of innovation throughout the economy [Rosenberg, 1976].

2.2.1 Diffusion and Development

Innovation is simply beginning of the diffusion process, says Rosenberg (1976: 76). However, here the Schumpeterian framework emphasizes a separation which distinguishes between the high level of leadership and creativity involved in the first introduction of a new technique as compared to the mere initiative activity of subsequent adopters. Here also, as a result, the analysis of the diffusion process fails to focus upon continued technological and engineering alterations and adaptations, the cumulative effects of which decisively influence the volume and the timing of the product's sales. The diffusion process is typically dependent upon a stream of improvements in performance characteristics of an innovation, its progressive modification and adaptation to suit the specialized requirements of various sub-markets, and the availability and introduction of other complementary inputs which decisively affect the economic usefulness of an original innovation.

Bell and Pavitt (1992:259) agree with Rosenberg. They describe diffusion as a process which involves more than the acquisition of machinery or product designs and related know-how. It rather involves continuing, often incremental, technical change to fit specific situations and to attain higher performance standards. They argue that in technologically dynamic situations, these forms of technical change typically involve two stages. First, technology may be improved on or adopted for the specific situation, as described by Ansalem (1983). Second, there is a post adoption phase that both raises initial efficiency and modifies the technology to conform to changes in input and product markets. The analysis of learning curves in industrial production shows the economic gains from this continuing improvement, but it has typically obscured the underlying processes (Bell and Scott – Kemmis, 1990). These learning curves are generated by the role of continuous improvement in the competitive success of Japanese firms (see Imai, 1986). The significance of this incremental technological dynamism has also been highlighted in a handful of studies of firms in developing countries for example, in the steel industry in Brazil (Dahlman and Foseca, 1987) and in the petrochemical industry in the Republic of Korea (Enos and Park, 1988). Some studies have emphasized the importance of continuing change in the organizational dimension of production technology (See Hoffman 1989, Meyer – Stamper and others 1991). Along these two stages of technical change (Bell and Pavitt 1992: 260) continue, there is continuous accumulation of knowledge and skills in the technology adopting firms. Initially, firms must accumulate the skills and know-how for operating the new processes at their expected performance standards and for producing the new products to existing specifications. In a second stage firms accumulate the deeper forms of knowledge, skills, and experience required to generate continuing paths of incremental change that both improve on the original performance standards of the technology in use and modify its inputs, outputs, and processes in response to changing inputs and product markets. At the same time they may also Strengthen their capabilities for seeking out and acquiring technology from other firms and economies

At the third stage firms can build on these capabilities to introduce more substantial technical changes – perhaps incorporating significant improvements into processes already used or into process technology acquired from elsewhere – to modify existing products, produce substitutes, diversity into the production of inputs materials or equipment, or improve the technologies used by supplier industries. This stage may blur into a fourth in which firms produce the kinds of technical change that are usually though of as " innovations".

Rosenberg (1986) conceives innovation as a series of acts closely linked to the invention process and diffusion. An innovation, he argues acquires economic significance only through an extensive process of redesign, modification, and a thousand small improvements which suit it for a mass market, for production by drastically new mass production techniques, and by the eventual availability of a whole range of complementary activities, ranging, in the case of the automobile, from a network of service stations to an extensive system of paved roads. These later provisions even if they involve little of scientific novelty, or genuinely new forms of knowledge, constitute uses and application of knowledge from which flow the productivity improvement of innovative activity.

2.2.2 Development

Economists have exhibited a consistent disinterest in the development process (Rosenberg 1976:76). One understandable difficulty to coming to grips with it is that it had become a kind of omnibus term and therefore includes many quite disparate things. It includes trivial product differentiation activities which may be important from a marketing point of view but which do not pose serious technological problems. It may be neither difficult nor interesting, but economically very important. It may, on the other hand, involve the solution of fundamental technological problems without which an idea is totally lacking in possible commercial applications. The diffusion of an innovation is inseparably linked with these ongoing technological activities which shift, often imperceptibly the private pay-off to individual adopters. Characteristically much attention is generally devoted to the research than the development component.

2.2.3 The Transfer of Technology

Pack (1992:29) has outlined various ways technology could be transferred to include:

i the purchase of new equipment;

ii direct foreign investment

iii the purchase of technology licenses for domestic production of new products or the use of new processes;

iv the use of nonproprietary technology including that obtained from purchasers of exports;

v Acquisition of knowledge from returning nationals who have been educated or have worked in industrial countries and from nationals who remain in industrial countries; and

vi Domestic research and development and efforts in reverse engineering.

Rosenberg (1979: 151) argues that the transfer of technology is unrealistic because of the difficulties – institutional and otherwise – which hamper the successful adoption of foreign technology. He identified the inhibiting factors to include differences in taste, standardization; and producer initiative. He also added the absence of some more subtle managerial or administrative talents (tacit knowledge).

He further observes that the role of the entrepreneur in the neo-classical model is replaced by the capital goods industry in the transmission of technology. The capital goods industry, according to him, has the financial incentive and therefore provides the pressure (marketing, demonstration) to persuade firms to adopt the innovation which they produce. Creating a capital goods industry is, in effect, major way of institutionalization of internal pressures for the adoption of new technology. This is an extremely important activity in overcoming the inevitable combination of inertia, ignorance, and genuine uncertainty which surrounds an untried product. Rosenberg then asks: "what mechanisms or institutions can be substituted for the motivational pressure provided in the past by domestic capital goods producers on the part of poor countries which reply on distant foreign producers for their capital equipment?". Since the firms in developing countries are heterogeneous rather standardized the capital goods producers in these countries tend to be passive and adaptive rather than active initiators.

When a new machine was introduced, there exists no established system of organization for producing the machine. A very high fraction of new inventions, new products or new processes, once conceived are of no economic relevance until the capital goods industries have successfully solved the technical and mechanical problems or developed the new machines which the inventions required. This creative process on the part of the capital goods industry has been badly slighted and a recognition of the process may help us understand the widely observed failure of poor countries to develop techniques with factor – saving bias which they need (Rosenberg 1976).

From this perspective the difficulties in technology transfers for developing countries which rely on the importation of foreign capital equipment are obvious. If new techniques are regularly transferred from industrial countries, how will the learning process in design and the production of capital goods take place? Reliance on borrowed technology, Rosenberg (1976: 166) insists, perpetuates a posture of dependence and passivity. It deprives a country of the development of precisely those skills which are needed if she is to design and construct capital goods that are properly adapted to her own needs.

Innumerable unsuccessful foreign aid projects in the past have confirmed that when modern technology is carried to points remote from its sources, without adequate supportive services, it will often shrivel and die. This is partly because the technology emerged in a particular context, often in response to highly narrow and specific problems, such as may have been defined by a particular natural resources deposit. But, more important, the technology functions properly only when it is maintained and nourished by an environment offering it a range of services which are essential to its continued operation. These would include the ability to diagnose correctly the causes of machine breakdown or other sources of inferior performance, the availability of facilities and personnel to perform repair work and to provide routine maintenance and repairs, and the provision of spare parts. In the absence of the kinds of skills produced and embodied in a capital goods industry, repair and maintenance costs in the use of machinery are likely to remain high. A major reason for a domestic capital goods industry therefore, is that the ability to utilize complex machinery effectively – whatever the country of origin of the machinery – depends upon the kinds of skills which such an industry uniquely makes available.

Successful technological change seems to involve a kind of interaction that can best be provided by direct, personal contact. Successful instances of technological change in the industrial economies have involved a subtle and complex network of contacts and communication between people, a sharing of interests in similar problems, and a direct communication between the user of machine, who appreciates problems in connection with its use, and the producer of machinery, who is thoroughly versed in problems of machinery production and who is alert to possibilities of reducing machinery costs.

2.2.4 Representation of Technical Change in the Production Function

Following Solow (1957: 312 – 20) the aggregate production function is realistic and important. It can be expressed as

$$Y = f(K, L, t) \quad \ldots\ldots\ldots \quad (1)$$

where Y represents aggregate output, K represents capital and L represents labour input in physical units.

The variable t, for time or number, appears in f to allow for technical change as a short- hand expression for any kind of shift in the production function. Thus slowdowns, speed-ups, improvements in the education of the labour force, and all sorts of things appear as technical change.

2.2.5 Neutral Technical Change

It is convenient to consider the special case of neutral technical change. Technical change is called neutral with respect to certain economic variables if it does not affect these variables or functional relationships between them. Each type of these relationships then forms a certain type of neutral technical change.

According to Hicks (1932), technical change is neutral if the marginal rate of substitution between capital and labour is invariant under technical change as long as the factor proportions are unchanging. By contrast to this definition Harrod (1949) requires from neutral technical change that the interest rate does not change whenever the capital – output ratio is constant. The empirical basis of his definition was the observed constancy of both the interest rate and the capital – output ratio.

2.2.6 Definitions and Implications of Neutral Technical Change

Gehrig (1980) gave some definitions and implications of neutral technical change. The usual procedure in defining concepts of neutral technical change is to formulate invariant relationships between economic variables-such as the interest (wage) rate, the elasticity of substitution, etc, which are either empirically tested or seen to be significant.

We consider the following seven neutrality concepts:

1 The marginal rate of substitution between capital and labour remains constant at a constant capital-labour ratio. This is Hicks-neutrality.

2 The interest rate is constant at a constant output-capital ratio. This is Harrod neutrality.

3 The wage rate is constant at a constant output –labour ratio. This is Solow's neutrality.

4 The wage rate is constant at a constant out-capital ratio.

5 The interest rate is constant at a constant output-capital ratio.

6 The wage rate is constant at a constant capital- labour ratio.

7 The interest rate is constant at a constant capital-labour ratio.

(See Asimakopulos and Weldon (1963); Harrod (1948); Hicks (1932); Kennedy (1961, 1962); Robinson (1938); Salter (1960) Uzawa (1961). In the literature on the subject the neutralities (1) to (7) are called;

1 Output augmenting;

2 Purely labour- augmenting;

3 Purely capital- augmenting;

4 Labour combining;

5 Capital combining;

6 Capital additive;

7 Labour-additive, technical change, respectively

The concept of Harrod - neutral technical change implies that capital should be accumulated in order that the additional efficiency units making up the labour force should be fully equipped, and the conventional approach to productivity measurement merely attributes to this accumulation some credit additional output.

2.2.7 Compatibility of Several Neutralities

Two types of neutral technical change are called compatible if there exists a production function which represents both concepts. Otherwise they are called incompatible

Gehrig (1980: 3-21) demonstrates that among the neutrality types (1) to (7) only Hicks, Harrod, and Solow neutral technical changes are mutually compatible. All other pairs of neutrality types are incompatible.

2.2.8 Hicks-Neutral Technical Change

Technical change shifts the entire production function, and an index-number type of problem therefore arises in deciding which point on the old production function to compare with which point on the new one. Consider first a one-commodity world. Compare production functions at two different dates, between which technical change has occurred. Assume constant returns to scale. The definition of neutral technical change given by Hicks (1932) is based on comparing points on the two functions where the labour –capital ratio (L/K) is constant, L being measured in number of men and K in physical units (technical change is capital saving if the marginal product of labour is raised by more than that of capital, given K/L and it is labour – saving in the opposite case).

Technical change may be neutral in this sense, for one value of K/L but not for others, in which case there is the usual index – number problem of whether to take as the criterion the old K/L or the new one or some third one. But the definition is usually taken in the stricter sense to require that the ratios of marginal products should be unaffected by technical change at any (constant) value of K/L.

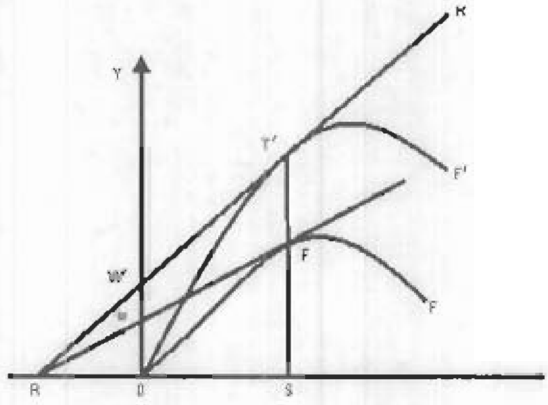

Figure 1: Production function with neutral technical change.

Figure 1, shows the production function before and after Hicks-neutral technical change. OR measures the wage- rotio, i.e. the ratio of the marginal products (Hahn and Mathew, 1964, 817).

The distinctive feature of Hicks-neutral technical change is that for any given value of the capital –labour ratio this remains unchanged by the technical change. It can be shown that in this case the curve F′ can be derived from F by raising output per head for all values of K/L ratio in the new proportion.

Restating the above in algebraic form, the treatment of technical change as an exogenous function of time (t) implies that the production function can be written as equation (I) above in order for technical change to be Hicks neutral the production function must be of the more specific form (Solow, 1957: 312-20):

$$Y \quad = \quad A(t) \quad f(L,K) \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

where A(t) is any (increasing) function of t, Hicks-neutrality takes as its standard of reference what would happen if K/L remained constant.

2.2.9 The Constant Elasticity Of Substitution (CES) Production Function

Arrow, Chenery Minhas and Solow (1961) developed the CES production function.

This function consists of three variables Y, K, and L, and three parameters A, α and ρ. It may be expressed in this form, assuming constant returns to scale:

$$Y \quad = \quad A[\alpha K^{-\rho} + (1-\alpha)L^{-\rho}]^{-\mu/\rho} \qquad \ldots\ldots (3)$$

where Y is the total output, K is capital, and L is labour. A is the efficiency parameter indicating the state of technology and organizational changes, the efficiency parameter leads to a shift in the production function, α (alpha) is the distribution parameter or capital intensity factor coefficient concerned with the relative factor shares in the total output and ρ (rho) is the substitution parameter which determines the elasticity of substitution. And $A>0$: $0<\alpha<1$; $\rho>-1$.

Klein (1985) observes that the CES production function is a family of functions in which the elasticity of substitution is an unspecified constant. This family has both the Cobb-Douglas (CD) and Leontief (a fixed proportions) productions functions as special cases. The CD function is obtained when the elasticity of substitution is equal to unity and the Leontiet function emerges in the limit as the elasticity of substitution approaches zero.

Arrow, et al (1961) presented both cross-sectional and time – series evidence that the elasticity of substitution was significantly different from both zero and unity. The conclusion from time series data was corroborated by Brown and John de Cani (1963: 289 – 309) and (1963: 386 – 94) whose alternative derivation of the CES function and empirical analysis allowed for non constant returns to scale. Romesh and Diwan (1963), came to a similar conclusion.

2.2.10 Properties Of The CES Production Function

The CES production function possesses the following properties.

(i) The CES function is homogeneous of degree one. If we increase input K ad L in the CES function by n-fold, output will also increase n - fold. Thus, the CES .production function displays constant returns to scale.

(ii) In the CES production function, the average and marginal products in the variables K and L are homogeneous of degree zero like all linearly homogenous functions. For instance, the marginal productivities of inputs K and L are:

$$\frac{\partial Y}{\partial K} = \frac{\alpha}{A^{\rho}}\left[\frac{Y}{K}\right]^{1+\rho}$$

and

$$\frac{\partial Y}{\partial L} = \frac{\alpha}{A^{\rho}}\left[\frac{Y}{L}\right]^{1+\rho}$$

(iii) From the property above, the slope of an isoquant, that is, the marginal rate of technical substitution (MRTS) of capital for labour can be shown to be convex to the origin,

$$MRTS_{L,K} = -\partial K/\partial L = MP_L/MP_K$$

$$= -\frac{1-\alpha}{\alpha}\left(\frac{K}{L}\right)^{1+\rho}$$

The parameter ρ in the CES production function determines the elasticity of substitution. In this function, the elasticity of substitution,

$$\sigma = \frac{1}{1+\rho}$$

and

$$\rho = \frac{1-\sigma}{\sigma}$$

This shows that the elasticity of substitution is a constant whose magnitude depends on the value of the parameter ρ. If $\rho = 0$, then $\sigma = 1$. If $\rho = \infty$, then $\sigma = 0$. If $\rho = -1$, then $\sigma = \infty$.

This reveals that when $\sigma = 1$, the CES production function collapses to the Cobb-Douglas production function, if $\rho <$ o, then $\sigma = -1$; and if $\rho < \infty$, then $\sigma = 1$. Thus the isoquant for the CES production function ranges from right angles to straight lines as the elasticity of substitution ranges form 0 to ∞.

(v) As a corollary of the above, if L and K inputs are substitutable for each other, an increase in K will require less of L for a given output. As a result the MP_L will increase. Thus the marginal product of an input will increase when the other input is increased.

(vi) The CES production function is also used to prove Euler's Theorem so as to distribute the relative shares of the two factors K and L in the total product.

2.2.11 Disembodied Technical Change

Disembodied technical change is purely organizational which permits more output to be produced from unchanged input, without any new investments. Disembodied technical change refers to an upward shift in the production function that leaves the balance between capital and labour undisturbed in the long run. Equation (1) represents disembodied technical change, and as pointed out earlier, t represents time.

Equation (2) is another form of the production function showing disembodied technical change in which A(t) is an index of technical change which indicates steady continuous upward shift in the production function. Such a production function implies that technical change is organizational in the sense that its effects on productivity does not require any change in the quantity of the input. Existing inputs are improved or used more effectively. They just shift the production function up through time.

Assuming that A(t) increases neutrally and exponentially at the rate of λ, the production function may be written in the Cobb-Douglas form as:

$$Y = Ae^{\lambda t} K^{\beta} L^{\alpha} \quad \text{.........} \quad (4)$$

In this form A represents the efficiency parameter and λ represents the neutral disembodied technical change.

The CES function, unlike the CD function, allows capital-saving (and/or labour-saving) technical change as well as permitting some move toward a clay world by allowing the elasticity of substitution to approach zero.

In disembodied technical change, capital is assumed as homogeneous and technical change flows down from the outside (economy). Productivity depends upon the amount of capital stock and not on its age. Disembodied technical change improves the productivity of all factors of production or those of a particular kind already existing. All disembodied technical change is capital –augmenting in which existing capital is, by one means or another, made more productive.

To explain disembodied technical change diagrammatically, assume a per capital (per worker) production function that shifts up through time.

Dividing the production function (2) through by L we have,

$$\frac{Y}{L} = A(t) f\left(\frac{K}{L}\right) \quad \ldots\ldots\ldots \quad (5)$$

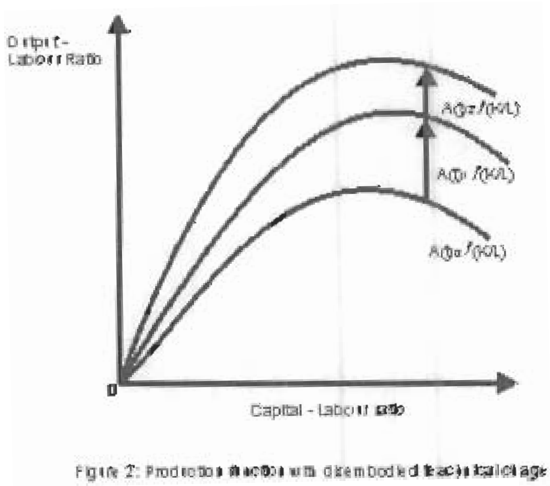

Figure 2: Production function with disembodied Technical change

In Figure 2, the per-capita production function A (t) f(K/L) shifts up through time at the rate λ to $A(t)_1 f(K/L)$ and $A(t)_2\, f(K/L)$ with disembodied technical change in capital and labour when output per head increases with a given percentage increase in the capital/Labour ratio. It shows that technical change is capital augmenting.

2.3 Empirical Literature Review

Some researchers have empirically researched on the relationship between technical change and the export of products of the manufacturing industry. The survey report by the world bank regional programme on enterprises development (RPED) (2001) on the manufacturing sector in Nigeria used the cost minimization approach. According to the report the determinants of productivity in the Nigerian manufacturing industry include capital, labour, ratio, of skilled to unskilled workers, capacity utilization, age of firm percentage for foreign equity, percentage of inputs imported and age of equipment. The inputs of labour and capital were highly significant in determining value – added per worker. The ratio of skilled to unskilled workers was significant at the 10 percent level, as were capacity utilization and age of the firm. Capacity utilization averaged about 52 percent for the entire sample, with very large firms utilizing significantly more capital (60 percent) than others. Foreign and non- African owned firms were also found to have greater capacity utilization than local and African owned firms The value –added per worker was found to be driven by the size of the firm. The smallest firms had the lowest value–added but large firms had a value added per worker that is significantly greater than the smaller firms . The age of the equipment used was negatively and significant correlated with value added.

Similar to the World Bank RPED (2001) study, the Untied Nations Industrial Development Organization (UNIDO) jointly carried out a survey in the centre for the study of African economies (CSAE) of the University of Oxford (2001) on the performance of Nigerian manufacturing firms. The survey involved 180 firms of different sizes in four broadly defined manufacturing sub-sectors including food processing, textiles, garments, wood works, paper processing, metal, machinery and chemicals.

From the report, labour productivity differs significantly across sectors and over the size of each firm. Food was the most productive sub–sector, followed by metal, then textile, and garments which took the last position. Large forms had more than 200 percent higher productivity than micro firms. Under total factor productivity, food was still the most productive sector followed by metals. Garments moved to the third position while textile became the least productive.

The firms with foreign ownership were found to have a 52 percent higher total factor productivity than firms with local ownership. Also, young firms were observed to be more productive than mature firms. Generally, total factor productivity showed positive causal effect on investment.

The UNIDO-CSAE (2001) survey report further shows that few manufactured goods were exported, and from this only 6 percent of the firms in the entire sample export their products and only 3 percent of them export out of Africa. Through regression analysis, the report shows that firms that are more efficient are more likely to export their products. This is in accordance with the self- selection hypothesis. Only efficient firms could overcome high transactions costs

The Central Bank of Nigeria, the Federal Office of Statistics, and the Nigerian Institute of Social and Economic Research, CBN/FOS/NISER (2001) in their joint survey adopted the mixed households and enterprises survey approach in the study of informal manufacturing enterprises in Nigeria and observed that these firms are highly labour intensive and are dominated by small size operators in terms of number of people employed. In general, employment size of between1and 5 people is dominant across activity sectors while an insignificant number of enterprises employed more than 20 persons. The firms derive a greater proportion of their raw materials and other inputs locally and largely from the informal sector. The average capital outlay was estimated by the report at N765, 196 per enterprise.

The report further observes that factor income has the largest percentage (over 60 percent) of the gross income or, sales value in nearly all sub-groups. The bulk of this factor income is appropriated as operating surplus by owners and this hardly translates into capital accumulation to strengthen and expand the firms. The consequence of this is that informal manufacturing firms remain small and eventually close down with the death of the owner. The sub-sector. (informal manufacturing), the report notes, contributes 7. 0, percent to the gross domestic product of Nigeria.

The informal manufacturing firms exhibit potentially high linkage effect with the rest of the economy in terms of their demand for raw materials and other intermediate inputs, and actually the linkage effect among the informal sector enterprises is high, but this is small with reference to the large economy. Olaoye (1985) estimated the total factor productivity (TFP) of the Nigerian manufacturing industry (aggregate) to be 2.06 percent. To him TFP represents;

- amount of expenditure a firm or an industry devotes to research to develop new product or cost-reducing technology;
- the research and development financed by the Universities and the Government research institutes;
- the degree of unionization in a firm industry. This affects productivity negatively. That is, through collective bargaining, unions take part in

decisions that set the pace of innovation and technological advance in industry are positively related to productivity, but they have unfavorable impact on employment. Unions then tend to decrease the pace of innovations and technological advance. Thus, the greater the extent of unionization in an industry, the lower the productivity.

- increase in the scale of output which open up possibilities of economies of scale through greater specialization of personnel, equipment and firms; health and safety; and
- mobility of factors.

For estimation, Olaoye followed Jorgenson and Griliches (1967) to measure TFP as the ratio of the index numbers of total output to total inputs. This method by-passes the production function.

Prescott (1991: 1) investigated the argument that the differences in physical and intangible capital do account for the large international income differences that characterize the world economy today, but concluded that they do not. Savings rate differences are of minor impotence. What is of utmost importance is TFP. In addition, the paper presents industry evidence that total factor productivities differ across countries and time for reasons other than differences in the publicly available stock of technical knowledge.

These findings led Prescott to look for a theory that could account for differences in TFP that arise from reasons other than growth in the stock of technical knowledge. He concludes that one factor contributing to the growth of TFP is increase in usable knowledge. For him usable knowledge explains why TFP in the United States today is four times greater than it was in 1850, but it does not explain why TFP in the U. S. is about four times greater than it is in Nigeria. This discrepancy exists despite the fact that knowledge used in the U. S. is there to be used by Nigeria to increase her TFP. The reason that Nigerian workers are less productive after correcting for stocks of tangible and intangible capital is that this usable knowledge is not as fully exploited in Nigeria as it is in the U. S., Prescott argues. The analysis by Prescott is a pointer to the fact that TFP consists of technical efficiency and technical change, and lends credence to the impact of tacit technology.

Pack (1992) observes that the TFP changes in the poorest countries is negative and that neither the neoclassical nor the endogenous growth accounting models could explain this. Mishimizu and Pack (1982) offer an interpretation of TFP change that brings together concepts of technical efficiency and technical change.

They observe that inter-sectoral (industry) rate of TFP change were negative in many developing countries over extended periods of time. Negative TFP change they contend, is equivalent to an increase in real per unit cost of production and that it is contrary to traditional interpretations of the residual in growth accounting exercise as technical progress. Technical efficiency therefore accounts for the negative TFP change, they conclude. Technical change is associated with movements in best practice. It may be zero or positive but never negative, they reason. Change in technical efficiency, however, are changes in the efficiency with which best practice is applied. These can be positive or negative, depending on whether an economy (or firm) is catching up to or falling behind best practice.

The rate of disembodied, neutral technical change is obtained by the formular; $10^{\lambda} - 1$ where λ is the term representing technical change. Klein (1985: 388) used simultaneous (continuous) estimation methods and data from the U. S. economy for the period 1909 to 1949 obtained a point estimate of 1.49 percent per annum, using the multiplicative errors formulation or 1.37 percent per annum, with addition errors. He argued that, allowing for increasing returns to scale reduces one's estimates of the pace of neutral technological progress of the disembodied type in a period when factor inputs increase rapidly.

Arrow, et al (1961: 244) using the same data and CES formulation as Klein, but without increasing return to scale, estimated a rate of neutral technological progress equal to 1.83 percent per year, which is somewhat larger than the estimates of Klein (1985: 388).

The technical change coefficient could also be obtained from CES production function, with labour and capital inputs being exogenous and real output and relative factor prices being endogenous (just the opposite of the estimates considered (above). This would be an appropriate model if factors were always fully employed and if the growth of the labour and capital inputs over time were totally unresponsive to economic conditions (Klein, 1985: 390).

CHAPTER THREE

RESEARCH METHODOLOGY

In this chapter we discuss the population of the study, method of data collection, instrumentation, sample size, sampling unit, sampling method, validity of test instrument, reliability and model specification.

3.1 Population of The Study

The population of interest in this work is the manufacturing industry in Imo State of Nigeria. This was purposively reduced to the manufacturing firms in Imo State because of the difficulty of sampling manufacturing firms in Nigeria.

In Imo state, the ministry of commerce and industry generously made available to us a list containing l4l manufacturing firms in the state. This number includes the informal manufacturing units, the small and medium scale enterprises and the large scale manufacturing firms (including the multinational firms). This list is attached to the appendix.

3.2 Method of Data Collection

We used the survey method to collect primary data from the manufacturing firms in Imo State. The data were collected for the 2005. We collected data for the year 2005 during which period they were all known and could be made available.

3.2.1 Instrument of Data Collection

The questionnaire was the basic instrument used in the data collection. It consists of 10 structured questions which raised the data for the estimation of the model and testing of the hypothesis. The questions were made simple and straight to the point. In the preamble we introduced the researcher and the purpose of the questionnaire. Then we appealed to the respondents to cooperate with the researcher to enable him achieve his objective. The data sought were sensitive information which the firms were reluctant to release. A copy of the questionnaire is attached at appendix 2.

3.2.2 Sample Size

The number of copies of the questionnaire distributed was determined by the use of adequate statistical approach itemized below as suggested by Robert (1989:64):

- the population was determined;
- the margin of error was determined;
- a sampling technique was used;
- the "Yaro Yamane' formula for determining sample size was applied. The formula is:

$$\text{sample size } (n) = \frac{N}{1 + N(e)^2}$$

where

N = population of the study;

n = sample size to be determined;

e = margin of error. The margin of error in this study is the level of significance, 5 percent. For our study

Population , N, = 141.

Thus the sample size,

$$n = \frac{141}{1 + 141\,(0.05)^2} = \frac{141}{1.3525} = 104.25$$

$$\cong 104$$

We distributed 104 copies of the questionnaire to the manufacturing firms listed in the appendix.

3.2.3 Sampling Unit

The sampling unit refers to the person who answers the questions in the questionnaire. Because of the nature of data we sought we gave the questionnaires to the managers, who in turn directed them to the accountants and other relevant officers of the firm, for example, the engineering department.

3.2.4 Sampling Method

The firms were scattered in all the 27 Local Government Areas of Imo State. A combination of purposive and cluster sampling methods was adopted. We selected the three urban local government areas purposively because the manufacturing firms were clustered mainly in the urban areas. Then we used simple random sampling method to select 12 other local government areas in which we could make up the 104 firms.

All the manufacturing firms in the selected local government areas were surveyed.

3.2.5 Response Rate

After distributing the questionnaires an intensive follow-up visits that lasted for about four months, we were able to receive 21 fully completed questionnaire which were used for the analysis. Good enough, some of the firms produced more than one output. We eventually obtained 60 data sets, from the 21 firms.

The details are contained in the appendix.

3.3 Validity of Test Instrument

To ensure that the instrument used for the study is valid, a pretest of the questions was made with five of the manufacturing firms in Owerri, Imo state. This was to ensure that the questions would be clearly understood and that the information sought could be obtained.

3.4 Reliability

The questions that were pre-tested were matched with the data required to estimate the model. This verified the applicability and reliability of the questions in the questionnaire before it was finally distributed.

3.5 The Model Specification .

Our study adopted the Constant Elasticity of Substitution (CES) production function because of its desirable properties discussed in chapter 2

The CES production function may be written as

$$Y = A10^{\lambda t}[\delta k^{-\rho} + (1-\delta) L^{-\rho}]^{-\mu/\rho} + u \quad \ldots\ldots\ldots\ldots(1)$$

where Y = total output of the firm, K is capital and L is labour (measured in man hours). A is the parameter indicating the efficiency part of total factor productivity. δ is the distribution parameter or capital intensity factor coefficient concerned with the relative factor shares in the total output, ρ(rho) is the substitution parameter which determines the elasticity of substitution, and μ is the parameter that measures returns to scale.

t is the variable representing technical change and λ is the coefficient of technical change. In time series data t is represented by time period but in cross-sectional data (as in this research) t is the mere number of the data sets. u is the error term.

The elasticity of substitution, denoted by σ is given by:

$$\sigma = \frac{1}{1+\rho} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

The CES production function is a strongly nonlinear function of the parameters A, λ, δ, ρ, and μ, which cannot be made linear by a logarithmic or other simple transformations. The natural procedure in this case would seem to use nonlinear methods of estimation.

It should be noted that we do not assume constant returns to scale by restricting μ to unity. We allow this parameter to be determined from the sample.

With the CES production function formulation, the marginal productivity relationship based upon cost minimization, may be written:

$$\frac{P}{w} = \left(\frac{\partial Y/\partial K}{\partial Y/\partial L}\right) = \frac{\delta}{1-\delta}\left[\frac{K}{L}\right]^{-(1+\rho)} + v \ldots\ldots\ldots\ldots (3)$$

The two-step procedure for estimation of CES production function would be to transform equation (3) logarithmically into:

$$\log\left(\frac{P}{w}\right) = \log \frac{\delta}{1-\delta} - [\rho+1] \log \left[\frac{K}{L}\right] + \log v \ldots\ldots\ldots\ldots (4)$$

and to compute estimates of $\left[\frac{\delta}{1-\delta}\right]$ and $(\rho+1)$ as regression coefficients.

With estimates of δ and ρ from this regression of logarithmic ratio variables, one can form

$$\text{Log } Y = \log A + \lambda t - \mu \log(\hat{\delta} K^{-\rho} + (1-\hat{\delta}) L^{-\rho}) + \log u \text{ ....(5)}$$

We next estimate A, λ, and μ from a second regression of log Y on t and

$$[\delta K^{-\rho} + (1-\delta) L^{-\rho}]$$

This is the procedure we used in the estimation of the parameters in this study.

3.6 Method of Estimation

We estimated the parameters of the CES production function with the Stata statistical (econometric) package. The Stata package is quite suitable for estimating models using cross sectional data.

3.7 THE STUDY AREA: IMO STATE OF NIGERIA HISTORY

Imo State is one of the 36 States of the Federal Republic of Nigeria. The state was created when the former East Central State of Nigeria was split into Anambra and Imo States on February 3, 1976. In June 1991 Abia State was excised from Imo state. It is one of the five States in the South-East geo-political zone in Nigeria.

Geography

Imo State is located in the tropical rain forest zone of West Africa. It is bound on the East by Abia State, on the North by Enugu State, on the west by Anambra State and on the South by Rivers State. There is a luxuriant growth of trees in the State where urbanization has not destroyed the original forest. The climate is tropical, humid and the vegetation is equatorial rain forest with an average maximum temperature of 34^0C and an average temperature of 25^0C. The two major seasons experienced in the State are the dry season (November – March) and the rainy season (April – October).

It is centrally located at the heart of the nine States of the former Eastern Region of Nigeria hence it is called the "Eastern Heartland." The city of Owerri is the capital of Imo State. The major cities of these nine states are equidistant from Owerri. The important rivers in the State are the Imo, Njaba, Urashi and Otamiri. The State derives its name from the Imo River. The major lakes in the State are the Abadaba and Oguta Lakes.

Demography

Imo State has a projected population of 2.49 million people with a growth rate of about 3.0% based on the 1991 population census. The land area is 5,289.49 square kilometers. The population density is 686 persons per square kilometer. It is one of the States that have the largest population density in Nigeria. The State is divided into three geo-political zones namely, Owerri, Okigwe, and Orlu with 27 Local Government Areas. The people of Imo state are predominantly farmers, although a good proportion of the people are traders.

Overview of the Economy

Imo State has a land area of 5,289.49 square kilometers as noted above. Its vegetation is quite suitable for food production. The State is endowed with natural resources/mineral deposits which are yet to be fully exploited. Some of these minerals include gypsum, salt, clay, kaolin and crude oil and gas, which place the State as the 6th highest oil producing State in Nigeria.

There is a good network of roads in the State though most of them are in a dilapidated state. In the rural areas, the State economy is predominantly sustained by micro-productions of palm oil, cocoa, cassava, rice, vegetable, etc.

There are eight tertiary educational institutions in the State namely: the Federal University of Technology, Owerri; the Imo State University, Owerri; the Federal Polytechnic, Nekede; the Alvan Ikoku College of Education, Owerri and the Michael Okpara College of Agriculture and

Technology, Umuagwo; School of Nursing, Owerri; School of Health Technology, Amaigbo and the Federal School of Land Resources, Egbeada. Presently, there are 307 secondary schools and 1,230 primary schools that are State owned. Several other secondary and primary schools that are privately owned exist side by side with the State owned schools. There are18 General Hospitals, 1,288 Primary Health Centres, 365 private hospitals, 12 mission hospitals. 1. Federal Medical Centre and 1 teaching hospital. There are also other institutions that train middle level manpower. Some of these institutions include the Technological Skills Acquisition Centre Orlu, School of Health Technology, Amaigbo and Co-operative College, Ehime, etc.

RESOURCE PROFILE:

Imo State revenue base is largely dependent on the statutory allocation from the Federation account, Value Added Tax (VAT) and Mineral derivation. Other sources of revenue include grants from Donor Agencies, both within and outside Nigeria and lastly Internally Generated Revenue (IGR). These are shown in table 1 below.

Table 1. Total and Internally Generated Revenues in Imo State 1999-2004

Year	Total Revenue	IGR
1999	3,377,797,343	251,851,423
2000	8,502,660,698	693,428,622
2001	12,310,156,199	2,289,750,617
2002	12,804,487,138	847,223,722
2003	16,641,669,397	1,205,619,628
2004	23,090,535,514	1,512,334,764

Source: Imo TRIPOD Vision: State Economic Empowerment and Development Strategy (SEED) 2006. page 15

The internally generated revenue has been growing at a decreasing rate over the years. In 1985, budgeted IGR was N117,848,230 (37.75%) of total budgeted revenue while performance stood at 34%. It decreased to 17.73% of budgeted revenue and 7.46% performance in 1999. This downward trend continued as the IGR recorded 11.77% and 7.24% in 20003 for budgeted and actual revenue respectively.

Human Resources

The total population of Imo State using the 1991 population was 2.49 million as already noted and spread across the 27 Local Government Areas. The population is further subdivided as follows:

Table 2: Distribution of Imo State 1991 Population

Age Group	Male	Female	Total	%
0-14 (under aged)	538,899	576,485	1,115,384	44.87
15-64 (active group)	586,723	703,126	1,289,849	51.90
65 & Above (aged group)	40,826	39,576	80,402	3.23
Total	1,166.448	1,319,187	2,485,635	100%

Source: National Population Commission 1991 Population Census

Table 3: The Work Status of the Active Groups is analyzed as follows:

Gender	Currently Employed	Previously Employed	Seeking Employment	House wife	Students	Self Employed	Others	Total
Male	361,314	11,090	42,663	-	322,073	14,571	26581	778,292
Female	317,969	5,847	50,219	207,190	345,241	10,281	25,728	962,385
Total	679,283	16,937	92,792	207,190	667,314	24,852	52309	1,740,677

Source: National Population Commission 1991, Pop. Census

Majority of economically active population are engaged in subsistence agriculture and related jobs while others are artisans. The 75% of female population live in the rural areas and are predominantly engaged in subsistence agriculture.

Manufacturing Industry in Imo State

There are 1,399 manufacturing firms in Imo State of which 22.1 percent are registered and 77.9 percent are not registered (see Table 4).

Over 80 percent of these manufacturing firms are mall and medium scale. Numerous problems plague these firms, such as lack of infrastructure, power, good judicial system, multiple laxes and levies.

Table 4: Distribution of Manufacturing firms in Imo State, 1996

% Registered	%Not Registered	Total No
22.1	77.9	1,399

Source: National Bureau of Statistics: Annual Abstract of Statistics, 2006, P. 313.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

The data employed in this study are those collected in the field survey from manufacturing firms in Imo state of Nigeria. Our data were those generated in the firms in 2005. The labour input is measured in manhours. The capital stock is the book value of machinery and equipment as at 31 December 2005 including buildings. An alternative would have been to obtain an independent measure of the degree of capacity utilization as a measure of capital. But records of independent degree of capacity utilization could not be obtained from the firms surveyed. Appendix 1 contains the data generated during the survey of manufacturing firms in Imo state of Nigeria.

Table 1 presents the first step in the estimation of the parameters of the CES production function. In the table, the first column is the estimate of the log-linear regression coefficients. The second is the standard error of the estimate of the parameters. P is the price of capital good proxied by the price of the final good, w is wage rate. The ratio p/w is a measure of the real profit (inverted). The computations were performed on the logarithms of all the variables.

The statistical picture which emerges from the estimation is one of a reasonable fit (R^2 is about 60%) of the CES production function.

Heteroscedasticity test was conducted using the cook-weisberg test. The omitted variable test was also conducted using the Ramsey RESET test. Test for autocorrelation could not be conducted because the Durbin-Watson statistics could not be computed. The values of the t-variable were not regular, as the Stata computer package indicated. This does not constitute a serious problem since econometric theory tells us that autocorrelation is a rarity in cross-sectional data.

4.1 Result of Estimation of the Parameters of the CES Production Function

The Constant Elasticity of Substitution (CES) production function was estimated in two steps. The first step consists of the estimation of the model;

$$\text{Log}\left(\frac{P}{w}\right) = \log\left(\frac{\delta}{1-\delta}\right) - (\rho+1)\ \log\left(\frac{K}{L}\right) + \log v$$

The Stata computer package gave the estimates as:

Table 1: Estimates of the parameters of the CES production functions:

P/W	Coef.	Std. error	t	P>ItI	[95% Conf. Interval
K/L	-0.6729287	0.149285	-4.51	0.000	-0.971755 to 0.3741024
Constant	7.223184	0.7966505	9.07	0.000	5.628515 to 8.817654

Number of observations	=	60
F(1,58)	=	20.32
Prob > F	=	0.0000
R-squared	=	0.2594
Adj. R- squared	=	0.2467
Root MSE	=	2.4416

Tests of Hypotheses

Hypothesis One

H_{01}: The Constant term $\left(\frac{\delta}{1-\delta}\right) = 0$

H_{11}: The Constant term $\left(\frac{\delta}{1-\delta}\right) \neq 0$

With 5 percent significance level, and 58 degrees of freedom the tabular t = 2.021

Decision rule:

If the absolute value of t-calculated is higher than tabular t, reject the null hypothesis and accept the alternative hypothesis, otherwise, you accept the null hypothesis. From table 1, t-calculated = 9.07 is higher than tabulate t = 2.021.

We therefore conclude that the estimated constant $\left[\frac{\delta}{1-\delta}\right]$ = 7.223181 is statistically significant

Hypothesis Two

H_{02}: The coefficient of the capital-labour ratio, $(\rho + 1) = 0$

H_{12}: The coefficient of the capital –labour ratio, $(\rho + 1), \neq 0$

Decision:

Since the absolute value of t-calculated ($t^c = 4.51$) is higher than tabular-t ($t_{0.025} = 2.021$), we reject the null hypothesis and accept the alternative hypothesis at the 5 percent level of significance. We therefore conclude that the estimated coefficient of the capital labour ratio [$(\rho + 1) = 0.6729287$] is statistically significant.

Computation of $\dot{\rho}$, $\hat{\delta}$ and the their standard errors.

$$\frac{\delta}{1-\delta} = 7.223184$$

From this equation $\hat{\delta}$ = 0.8783926.

Also

$$-(\rho + 1) = -0.6729287$$

and this gives $\dot{\rho}$ = - 0.3270713.

These values of $\hat{\delta}$ and $\dot{\rho}$ were used to compute $[\delta K^{-\rho} + (1-\delta)L^{-\rho}]$

Details of the computation is shown in appendix

This constructed value is used along side with the values of K/L and t to estimate other parameters of the equation:

$$\text{Log } Y = \log \hat{A} + \lambda t - \frac{\mu}{\rho} \log (\hat{\delta} K^{-\rho} + (1- \hat{\delta}) L^{-\rho}) + \log v$$

Also using the Stata computer package we obtained:

Table 2: Second step estimates of the parameters of the CES production function

Y	Coef.	Std. Error	t	P>ltl	[95% Confid	Interval]
μ/ρ	-2.71518	0.7098741	-3.82	0.000	-4.135017 to	-1.29202
λ	-0.5106658	0.4992499	-1.02	0.311	-1.510396 to	0.4890649
A	5.411812	2.50724	2.16	0.035	0.3911515 to	10.43247

No. of observations = 60

$F(2,57) = 9.41$

Prob > F = 0.0003

R-Squared = 0.2483

Adj. R-Squared = 0.2219

Root MSE – 2.5719.

Hypothesis Three

H_{03}: A = 0

H_{13}: $A \neq 0$

With 5 percent level of significance and 54 degrees of freedom the table value of t- statistic = 2.021.

Decision

Since the t-calculate = 2.16 is higher than the t-table value = 2.000, we reject the null-hypothesis and accept the alternative hypothesis. We therefore conclude that the estimated value of A = 5.411812, is statistically significant.

Hypothesis Four

H_{04}: $\lambda = 0$

H_{14}: $\lambda \neq 0$

With 5 percent level of significance and 54 degrees of freedom table value of t-statistic = 2.000.

Decision

The absolute value of t-calculated t_c = 1.02 is less than the t-table value, $t_{0.025}$ = 2.000. The null-hypothesis is accepted and we conclude that the estimated value of λ = - 0.5106658 is not statistically significant at the 5 percent level.

Hypothesis Five

H_{05}: $(\mu/\rho) = 0$

H_{15}: $(\mu/\rho) \neq 0$

With 5 percent level of significance and 54 degrees of freedom the table value of t – statistics = 2.000.

Decision

Since the absolute value of t-calculated = 3.82 is higher than the t-table value = 2.000, we reject the null-hypothesis and accept the alternative hypothesis. We therefore conclude that the estimated value of (μ/ρ) = - 2.713518, is statistically significant. Since ρ was estimated earlier as – 0.3270713, then μ/ρ = - 2.713518 and μ = 0.88751356.

4.1.2 Test for overall goodness of fit

The computed F-value, F(2,57) = 9.41 and the F-table value, F(2,57) = 3.23 at the 5 percent level of significance. Since the estimated F-value is higher than the F-value from the table, we conclude that the fit of the regression equation is good.

Other econometric tests

The Stata econometric package also gave the tests for heteroscedasticity.

Cook –Weisberg test for heteroscadasticity using fitted values of Y

H_0: The variance is not constant

H_1: The variance is constant

α/n = 0.00083

Chi 2(1) = 17.30

Prob > chi z = 0.000

The decision rule is: if the ρ - value obtained in the estimation is below α/n, we conclude that the estimate is significant at 5 percent level. Thus, the variance is constant.

4.3 Discussion of Finding. To recall our definition, technical change or technological process may be generated by applying scientific discoveries in the production process or by continuous improvement on existing machinery, but we were concerned with the latter which is Hicks neutral disembodied technical change.

Hicks neutral disembodied technical change is one in which the ratio of the marginal rate of substitution between capital and labour is invariant as long as the factor proportions are unchanging.

The disembodied technical change refers to an upward shift in the production function that leaves the balance between capital and labour undisturbed in the long run. It is purely organizational which permits more output to be produced from unchanged inputs, without any new investment.

In this study we adopted Hicks neutral disembodied technical change, that is, we investigated how improved managerial skills, continuous maintenance and repairs of existing machinery and equipment and the application of currently produced capital assets affect the output of the manufacturing industry in Imo State of Nigeria, with particular reference to Imo State. From our analysis this disembodied neutral technical change makes an insignificant contribution to the output of manufacturing firms in Imo State and generally in the economy.

Labour and capital contributed to the output of the firms and the capital input appears to contribute more than labour as indicated by the coefficient of capital (δ = 0.88) in the CES production function we used. The contribution of labour [(1-δ) = 0.12] is relatively low. If these are expressed in percentage, we may say that capital contributes 88 percent while labour contributes 12 percent, to the output of manufacturing industry in Imo State.

In the manufacturing firms in Imo State, many of the large firms formed under import substitution industrialization strategy had closed down and their equipment and machinery are lying idle, and some have become outdated. The few large scale firms that survived were operating far below installed capacity. Some of the managers we discussed with complained that they no longer had the ability to import spare-parts for many of the installed machinery and equipment. The firms therefore limited their operations to the inputs and raw materials that were either sourced locally or those that they could import with their limited resources. Another factor that affected their operation severely is the unsteady, unreliable and insufficient supply of electricity. The firms were therefore compelled by prevailing economic circumstances to install their own electricity generating plants. There is enough market for their products and they supplied a fraction of the local demand. The firms do not engage in research and development because, according to them, there is no incentive to do so. The government agencies were more interested in collecting taxes and other levels from them rather than motivate them to improve their productivity. Loans from the financial institutions were difficult to obtain.

Further enquiries from the firms and the Ministry of Science and Technology show that there is no separate policy on technological development. The government believes that the policy on science and technology and the effort of the researchers in the educational institutions would spark-off inventions and innovations that would impact greatly on the productivity of the manufacturing firms. As a result of low profit margins some of the manufacturing firms do not even retrain their staff. They retrench some of their workers, due to dwindling revenue.

None of the firms we surveyed had a patent or licence for its production. New ways of producing the products are not ventured with and no new products are developed. But some of the firms advertise their products and package them attractively for the customers to be enticed.

The small enterprises are labour intensive, but the medium and large scale firms are capital intensive. In all, the dismal marginal product to labour is of concern.

Our regression result reveals that the marginal product of labour is about 12 percent while the marginal product of capital is about 88 percent. Considering the high level of unemployment in Imo State in particular and Nigeria in general, the ratio of marginal product of capital to that of labour is unsatisfactory. The technical change should be regulated to establish labour intensive but highly productive technology. We believed that this could be achieved through a distinct policy on technology, which will be firm based. In the firm based policy the manufacturing firms should be compelled by law to contribute to research and development and where appropriate they should set some proportion of their profit to research and training and retraining of their staff.

Rosenberg (1976) argues that the capital goods industry is vital to the take-off and nurturing of technological progress. We observe that the capital goods industry in Nigeria is still at its infancy. We are of the opinion that a distinct technology policy will ameliorate this situation.

Thus the capital goods industry should be fortified through policy and this will spark-off technological progress and consequently improve productivity in the manufacturing industry in Nigeria.

The quality and quantity of domestic production should improve through technical change. This will enable the firms launch themselves into the export market. The export market will in turn improve the technical change.

CHAPTER FIVE

Summary of Findings, Conclusion and Recommendation

5.1 Summary Of Findings

This study has the objective to investigate the impact of technical change on the productivity of manufacturing industry in Nigeria. We limited the scope of the study to the impact of tacit technology, that is Hicks neutral disembodied technical change. We selected the manufacturing firms in Imo State of Nigeria and distributed 104 copies of the questionnaire to the manufacturing firms in the State. Twenty one of the firms completed and returned the questionnaires sent to them. The multinational firms and other firms that have their headquarters outside Imo State did not return questionnaires given to them.

We analysed the data collected with the constant elasticity of substitution production function because of its superiority to other production functions. The Stata statistical package was used to estimate the parameters of the production function.

The regression result shows that the production function of the manufacturing firms in Imo State is capital intensive and the marginal product of lobour is less than the marginal product of capital. The technical change variable did not make an Impact on the output of these manufacturing firms at the 5 percent level of significance. Also the large scale firms were decaying for lack of technological progress among other constraints. The small and medium scale firms were not motivated through policy to enhance their technological input. The policies in existence in Nigeria are science and technology policy, which is not firm- based, and education and training policy, which focuses on the educational and training institutions rather than the firms.

The capital goods industry, which is the modern carrier of technology, is at its infancy and has not been given a boost in Nigeria.

5.2 Conclusion

Technical change, which in our study is defined as continuous improvement on existing capital inputs through labour trained to exhibit modern relevant skills, does not make significant contribution to the productivity of the manufacturing industry in Nigeria. Capital contributes larger proportion than labour to the productivity of manufacturing industry in Imo State.

5.3 Recommendations

This study recommends that the Nigerian Government could fortify the impact of technical change on the productivity of the manufacturing industry by separating the technology policy from the policy on science and technology, and education and training policy. In this way the technology policy should be firm based. The firms should be compelled by law to improve their technology input by engaging in research and development in which case a specified percentage of their profit should be devoted to this regard. Any firm that makes a break-through in new product, new method of production, etc, should be given patent right for the discovery for a specified time.

The capital-goods industry should be encouraged. The iron and steel complexes in Nigeria which are being rehabilitated should be continued. The current exercise of commercialization and privatization of these projects are encouraging but the Government should monitor the exercise very closely to achieve the desired result.

Nigeria embarked on the restructuring of her economy in 1986. The manufacturing firms have not fully adjusted to this restructuring. Some policies that could facilitate the gains of the restructuring have not been put in place (such as policies on the funding of these firms). Even the implementation of the restructuring policies is still going on, for instance the commercialization and privatization exercise.

Some of the government owned manufacturing enterprises are yet to be privatized or commercialized. The iron and steel sub-sector which is vital in the machine tools and spare parts manufacturing is not yet fully privatized and operational.

Repairs and maintenance of the machines and equipment in the manufacturing industry should be intensified through training (at home and abroad) of the technical staff. The firms should be encouraged to enter into contractual agreements with the manufacturers of the capital inputs for the training of the technical staff, who carry out daily repairs and maintenance of the capital inputs. This will have positive impact on the productivity of these firms. The local engineers should engage in reverse engineering in which capital equipment manufactured abroad are dismantled to study their operations. This will enable the local engineers produce imitations of these capital equipment. In the long run better equipment will be produced.

In the technology policy, the government and the private sector should collaborate to bring back home Nigerians who have acquired relevant skills and experience but who are living and working in foreign countries. In this way these Nigerians who are embodiments of tacit technology, will impact positively on the technological change of the manufacturing firms in the country.

Through improved efficiency and large scale production, goods manufactured in Nigeria should be exported as this is another way to improve technical change and hence productivity.

The infrastructural facilities should be improved upon and conducive environment should be created to enhance the productivity of the manufacturing firms in Imo State in particular and Nigeria in general.

Labour-intensive methods of production should be adopted since Imo State endowed with adequate supply of manpower.

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Appendix 1a

Growth rates of real GDP: 1971-2003

Year	Growth rate of real GDP
1971	20.8
1972	8.5
1973	1.3
1974	11.8
1975	-2.9
1976	10.7
1977	8.3
1978	-7.3
1979	33.4
1980	-0.6
1981	3.4
1982	9.4
1983	-6.2
1984	-4.5
1985	-0.1
1986	0.5
1987	-4.9
1988	3.7
1989	-11.4
1990	8.2
1991	4.7
1992	2.3
1993	1.3
1994	2.2
1995	4.4
1996	2.8
1997	2.9
1998	0.4
1999	5.4
2000	6.4
2001	3.5
2002	10.2

Source: (1) FOS (1996) Socio-Economic Profile of Nigeria, p. 23

(2) CBN (2003) Statistical Bulletin, Volume 14, p. 245

Appendix 3

Contributions of Selected sectors to the Gross Domestic Product of Nigeria, 1959/60 2003.

Year	Agriculture	Mining and quarrying	Manufacturing
1959/60	65.2	0.008	3.7
1960/61	65.6	1.4	3.9
1961/62	64.7	1.7	3.9
1962/93	61.8	2.1	5.6
1963/64	61.5	2.1	6.0
1964/65	58.7	2.7	6.1
1965/66	55.2	4.8	7.2
1966/67	51.9	6.9	7.3
1967/68	2.8	6.4	7.4
1968/69	52.6	3.3	7.9
1969/70	47.4	8.1	8.2
1990/71	44.7	11.9	7.5
1971/72	42.1	14.9	6.5
1973/74	38.0	17.0	7.8
1974/75	29.8	18.0	4.4
1967475	29.6	18.3	5.10
1975/76	25.4	14.1	7.7
1976/77	22.5	16.5	7.2
1977/78	21.4	15.8	6.6
1978/79	23.0	24.0	7.0
1979/80	20.0	28.0	8.
1980	21.0	24.0	11.0
1981	34.4	15.28	9.89
1982	35.77	13.73	11.21
1983	37.68	13.79	8.36
1984	37.78	16.11	7.82

1985	40.33	15.58	8.56
1986	42.72	14.11	7.98
1987	41.54	12.84	8.43
1988	41.51	12.65	8.65
1989	39.06	13.52	8.19
1990	39.06	13.18	8.15
1991	38.60	13.73	8.50
1992	38.25	13.69	7.86
1993	37.78	13.37	7.34
1994	38.30	12.92	6.90
1995	39.0	13.00	7.00
1996	45.0	13.00	7.00
1997	40.0	13.00	6.00
1998	40.0	13.00	6.00
1999	41.0	11.00	6.00
2000	39.0	12.00	6.00
2001	40.0	12.00	6.00
2002	41.0	10.00	6.00
2003	40.0	9.00	6.00

Sources:

1. Date for the 1959/60 – 1961/62 period were at 1957 constant prices and the source is digest of statistics, vol. 15, no, 3 and 4, July and October 1966, FOS, Logos 103.
2. Data for the 1962/63 – 1972/73 period were at 1962/63 constant prices and the source is the annual abstract of statistics, 1975, FOS, Lagos: 149
3. Data for the 1973/74 – 1977/78 period were at 1973/74 constant prices and the source is the annual abstract of statistics, 1981 edition, FOS, Lagos; 136

4. Data for the 1981 – 1994 period were at 1984 constant prices and the source is the national accounts of Nigeria, 1981 to 1994, FOS Lagos.
5. Data for the 19995 20003 period were at 1990 constant basic prices and the source is statistical bulleting, CB, Abuja 294 - 253

APPENDIX 1
Primary data raised from Questionnaire

Name of Firms and the primary data compiled from the questionnaires	Labour (Number of men)	Capital (naira)	Output (naira)	Wage (naira)	Price (naira)
Charles Ben Welding Fab. A	1232	240,000	1,200,000	984,000	50,000.00
Charles Ben Welding Fab. B	1232	240,000	2,000,000	984,000	10,000.00
Charles Ben Welding Fab. C	1232	240,000	34,000,000	984,000	113,333.33
Charles Ben Welding Fab. D	1232	240,000	44,000,000	984,000	11,000.00
Ileco Technical Engineering A	1232	340,000	5,000,000	180,000	50,000.00
Ifeco Technical Engineering B	1232	340,000	3,5000,000	180,000	350,000.00
Ifeco Technical Engineering C	1232	340,000	25,000,000	180,000	5,000.00
Ifeco Technical Engineering D	1232	340,000	10,000,000	180,000	5,000.00
God First Furnitures	176	40,000	408,000	300,000	4,000.00
Poly Metal Construction Company	704	25,000	2,240,000	1,440,000	70,000.00
Bestman Bakery Bread	2288	3,000,000	9,000,000	804,000	60.00
Divine Mustard Wood Co. (Nig) A	1584	200,000	3,000,000	780,000	15,000.00
Divine Mustard Wood Co. (Nig) B	1584	200,000	4,500,000	780,000	30,000.00
Divine Mustard Wood Co. (Nig) C	1584	200,000	3,600,000	780,000	3,000.00
Divine Mustard Wood Co. (Nig) D	1584	200,000	8,000,000	780,000	10,000.00
Industrial steel wire manufacturers	4752	181,852,472	11,550,000	3,553,200	35,000.00
Jerusalem Woods A	1232	414,000	1,610,000	936,000	35,000.000
Jerusalem Woods B	1232	414,000	1,300,000	936,000	100,000.00
Jerusalem Woods C	1232	414,000	900,000	936,000	50,000.00
Jerusalem Woods D	1232	414,000	960,000	936,000	10,000.00
Ihem Davis press Ltd A	1056	8,730,000	1,050,000	792,000	150.00
Ihem Davis press Ltd B	1056	8,730,000	360,000	792,000	180.00
Ihem Davis press Ltd C	1056	8,730,000	1,000,000	792,000	17.48
Ihem Davis press Ltd D	1056	8,730,000	250,000	792,000	500.00
Nation Wyde Printers Ltd A	2112	15,000,000	2,220,000	1,680,000	185.00
Nation Wyde Printers Ltd B	2112	15,000,000	3,500,000	1,680,000	350.00
Nation Wyde Printers Ltd C	2112	15,000,000	20,000,000	1,680,000	200.00
Nation Wyde Printers Ltd D	2112	15,000,000	3,000,000	1,680,000	60.00
Cape publishers Int'L Ltd A	3872	10,000,000	2,000,000	4,020,000	200.00
Cape publishers Int'L Ltd B	3872	10,000,000	2,000,000	4,020,000	200.00
Cape publishers Int'L Ltd C	3872	10,000,000	1,250,000	4,020,00	250.00
Tony Carvers and Chieftancy Shop A	2288	51,000	1,500,000	120,000	1500.00
Tony Carvers and Chieftancy Shop B	2288	51,000	375,000	120,000	5000.00
Tony Carvers and Chieftancy Shop C	2288	51,000	2,000,000	120,000	4,000.00
Camela Veg. Oil Co. Ltd. A	15,840	565,205,190	155714160000	12,240,000	140,000.00
Camela Veg. Oil Co. Ltd. B	15,840	565,205,190	4220040,000	12,240,000	35,000.00
Camela Veg. Oil Co. Ltd. C	15,840	565,205,190	250,344,000	12,240,000	90,000.00
Mevok Ltd A	13376	10,000,000	36,000,000	6,768,000	45.00
Mevok Ltd B	13376	10,000,000	104,400,000	6,768,000	290.00
Mevok Ltd C	13376	10,000,000	60,000,000	6,768,000	500.00
C.C. & Co. Ltd A	6,688	2,750,000	1,331,520,000	2,880,000	12,000.00
C.C. & Co. Ltd B	6,688	2,750,000	434,700,000	2,880,000	10,500.00
C.C. & Co. Ltd C	6,688	2,750,000	59,375,000	2,880,000	5,000.00
Key Product Ltd A	4,752	30,000,000	21,600.000	3,120,000	180.00
Key Product Ltd B	4,752	30,000,000	21,600.000	3,120,000	90.00
Key Product Ltd C	4,752	30,000,000	21,600.000	3,120,000	25,000.00
Lamonde Printing & packaging A	3872	100,000,000	750,000.000	7,668,000	300.00
Lamonde Printing & packaging B	3872	100,000,000	200,000,000	7,668,000	150.00
Lamonde Printing & packaging C	3872	100,000,000	500,000,000	7,668,000	60.00

Rokana Ind. Plc A	8096	118,743,567	80,257,500	1,175,500	67.50
Rokana Ind. Plc B	8096	118,743,567	6935000	1,175,500	3.75
Rokana Ind. Plc C	8096	118,743,567	199815	1,175,500	55.00
Rokana Ind. Plc D	8096	118,743,567	302250	1,175,500	65.00
Gmicord Inter Biz Ltd A	11,440	63,299,531	2,880,000	8,796,000	2400.0
Gmicord Inter Biz Ltd A	11,440	63,299,531	6,300,000	8,796,000	1050.0
Gmicord Inter Biz Ltd B	11,440	63,299,531	3,000,000	8,796,000	500.00
Aluminum Extrusion Industries Plc	14,080	261,794,739	652,771,577	80,702,418	3500.0
Kricel Publishers	2640	20,000,000	5,125,000	1,440,000	500.00
Adapalm (Nig) Ltd A	18,480	50,000,000	15,000.000	1,225.000	4500.0
Adapalm (Nig) Ltd B	18,480	50,000,000	4,500,000	1,225,000	7,200.0

Source: Data collected through survey of manufacturing firms in Imo State of Nigeria.

Appendix 1a

Growth rates of real GDP: 1971-2003

Year	Growth rate of real GDP
1971	20.8
1972	8.5
1973	1.3
1974	11.8
1975	-2.9
1976	10.7
1977	8.3
1978	-7.3
1979	33.4
1980	-0.6
1981	3.4
1982	9.4
1983	-6.2
1984	-4.5
1985	-0.1
1986	0.5
1987	-4.9
1988	3.7
1989	-11.4

Year	Growth rate of real GDP
1990	8.2
1991	4.7
1992	2.3
1993	1.3
1994	2.2
1995	4.4
1996	2.8
1997	2.9
1998	0.4
1999	5.4
2000	6.4
2001	3.5
2002	10.2

Source: (1) FOS (1996) Socio-Economic Profile of Nigeria, p. 23

(2) CBN (2003) Statistical Bulletin, Volume 14, p. 245

Questionnaire

1. Name of Business ....
2. Address of Physical Location ....

....

3. What category of manufacturing industry is your enterprise (tick as Appropriate)
   - (a) Food and beverage;
   - (b) Textile, wearing apparel and leather industry;
   - (c) Wood and wood products including furniture;
   - (d) Paper and paper products, printing an publishing;
   - (e) Chemicals, petroleum, coal, rubber and plastic products;
   - (f) Non-metallic mineral products except petroleum and coal;
   - (g) Basic metal industry.
   - (h) Fabricated metal products, machinery and equipment.

4. Complete the following by filling in the appropriate data in the space provided.
Labour Employed

Category	Number in 2005	Wages/salaries
Skilled labour		
Semi-skilled labour		
Unskilled labour		
Total		

5. Production (output)

Product type	Quantity produced in 2005	Price per unit (in 2005 prices)

6. Capital asset

Cost of machinery/equipment	Depreciation (in naira)	Value in 2005 (in naira) [cost-less depreciation]

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Contributions of Selected sectors to the Gross Domestic Product of Nigeria, 1959/60 2003.

Year	Agriculture	Mining and quarrying	Manufacturing
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1963/64	61.5	2.1	6.0
1964/65	58.7	2.7	6.1
1965/66	55.2	4.8	7.2
1966/67	51.9	6.9	7.3
1967/68	2.8	6.4	7.4
1968/69	52.6	3.3	7.9
1969/70	47.4	8.1	8.2
1990/71	44.7	11.9	7.5
1971/72	42.1	14.9	6.5
1973/74	38.0	17.0	7.8
1974/75	29.8	18.0	4.4
1967475	29.6	18.3	5.10
1975/76	25.4	14.1	7.7
1976/77	22.5	16.5	7.2
1977/78	21.4	15.8	6.6
1978/79	23.0	24.0	7.0
1979/80	20.0	28.0	8.
1980	21.0	24.0	11.0
1981	34.4	15.28	9.89
1982	35.77	13.73	11.21
1983	37.68	13.79	8..36
1984	37.78	16.11	7.82

1985	40.33	15.58	8.56
1986	42.72	14.11	7.98
1987	41.54	12.84	8.43
1988	41.51	12.65	8.65
1989	39.06	13.52	8.19
1990	39.06	13.18	8.15
1991	38.60	13.73	8.50
1992	38.25	13.69	7.86
1993	37.78	13.37	7.34
1994	38.30	12.92	6.90
1995	39.0	13.00	7.00
1996	45.0	13.00	7.00
1997	40.0	13.00	6.00
1998	40.0	13.00	6.00
1999	41.0	11.00	6.00
2000	39.0	12.00	6.00
2001	40.0	12.00	6.00
2002	41.0	10.00	6.00
2003	40.0	9.00	6.00

Sources

1. Date for the 1959/60 – 1961/62 period were at 1957 constant prices and the source is digest of statistics, vol. 15, no, 3 and 4, July and October 1966, FOS, Logos 103.
2. Data for the 1962/63 – 1972/73 period were at 1962/63 constant prices and the source is the annual abstract of statistics, 1975, FOS, Lagos: 149
3. Data for the 1973/74 – 1977/78 period were at 1973/74 constant prices and the source is the annual abstract of statistics, 1981 edition, FOS, Lagos: 136

4. Data for the 1981 – 1994 period were at 1984 constant prices and the source is the national accounts of Nigeria, 1981 to 1994, FOS Lagos.

5 Data for the 19995 20003 period were at 1990 constant basic prices and the source is statistical bulleting, CB, Abuja 294 - 253

IMO INDUSTRIAL SHOWCASE

PROMOTERS • ENTERPRISES •

OUTPUT - LOCATION

LIST OF INDUSTRIES IN IMO STATE

This is the most comprehensive list of industries ever produced!

S/NO	NAME OF INDUSTRY	PRODUCT LINE	PROMOTER	LOCATION
		OWERRI ZONE		
		Osha Road Industrial Estate/New Owerri Sub-Sector		
001	[illegible] Bottling Co Plc	Soft Drinks	[illegible] PLC	Osha Rd
002	[illegible] Eng & Mfg Co Ltd	Nails & Fence Wire	Chief I.D. [illegible]	Osha Rd
003	R.O. Ikoro & Sons Ltd	Vegetable Oil	Chief Okey Ikoro	"
004	Ikas Ken Agro & Allied	Vegetable Oil	Ogbuagu Ken Obiekea	"
005	Dauphin Ind. Mfg Ltd	Bags	Sir Chima Emenyonu	"
006	Onyx Crown Oils Ltd	Engine Oil	Eng. H.A.S. Obidike	"
007	Agasons Mfg Ltd	Soap	Chief Arthur Aso	"
008	Renco Industries Ltd	Vegetable Oil	Chief L.O. Onyema	"
009	David Laboratories Ltd	Drugs	Bro. Marcel Ibekwemo	"
010	BAA Industries Ltd	Nails	Late Chief B. Ari	"
011	International Paper Mills	Paper Products Conversion	Mr. [illegible] Osuji	Osha Rd Ind
012	[illegible] Industries Ltd	PVC Pipes Hose	Chief D.H. Amaechi	Wetheral/Osha Rd
013	Assumpta Press Ltd	Newspaper & Stationeries	Catholic Church	[illegible]
014	Integrated [illegible] Processing Co	[illegible]	[illegible] Investors	Onitsha Road
015	Atman Ind	Electrodes		Osha Rd
016	C A Amaechi & Sons Ltd	Furniture	Chief C A Amaechi	Osha Road
017	Laws [illegible] Ind	Fashion	Sir Law Oguzor	Osha Rd
018	Tab Motors	Auto	Chief E.L. Uwandu	Osha Rd
019	Marpen (Relocated)	Roofing Sheets	Chief I.R. Anyachu	Osha Rd [illegible]
020	Ibekwem [illegible]	Printing	Chief (Mrs) F.C. [illegible]	Osha Road
020	[illegible] Ltd	Drugs	Dr. Christian Igwe	P Harcourt Rd
021	Imo Concorde Hotel	Hotelling & Tourism	Imo State Govt	P. Harcourt Rd
022	[illegible]	Foams		P Harcourt Rd
023	[illegible] Furniture	Furniture		P Harcourt Rd
		OWERRI MAIN SUB-SECTOR		
024	[illegible] Ventures Ltd	Audio Visual Products [illegible]	[illegible]	[illegible]
025	Mid East Eng Ltd	Roofing Tiles	Chief [illegible]	[illegible]
026	Up Dike Ind Ltd	Distilled Water	Chief Dike	[illegible]
027	Ihem Davis Printing Press Ltd	Printing & Publishing	Mr. Ihem Davis	MCC/[illegible]
023	Standard Shoes Ind Ltd	Foot wears	Imo State Govt	Orlu Road, Ow.
025	[illegible] Industries Ltd	Roofing Sheets	Late Eze Anyanwu	Assumpta Rou.
026	[illegible] Eng Co Ltd	Metal Fabrication	Mr [illegible] Akabuonu	Ikenegbu, Ow.
027	Besta Paints Ind Ltd	Besta Paint	Chief I.O. Nwaodu	[illegible], Ow.
028	Imo Newspaper Ltd	Newspaper	Imo State Govt	Egbu Rd, Ow.

106	Ferdinand Oils Mill Ltd	Vegetable Oil	Chief Anaghara	Umuoba [illegible]
107	Ferdinand Industries Co Ltd	Kitchen Utensils etc	Chief Anaghara	Umuoba [illegible]
108	C N Ogbaji & Sons Nig Ltd	Poultry & Stationery	Chief C N Ogbaji	
109	Ferdinand Steel Ind Ltd	Oil Filters	Chief Anaghara	
110	Bolingo Plastic Ind Ltd	Plastic	Chief J G Igwe	Obodukwu
111	Jorson Printing & Packaging	Packaging	Chief J H Igwe	Obodukwu
112	Jolux Paints	Paints	Chief J H Igwe	Obodukwu
113	Akelma Industries Ltd	Spare Parts		Isiekpo
114	Amanze Plastic Ind Ltd	Plastics	H R H Eze R A Ufonze	Isiekpo
115	Junction Idustries Ltd	Plastic wares	Chief Ezekwe	Isiekpo
116	Alibaz Industries Ltd		Chief A Aloysius	Alokwa
117	Agility Chemical & Allied Pro Ltd	Paints	Chief Agility Nwagbo	Okwa
118	NIPROC	Palm Kernel Oil Ext	Chief E. N Ohoha	Aroodozo, [illegible]
119	Safari Breweries Ltd	Alcohol Beverages	Chief R E Ohoha	
120	Ukomadu Industries Ltd	Farm implements	Chief Ukomadu	
121	IHOCO Shoes Ltd	Footwears		
122	Omeue Pharm Ltd	Drugs	Chief M O Kanu	
123	Excellent Paints Ltd	Paints	Chief E Mbadiwe	
124	Cosmos Paper	Paper products	Chief C N Ogbaji	Umuoba
125	Ukomadu Ind Ltd	Household utensils	Chief Ukomadu	Aroodozo [illegible]
		ORU SUB-SECTOR		
126	Afrik Pharmaceut Plc	Drugs	Dr J Okafor Duru	Awo Omamma
127	Jacob Wines Ltd	Table Wines	Dr E S O Jacobs	Mgbidi
128	NICHBEN Group	Drugs & Alcoholic B	Chief N Onwumere	Awo Omamma
129	EMCEFA NIG IND	Drugs	Chief M Nkemdirim	Mgbidi
130	Otulu Nails & Wire Ind	Nails & Wire		Otulu
131	Fetow-fan Ind Ltd	Drugs	Hon Ugtiegbulam	Mgbidi
132	Santa Bakery Nig Ind	Food Processing	Mrs Elizabeth	Mgbidi
133	Consolidated Breweries	Beverages	Plc/Mbadiwe	Awo-Omamma
		OKIGWE ZONE		
134	Uzu Hydro Res Ltd	Spring Water	Engr C C Ugwuh	Obowo
135	Limca Bottling Co Ind	Soft Drinks	Lemitor	Umuduru [illegible]
136	Imo Modern Poultry	Poultry goods	Imo State Govt	Avutu, Obowo
137	Nwaoku Farm Paper	Core Paper for Tissue	Chief Nwaoku	Umuome [illegible]
138	Clay Products Ltd	Ceramics	Imo State Govt	Umuele [illegible]
139	Nsu Tiles Ind Ltd	Tiles	Imo State Govt	Nsu
140	Topaz Nig Ltd	Bricks & Ceramics		Amaraku Okigwe
141	Pioneer Projects Ltd	PKO		Okigwe

* A Full status report on each industry will be made available, under confidential cover, if requested

029	Evalex Ventures Ltd	Toilet Rolls Paper	Engr. [illegible]	Ikeregbu, Ow
030	Conso Dist. Int. Ltd	Alcoholic & Wine Beverages	Mr C. Akalonu	Ikeregbu, Ow
031	NDI CJ Furniture Furniture	Omerpaka Family		Wetheral [illegible]
032	Lolete Int. Ltd	Agric Equipment	Sen. [illegible]	Ikeregbu
033	Pasa Comm. Ltd	Newspaper & Stationeries	Chief E. C. Iwuanyanwu	ABII [illegible]
034	O Blue Bird United Industries Ltd	Toothpicks, Cotton Buds etc	Chief Sam Ohalu	Upper Obi. Ow
035	Benzas Industries Ltd	Marble	Chief B.U. Apara	Oru [illegible]
036	Wotepka Ind. Nig. Ltd	Polythene Bags & Sacks		Upper Obi. Ow
037	Magil Furniture	Furniture	Engr. Iwuanyanwu	Ow
038	Bokuna Industries Plc	Dental Care Products, Aerosols	Engr. C. Ugwuh	[illegible] Ow
039	Imo Rubber Estates Ltd	Rubber	IMSG/IRE	Ndaldy [illegible]
040	Nigerian Oil Mills Ltd	Oil Cake and Soap		Obinze, Ow
041	Key Products Ltd	Gas Plant	A. Onwumere	Owerri
042	Umukene Veg Oil Edible	Palm Oil	Chief Eppage	Umukene
043	Industrial Dynamics	Oil Palm Product	Engr. R. Amene	Nekede
044	R.C. Omeaku & Co	Tissue Paper	Chief R.C. Omeaku	Owerri
045	Mezu Industry	Plastics	Dr. S.O. Mezu	[illegible]
046	Moonplast Ind. Ltd	Soap, etc	Sir M. Onwuegu	[illegible]
047	Totan Publisher Ltd	Printing & Pub	Chief T. Mazikwe	Owerri
048	Metals & Rocks	Solid Min	Chief E.C. Ekwenna	Owerri
049	Anambra/Imo Riv. Basin	Agro Ind	Federal Government	Aghara
050	Ind. Dev. Centre	Industrial Support	Federal Government	Owerri
051	CTID Ltd	Solid Minerals	Engr. M. Anyanwu	Owerri
052	Avalon Int'l Ltd	Cashew nuts	Sir Ambrose Ejiogu	Owerri
053	Udewell Int'l	PL, PKO		Ubomiri
		HAZE SUB-SECTOR		
054	Anmapex Ind. Ltd	Paper Products	Joint Venture	Haze
055	G.C.M. Electricals Ltd	Electrical wires		Haze
056	Abaja Crown Corks Ind Ltd	Bottle Corks		Haze
057	Radiolabs Nig. Ltd	Science equipment	Engr. E. Izuogu	Na[illegible]
058	Izuogu Motors Ltd	Auto Manufacturing	Engr. E. Izuogu	Iz[illegible]
059	Power Poles Ind. Ltd	Poles/Precasts	Chief Nwankwo	Mb[illegible]
060	Deltec Investment	Soap, etc	Chief D.N. Aneke	Mb[illegible]
		OKIGWE/ISU SUB-SECTOR		
061	Magil Industries Ltd	Tissue/Steelwool	Engr. Iwuanyanwu	[illegible]
062	Continental Tyre	Tyre Retreading	B. Ihenacho	Ama[illegible]
063	Dema Industries Ltd	Footwears Accessories	Chief E. Dimanum	[illegible]
064	Godarnder Mills Ltd	Vegetable Oil	Chief G.F. Ekwueme	Ak[illegible]
065	Akabo Flour Mill Ltd	Flour	Late Eze E.U. Anyanwu	Ak[illegible]
066	Aluminium Extrusion Plc	Aluminium Products	PLC	Inyishi, Ikeduru
		MBATOLI SUB-SECTOR		
067	Unut Industries Ltd	Vegetable Oil/Conf	Chief M. Obioha	Ubomiri
068	Herbert N. Ind. Ltd	Oil Palm Processing	Chief H. Nwokeji	Ohii
069	Onuonye Farms	Agro Allied	Chief Onuoye	Ogwa
070	Easytech Nig Ltd	Nuts & Bolts	Engr. Anaghara	Egbeada
071	Orogwe Plastic Ind. Ltd	Plastics	Chief Ilea	Orogwe
		MBAISE/NGOR OKPALA SUB SECTOR		
072	Akaoka Ind. Ltd	Solid Minerals	Okoroeh C. Onyeka	Aboh Mbaise
073	Daniel Ind. Ltd	Vegetable Oil/PKO	Barr. Ezealah	Ahiara Mbaise
074	Maggie Ind. Ltd	Plates/Plastic ware	Chief Agwu	Aboh Mbaise
075	Dimnadi Industries Ltd	Nails	Eze Anyanwu	Aboh Mbaise
076	Resin Paint Ind. Ltd	Paint	Imo State Govt	Aboh Mbaise
077	Cassa Industries Ltd	Toilet Rolls	Chief Akponku	Ahiara Mbaise
078	Ike Industries Ltd	Plastic	Chief Chris Ogonna	Aboh Mbaise
079	Bacron Industries Ltd	Batteries	Dr. R. Anyanwu	Ezinihitte
080	Moore Memorial farms	Poultry	Okenze S. J. Obinna	Ngor Okpala
081	ADAPALM Mill (1)	Oil Mill	IMSG	Umuagu Mbaise
		ORLU ZONE		
082	Adapalm Nig. Ltd	Oil Palm Products	Imo State Govt.	Ohaji
083	Lodys Oil & Chemicals	PKO, PKC		Isu
084	Seamaster Industries Ltd	Veg. Oil Extraction	Chief Obajimadu	Amaifeke, Orlu
085	Mawatec Industries Ltd	Veg. Oil Extraction	Chief M. Nwabuo	Owerri Ebeiri Orlu
086	New Harmony Paints	Paints	Chief Nguoncha	Amaifeke, Orlu
087	Decorcote Paints Ind Ltd	Paints		Ebenator-Orlu
088	Campharm Products Ltd	Drugs	Mr S. Uzoma	Ihioma - Orlu
089	Paper Packaging Ind Ltd	Paper Packaging	Imo State Govt	Owerri Ebeiri Orlu
090	Alfopam Industries Ltd	Leather Goods	Late Eze Udenze	Amaifeke-Orlu
091	Beevaku Food and Niger Pharm. Industries		"	Orlu
092	Ohams Int Ltd	Organic fertiliser	Chief Ohams	Orlu
093	F.A. Laver Nig. Ltd	Food Processing	Elder F.O. Eze	Amaifeke, Orlu
094	Savico Nig. Ltd	Metal Fabrication	Chief G.C. Okwara	"
095	Sanuzo Ind. Ltd	Nails And Wire	H.R.H. Eze Uzor	Egbema
096	Pedmagreeks Ltd	Solid Minerals	Chief Anyiam-Osigwe	Nkwerre
097	Kapital Projects Ltd	Ind. Equipments	Loeze Egurawa	Orlu
098	TESAC	Ind. Support	IMSG	Orlu
099	FH Industries Ltd	Vegetable Oil	The Duke	Nkwerre
100	CEDSON Int'l Ltd	Soap, Candles		Umuna Orlu
101	Atlantic Gulf Int'l Ltd	Vegetable Oil PKO	Chief B.O. Anyanwu	Umuaka
		IDEATO SUB-SECTION		
102	Fairline Pharm. Ltd	Pharm	Nze R/. Onwudike	Osina
103	Ofoma Farms	Agro & Allied	Chief Ofoma	Ideato South
104	Vinkmann Paper	Stationery		Ideato South
105	D. Tophers Ind.	Plastics	Chief C. Anyaike	Ideato South

Egbema

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