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The Iron and Steel Industry and Nigeria's Industrialization: Exploring Cooperation with Japan

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Abstract

Starting from the premise that one of the most important factors responsible for Africa's development crises could be traced to its inability to organize its technological development, a development that has much to do with the development of the iron and steel industry, this study focuses on the importance of this industry and its linkage to industrialization. Conceptually, it examines the relationship between technology, industrialization and development and x-rays the state of industrialization in Nigeria, including the performance of the manufacturing sector. The development of the iron and steel industry in Nigeria was comprehensively examined with respect to the early initiative, raw materials development, the state of the industry, role of the state and efforts at privatization. Further, in order for any meaningful exploration of cooperation to be made, the study also examined the development of the iron and steel industry in Japan and its contribution to Japan's industrialization. In doing this, Japan's position in global steel trade, the state of the industry – including technology, equipment and raw materials development were all presented and examined, and lessons delineated for developing countries like Nigeria. Finally, the study explored ways through which cooperation could be achieved between the Japan steel industry and the Nigerian iron and steel industry, including the relevant institutions that may be involved. In the study, it is argued that the idea of cooperation in this industry is not necessarily utopian, but borne out of decades of increasing political and economic relations between both countries, enhanced by Japan's successful cultural diplomacy.

Dedication

To Jane-Frances,
Chinedum, Onyeka and Isabel

Preface

It is common knowledge that the development of the iron and steel industry is a key ingredient for the modernization of societies. History indicates that the ability of societies in Western Europe and the Americas, and also in Japan to cope with their environment and provide for the welfare of people was to large extent possible because of the progressive development, mastery and use of iron and steel products. This industry is not only a critical input in agriculture, of which Africa depends for the survival of its peoples, but also underlies the military-industrial complex. It is equally invaluable for the stimulation and innovation of diverse technologies that are simply too important for the day to day needs of the ordinary people. A key motivation for this study is my observation that the lack of technologically-driven solutions to Africa's problem is a major, if not the most important reason for Africa's development crises and the seeming inability of millions of people in Africa to escape from the clutches of poverty. At the base of this predicament is the poor development of science and technology, but especially the human resource necessary to acquire and duplicate the technologies associated with the iron and steel industry. The lack of material resources to develop this industry, which is capital-intensive also serve to constrain the industrialization efforts of many countries in the developing world.

I have therefore, in this study examined the possibility for mutually-beneficial cooperation between a technologically developed country Japan - which has some of the most modern steel plants in the world, and Nigeria, which though has started the journey, is still faced with teething problems of how to develop the industry. Considering the 21st century global environment, which is characterized by the globalization of trade, politics and raw materials acquisition amongst others, I have in this study employed a multidisciplinary perspective revolving around the global political economy in determining the relevant issues and understanding the global iron and steel environment. My study has therefore, traversed a gamut of issues in exploring possible cooperation between Japan and Nigeria in the iron and steel industry. You will find in this volume issues concerning Africa's development crises, industrialization and development, technology development, the technology of steelmaking, the iron and steel industry in Nigeria and Japan, the role of the state in steel development and industrialization, lessons from the development of the Japan steel industry, an overview of Japan's development cooperation architecture and state of political and economic relations between Nigeria and Japan. From a multidisciplinary perspective, the political dimension of the relations between both countries is considered important even, when purely economic matters are involved.

It is my expectation that this study would serve as a wake-up call to all, both the developed and developing countries, that there is no way meaningful and sustainable industrialization and development could be achieved, and poverty reduced in the developing parts of the world if the deserved attention is not given to those basic industries considered imperative for the development of other sectors. In this wise, the iron and steel industry is critical. I sincerely hope that my effort will be of use to countries of the developing world, the governments of Nigeria and Japan, economic and technology policy planners, experts in the iron and steel industry and development studies, and the specialized agencies of multilateral institutions.

Osita Agbu
March 2006

Abbreviations

AISA	African Iron and Steel Association
AISI	American Iron and Steel Institute
AOTS	Association for Overseas Technical Scholarship
ASCL	Ajaokuta Steel Company Limited
ASEAN	Association of South East Asian Nations
BOF	Basic Oxygen Furnace
BPE	Bureau of Public Enterprises
CBI	Cold Briquettes Iron
CBN	Central Bank of Nigeria
CC	Continuous Casting
CIPs	Core Industrial Projects
CIS	Commonwealth of Independent States
DSC	Delta Steel Company Limited
DPR	Detailed Project Report
DRI	Direct Reduced Iron
ECA	Economic Commission for Africa
ECE	Economic Commission of Europe
EBRD	European Bank for Reconstruction and Development
EU	European Union
EPZ	Export Processing Zone
FDI	Foreign Direct Investment
FEC	Federal Executive Council
FRN	Federal Republic of Nigeria
G8	Group of Eight
GIHL	Global Infrastructure Holdings
GSHL	Global Steel Holdings
IISI	International Iron and Steel Institute
JDB	Japan Development Bank
JETRO	Japan External Trade Organization
JF	Japan Foundation
JBIC	Japan Bank for International Corporation
JICA	Japan International Cooperation Agency
JISF	Japan Iron and Steel Federation
JODC	Japan Overseas Development Corporation
LNG	Liquefied Natural Gas
METI	Ministry of Economy, Trade and Industry

MITI	Ministry of International Trade and Industry
MOFA	Ministry of Foreign Affairs
MTEL	Mobile Telecommunications Plc.
NAFDAC	National Agency for Food and Drug Administration and Control
NCST	National Council on Science and Technology
NEEDS	National Economic Empowerment and Development Strategy
NEPA	National Electric Power Authority
NEPAD	New Partnership for Africa's Development
NEPC	Nigeria Export Promotion Council
NIPC	Nigerian Investment Promotion Commission
NIOMCO	National Iron Ore Mining Company
NITEL	Nigerian Telecommunications Plc.
NNPC	Nigerian National Petroleum Corporation
NSDA	Nigerian Steel Development Authority
OHF	Open Hearth Furnace
ODA	Official Development Assistance
PPR	Preliminary Project Report
PRSP	Poverty Reduction Strategy Paper
RECs	Regional Economic Communities
SON	Standard Organization of Nigeria
SAP	Structural Adjustment Programme
TICAD	Tokyo International Conference on African Development
UNCTAD	United Nations Conference on Trade and Development
USSR	Union of Soviet Socialist Republics

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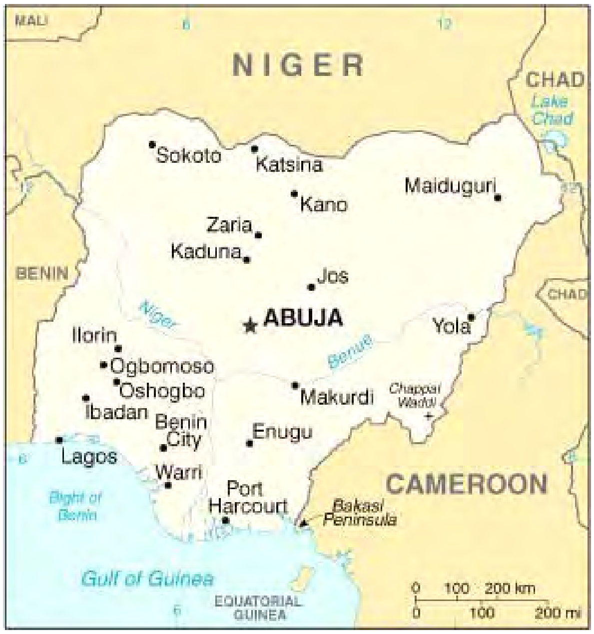
Finally, I seize this opportunity to express my sincere thanks to the management of the Nigerian Institute of International Affairs, Lagos for granting me the permission to spend my sabbatical leave in Japan researching into a subject matter of deep interest to me.

Maps of Nigeria and Japan



Map: Federal Republic of NIGERIA. Courtesy, The General Libraries, The University of Texas at Austin.

Map: JAPAN. Courtesy: Magellan Geographic, 1997.

1. Introduction

This study arose from my observation over the years that the iron and steel industry and its associated linkages play critical roles in the economic development of any society, and therefore the society's ability to cater for the welfare of its citizens. Behind my thoughts was not surprisingly the perennial cliché about Africa's crises of development, which many have often talked about but done very little about in terms of providing sustainable ideas for getting out of the crises. From a broader perspective, one could see that the problems confronting Africa are not only just the usual problems associated with economic growth; rather we see symptoms of a society undergoing fundamental social transformation in which its store of accumulated knowledge, institutions and modes of production require a rethinking and therefore, re-development and retooling. Indeed, Africa may be said to be going through a 'total crises', in which many of the problems associated with social transformation appear to be manifesting all at the same time thereby making it almost impossible for the various African governments to cope. Unfortunately, this is occurring at a time the world appears to be moving economically and politically at breakneck speed, which does not allow for a better appreciation of the enormity of the problems facing the developing world and the possible ways of addressing these problems. Invariably, societies of the developing world are caught up in the rat race of surviving in a highly competitive, complex and all consuming environment that does not give much room for the technologically disadvantaged entities. This is an undesirable scenario for most of the developing countries, and especially for countries of Africa.

It is against this background that this study offers the view that the development of the iron and steel industry identified as a key industry, and its affiliated uses is crucial to the growth of industrialization and sustainable development, a development that should ideally be defined by the different societies, but supported in a collaborative way by development partners. It is from this position that exploration is made of the possibility of not only understanding how an advanced industrialized country like Japan was able to develop its iron and steel industry and invariably transcend many of its basic developmental problems or 'crises', but also, how in a collaborative but mutually beneficial way, it could be convinced to extend development cooperation to a developing country, say Nigeria, in the Iron and steel industry. I have identified this industry as fundamentally crucial for Africa's industrialization and development mainly because of its many linkages, backwards and forward; but even more importantly, its contribution to the development of social infrastructure that is a basic and long-term investment necessary for industrialization and development. A critical examination of the world's pattern of industrialization indicated that iron and steel was an important industry, and its continual refinement fed into other aspects of manufacturing during the industrial revolutions. According to Amsden (1989:3), the first industrial revolution in Britain toward the end of the 18th century, and the second industrial revolution in Germany and the United States approximately 100 years later, shared the distinction of generating new products and processes mostly through inventions and innovations. Many of these inventions could not have had commercial value without iron and steel as critical inputs. In retrospect, the early spread of industrialization traced to Western Europe between 1750 and 1800 was enabled by the development of iron and steel, when Britain had industrial monopoly compared to other parts of the world. Indeed, industrial capitalism arose with the founding of heavy iron and steel industries in North America in the 1870s and the rail networks of the 1860s that integrated the various regions of the United States (Bently and Ziegler, 2003). The importance of iron and steel to infrastructure development and industrialization could also be seen in Russia, when between 1860 and 1900 Russia built 35,000 miles of railroads. It was iron and steel that enabled West Germany to almost over-run Europe, and Japan to suddenly leap to the forefront of modern technology with unprecedented and yet unrivalled innovations in computer and automobiles. Since the end of the Second World War in 1945, nations of the world have come to appreciate the role of steel as the basis for rapid technological development and paid greater attention to it. For Nigeria and other developing countries, the object should not be to re-invent the wheel with respect to steelmaking technology, but rather, just like Japan, Taiwan and South Korea to diligently *obtain*, *learn* and *apply* the technologies in existence as a key step in developing this industry and enhancing industrialization and development. This is because there has been a significant change from the absorption of foreign technology through copying and self-teaching to the adoption of foreign technology through investing in foreign licenses and technical assistance (Amsden, 1989:20). There are therefore, several ways cooperation could be explored between technology givers and receivers like Japan and Nigeria respectively, without this relationship being necessarily one-sided.

1.1 Choice of Case Studies

Nigeria is our chosen case study, as it typifies a potentially strong and regional economy and important player with the capacity to serve as a growth pole in the West African sub-region. Economic growth in Nigeria has implications for the reduction of poverty in the sub-region. However, this country's economy cannot be strong and vibrant without growth in its iron and steel industry or without the use of iron and steel in its manufacturing sector. The Nigerian iron and steel industry has been experiencing serious problems which have not allowed it to function effectively nor efficiently. The constraining factors include inadequate financing, poor planning and implementation and the vagaries of Nigerian politics, which has allowed political considerations to influence plant location rather than rational economic considerations (Agbu, 1992). It was therefore not surprising that many of the steel facilities either failed to take off or are performing under low capacity utilization. The country's steel requirements have been met since independence by imports from Britain, Japan, West Germany, and the United States and recently, by relatively cheap and sub-standard steel from some Asian countries.

In the quest at exploring cooperation or partnership in support of the sustainable development of the iron and steel industry in Nigeria, Japan with its achievements in the use of technology, especially in the iron and steel industry and in industrialization generally stood out as a foremost player and potential partner. This is a country with very few natural resources, and geographically far away from what are historically seen as the other advanced industrialized nations. Though volcanic activity, earthquakes and typhoons usually combine to create adverse conditions in Japan, it is nonetheless noteworthy that such a country accounts for 15 per cent of the world's economic activity. Many have rightly observed that the driving force is the added value brought by the manufacture of industrial goods. Every year ¥16 trillion is spent on Research and Development (R&D) in Japan. This equates to 3.2 per cent of Japan's Gross National Product (GNP) of ¥500 trillion. In the European Union (EU), only about 2.5 per cent of total GNP is spent on R&D, indicating that Japanese companies are making every effort to be prepared for the future. It is therefore no wonder that the number of patents acquired by Japanese companies is relatively large. According to statistics released in the United States, seven of the top 10 companies registering patents are Japanese. Also, the number of theoretical patents from Japan is also increasing (Japan Economic Foundation, 2005:9).

In retrospect, for industrialization in Japan, the priority production method that was applied immediately after the World War 11 was taken as an emergency action in an unstable and chaotic environment. This was basically the direct control of production by the government under the abnormal conditions that existed then. Encapsulated in this policy included the allocation of raw materials, price controls, financing for restoration, price support subsidy, and the rationing of imported materials. The Policy then gave priority to the production of coal and iron and steel (Kuchiki, 2003:8). By mid-2005, Japan's iron and steel industry had attained a production level of ¥13 trillion, with ¥4.5 trillion of added value, the same as that of the automobile industry. The steel industry earns profits through sales of high-tensile steel that other countries could hardly produce. It has also succeeded in developing ultra-steel, which is twice as strong as conventional steel (Japan Economic Foundation, 2005).

Therefore, Japan's war time experiences during the World War 11, its amazing post war history and ability to recover, ability to develop its human resources, and develop its iron and steel industry and destroyed infrastructure while marrying culture to technology (Agbu, 2002a), were reasons that made it a perfect role model for this potential partnership in development cooperation. The use made of technology should ideally be married to a people's culture for it to be meaningful to the people. Indeed, one or two lessons could be learned from Japan on this matter especially for Africa, which is rich in culture, culture that should not be allowed to die in the quest for industrial development. There was therefore, very little hesitation in selecting Japan as the most suitable partner for any potential exploration of development and technological cooperation in the Iron and steel sector.

1.2 Thrust of the Study

In focusing on the iron and steel industry, a leading sub-sector of the manufacturing industry, it is important that attention be paid to the management and progress of science and technology in the field. Science and technology substantially increases man's ability to understand the world, and not live in fear at both the micro and macro levels and gives man a powerful support to boost his or her well-being (Spiegel-Rösing and Derek de Solla Price, 1977). However, to innovate and master certain technologies, the role of human resources development cannot be overemphasized. It is in areas like this, in addition of course, to the physical availability of the technology that a country like Japan could be very helpful. Overall, human resources development helps quicken the tempo in the optimization and re-organization of the factors of production and transfers in the global context that could generate favourable conditions for mutually beneficial cooperation.

Indeed, there is little disagreement about the fact that overall economic and social development of African countries in general, and Nigeria in particular can readily and beneficially be accelerated through the adaptation, assimilation, internalization, innovation and invention of technologies appropriate to their environment and cultures. However, and more importantly, we recognize that the iron and steel Industry and its sundry products play a key role in attaining this goal, even inspite of the recourse by the advanced economies to seeking alternative, newer and cheaper materials for use in the manufacturing sector. Some of the new substitutes for steel include aluminum, plastics, resistant glass and ceramics.

The importance of the use of iron and steel technology for development cannot however be overemphasized, as overall it has been recognized as the engine of social and industrial transformation. Infact, it is ironical that Africa's industrial minerals like iron ore and coal have propelled technological revolutions in other parts of the world such as in Europe (African Academy of Sciences, 1999). At this juncture, I make bold to re-opine that the poor development and application of technology for societal uses and to industrial production, of which the iron and steel industry is basic, could be considered one of the most important factors inhibiting Africa's development efforts. Whereas African leaders have not helped matters by their internecine political bickering and kleptocracy, it is however increasingly becoming clear that the industrialized societies which had the good fortune of developing modern technology first have made little effort at extending these technologies to the underdeveloped parts of the world, except in instances where they are interested in extracting valuable raw materials for their industries. It has been a case of the developed countries using global governance institutions and their stringent rules to exclude others from developing technologies in areas of critical importance to them, like access to nuclear technology for peaceful uses. There is therefore, the urgent need for research or studies focused on how to explore the possibilities, potentials and modalities for cooperation between industrialized and developing countries in the area of developing basic industries. From this perspective, conscious efforts should be made for example, towards the revitalization and development of the iron and steel industry generally, in Africa, considered a desideratum for industrialization and the eventual alleviation of poverty in the continent. However, the key question remains - How should this be done? This is the problematique of this enquiry.

This study as earlier stated fundamentally focuses on possible cooperation between Japan and Nigeria in the iron and steel industry. It provides a sign post for the possible benefits and problems that may arise in such cooperation. This study is exploratory in nature, but factual in its use of economic history and data, and the raison d'tre for development cooperation or a partnership. It recognizes that this cooperation is taking place in a global political economy that is characterized by increasing synergy and cooperation in economic and political matters, in which it is difficult for any country to be an island onto itself.

In bemoaning Africa's crises of development and in recognizing the continent's low level of industrialization attributable to its poor utilization of technology especially iron and steel products, this study using the Nigerian case seeks to explore answers to certain crucial questions, questions that are not necessarily exhaustive but serve as signposts towards the attainment of the objectives of the study. For example, to what extent is the iron and steel industry important for industrialization? How did Japan achieve industrial development? What is the nature and state of the iron and steel industry in Nigeria? What is the nature and state of the iron and steel industry in Japan? What role did the iron and steel industry play in Japan's industrialization? What possibilities and modalities exist for cooperation between Japan and Nigeria in the iron and steel industry? What are the implications of a successful cooperation for the West African sub-region? These and related matters constitute the crux of this study, which is a genuine desire and effort to explore and explicate the role of the iron and steel in industrialization and the possibilities for cooperation with advanced industrialized countries such as Japan. This is understood as an alternative and more sustainable way of addressing the lack of industrialization and persistent poverty in many of the developing countries of the world.

This study therefore recognizes and maintains that modern technology and in particular, its application in the iron and steel industry with its various linkages are fundamental to economic growth and development. It therefore focuses on exploring possibilities and modalities for development cooperation in the iron and steel sector between Japan, identified as a benign ally, and Nigeria. The thinking here, is that Nigeria does not necessarily need aid, but aid in the right sectors. And the iron and steel industry in Nigeria has been identified as crucial to the country's industrialization, growth and welfare, especially considering its present level of development. This study is significant to the extent that it seeks to deepen the already visible involvement of Japan in supporting development and growth in Africa. However, this time around, the manner of support is expected to be more productive and more sustainable as a successful partnership could result in a rapid transformation of the Nigerian industrial landscape with implications for poverty reduction not only in Nigeria, but also in West Africa.

Theoretically, this study is a more recent addition to the bourgeoning literature on industrialization, global political economy, development cooperation and partnership; while practically, it provides a way forward for the revitalization and development of the iron and steel industry and therefore, industrial growth in Nigeria, and possibly in the West African sub-region. Standard Growth Theory predicts that low-income countries will grow faster than high-income countries, because they can borrow technologies from the rest of the world and increase the marginal productivity of capital more rapidly than advanced countries (World Bank, 1994). However, this is predicated on the ability of the low-income countries to take advantage of the technology, knowledge, and experiences of other countries. The West African sub-region will tend to benefit from an improvement in Nigeria's iron and steel industry, more so, as regions currently serve as focal points of development for the New Partnership for Africa's Development (NEPAD), and other development partnership efforts. Should this idea come to fruition, it will be difficult to forget what would be a positive role played by the Japanese government, businesses and people in real industrialization and economic growth in Nigeria. The potentials of the African market for iron and steel products should serve as an incentive to court the support of those companies in this industry. An underdeveloped and unutilized market, activities in this industry could spur a bandwagon effect that will ramify to the industrial sector in Africa. From the foregoing, this research should be of relevance to African governments, the Japanese government and institutions concerned with development cooperation, science and technology policy planners, experts and scholars in development studies and in the multilateral agencies.

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2. Industrialization and Development: An Overview

The literature is replete with the importance of technology in development, and especially of iron and steel to industrialization. Some, out of the many that exist include those by Bhagavan (1990), Aju (1994), African Academy of Science (1999), Kuchiki (2003), Agbu (2002a, 2002b, 2002c, 2003a, and 2004), UNCTAD (2004) and Omoweh (2004). Whilst some of the contributions focused on the importance of technology to development (Agbu, 2003a; 2004; African Academy of Science, 1999), others specifically addressed economic issues involved in the iron and steel industry and in industrialization (Sato, 2005; Fine, 2005). Agbu (1992) and Omoweh (2004) have extensively discussed the origin, nature and problems of steel development and industrialization in Nigeria, including the influence of the international environment, and in particular of the World Bank. Bhagavan (1990) was to argue that Africa's crisis of development could be significantly traced to its incapacity technologically to cater for the welfare of its peoples. Agbu (2002b) explored the linkage between globalization and technology and the possible relationship between technological capacity and the food crisis in Africa. Mohammed (2002) pungently argued that most countries developed their industrial bases by establishing viable steel industries, and that these industries began as serious national projects with the various governments taking an active interest in steel development.

Other studies in discussing technology related issues invariably addressed the issue of industrialization and its link to development. Industrialization, which may be defined as the progressive ability of a people to harness human and material resources for the production of goods and services is a key component of economic development. It has been observed that periods of massive technological progress usually lead to industrialization. Industrialization has also been understood as the capacity to produce goods used in the production of other goods, that is engineering goods (Bell and Pavit, 1993). In other words, industrialization describes the process of harnessing human and material resources, with increasing application of science and technology to the production of goods and services (Adejugbe, 2004:11).

In tracing the historical trajectory between technology and industrial revolutions, Mudenda (1995), observed that the first industrial revolution (1780-1840), which was based in the United Kingdom, had as its key achievements the steam engine, the textile industry and mechanical engineering. The second industrial revolution (1840-1900) also based in Europe (England, France and Germany), had its key achievements as the electric engine and the steel industry. The third industrial revolution (1900-1950) was based in the United States and its major achievements were the electric engine and industries manufacturing heavy chemicals, motorcars, and consumer durables. What could be termed the fourth industrial revolution (1950-2000), appeared based in South East Asia, and in particular in the Pacific

Basin (Japan, China and Hong Kong). Its key industries include synthetics, organic (petroleum) chemicals and computers.

2.1 Industrial Infrastructure, Technology and the State

In terms of the nature of industrial infrastructure, Mudenda (1995) observed that a dynamic industrial infrastructure usually comprises numerous strategic industries in a national economy, and includes basic metals, chemicals, metal-working and engineering. The basic metal industry is often composed of the ferrous metals (iron and steel) and the non-ferrous metals, like copper, tin, zinc, lead and nickel and involves mining, metallurgy, rolling, extrusion and drawing that produce intermediate goods. These goods serve as inputs into the metal working industry. Broadly, the metalworking industry can be divided into three parts: metal forming (forging and foundry), metal cutting (milling and machining), and sheet-metal working (fabrication). This industry is crucial to the production of capital goods and spare parts for industrial parts and equipment. The engineering industry comprises certain elements such as engineering design and development, tool engineering and production, production engineering, materials engineering, and maintenance engineering. Together these translate science and technology (S&T) innovations and developments into new, more efficient and more economical machines, plants and equipment. The engineering industry has the capacity to design, adapt, and manufacture the components of new technical systems; as well as repair, modify, and rehabilitate existing industrial plants and equipment. It is therefore obvious that the engineering industry drawing from the basic-metals and metalworking industries constitute the central pillar of an industrial economy (Mudenda, 1995). It is thus central to the iron and steel industry in terms of value-added, and also to industrialization generally.

In terms of technology transfers and industrialization, Ogbu et.al (1995), observed that policy makers used to conceptualize international technology transfer as being no more than a transplant of a given commodity from one geographic location to another. Investment decisions were usually limited to funding the requisite capital, while the long-term issue of technology creation, using imported technology as a base was hardly ever raised. Although, the central role of firms is important, one must not assume that individual enterprises are isolated actors in the process of technology accumulation. Just as firms, states have also proven invaluable in directing and dictating the path of industrialization, even inspite of the privatization syndrome in the global economy. Ogbu et.al (1995), noted that the rapid structural transformation witnessed in the late-industrializing countries of Japan, South Korea, Brazil, India and Taiwan could not have occurred without the strong intervention of the state. According to Etukudo (2005), as asserted by Peter Drucker, the economic sphere cannot and will not be considered to lie outside the public domain. But the choices for the economy as well as for all other sectors – are no longer either complete government indifference or complete government control. Etukudo (2005) in noting the poor performance of parastatals in Africa, especially the utilities and basic industries, canvassed the reconstruction rather than the dismantling of the state as a way of improving performance. According to him, a lean government does not necessarily mean a better government as witness the spate of redundancies in the public sector, which has not resulted in greater efficiency, rather in many cases most of the downsizing has been counterproductive. Comparing public-private sector cooperation in Africa as against Asia, he observed that whereas this relationship in Africa is predatory with the state preempting the private sector; in Asia, the state promotes the private sector resulting in growing prosperity in contrast to increasing poverty in Africa.

Elsewhere, I had lamented the technological dimension of Africa's crisis of development, and noted that the dearth of technologically driven approaches to addressing developmental problems had adversely affected the continent (Agbu, 2003a or b). I have also pointed out in another study the problems facing the Ajaokuta integrated steel plant in Nigeria and the implications of this for Nigeria's industrialization (2002c). I have also explored the issue of technology and Africa's industrialization within the context of the NEPAD document (Agbu, 2004); while exploring possible lessons for Africa after examining the cultural and technological dimensions of Japan's industrialization (Agbu, 2002b). In the last case, I had argued the fact that the Japanese have, to a very significant extent been able to marry their culture to technological growth and achievements in a positive way. Overall, the literature indicated increased interest in technological matters as this related to industrialization inn Japan. This was an industrialization based on the massive input of coal, iron and steel.

Rahman (1996), in his book, *The Japanese Strategy*, while analyzing Japan's strategy of development tried to identify the factors or the driving forces behind Japan's development, seeking to establish whether Japan's development process or strategy could be a model for other countries. In his studies, he believed that the iron and steel industries were the supporting as well as guiding industries for all other heavy and light industries of Japan. Observing that the metal industries as a whole had been the second largest foreign exchange earners in post-war Japan, he noted that they are still playing a big role in the Japanese economy and in international trade.

Further, Kuchiki (2003:8), though dwelling more on the changing industrialization policy in East Asia under globalization, did however, note the importance of government intervention in post-war Japanese economy. The intervention according to him was to ensure that resources were properly allocated and utilized. He observed that the policy was one which supported the development of the domestic industries, and that for a few years the government directly controlled production, product distribution, price determination and the efficiency of resource allocation, and above all, that priority was then given to the production of coal and of iron and steel. During the period of early industrialization, the Japanese government tightly controlled the import of technologies; it usually presented the lists of desired industrial technologies to be acquired from abroad (Ozawa, 1973:667). The technology contracts were periodically reviewed; the scope of imported technology was frequently altered while royalties were also periodically reviewed. In terms of industrial linkages, sub-contracting become a very major feature of the Japanese economy (Adejugbe, 2004:334). This feature and some level of informality appear to have worked well for industrialization in Japan. Generally, Singh (1995:7) saw policy interventions for industrialization in Asia as having taken many forms - they included targeted and subsidized credit to selected industries, low deposit rates and ceilings on borrowing rates to increase profits and retained earnings, protection of domestic import industries, the establishment and financial support of government banks, public research investment in applied research, firm- and industry- specific export targets, development of export marketing institutions and wide sharing of information between public and private sectors. While some of the industries were promoted, others were not.

Further explicating the reasons for the successful industrialization witnessed in some Asian Countries, Etukudo (2005) noted that the protection of the home markets at the early industrialization stage provided Japan, the Republic of Korea and other emerging markets of East Asia a “captive market”, which resulted in high profits and allowed domestic companies to make greater investment and learn-by-doing to improve product quality. It was also noted that at the early industrialization stage it is inadvisable to seek an unconditional integration into the world market. He opines that what Japan, the Republic of Korea and Taiwan did when they experienced early rapid growth was selective integration with the world economy, that is, they sought integration to the extent dictated by self-interest.

For Africa, following the attainment of independence by most of the countries in the 1960s, they followed or adopted a model of development with industrialization as the vehicle. This was on the belief that industry was the engine of growth and that a dynamic industrial base was likely to stimulate investments in other sectors. According to Ngom (2005), most of the post-colonial African countries had undergone two phases of industrialization. The first phase, which was initiated during the colonial period, was geared towards the major regional markets and rapidly came up against the problems of limited market size in the newly independent countries and excessive state control. The second phase which was in the 1970s, witnessed the promotion of phased industrialization supported by the development banks and development cooperation agencies. This was based on the state approach and failed for the same reasons of market size, although this time other factors came into play, such as the use of inappropriate technology. In terms of approach selected for industrialization, Ngom (2005) observed that the import-substitution strategies pursued had on the whole yielded results that were short of expectations in periods characterized by falling exports. He identified certain factors, which if neglected will have adverse consequences for industrialization. These include for example, the use of technology, market size, the need for cross-cultural exchanges, the social crisis that results from unemployment and too rapid urbanization. According to him, the situation may even be worse in those cases in which industrialization "kills" agriculture without achieving the expected results.

2.2 Africa's Crises of Development

It is generally agreed that there is a development crises in Africa (Mkandawire and Soludo, 1999; CODESRIA-TWN-Africa, 2002; Agbu, 2003a or b) that require immediate and sustained efforts at curbing not just by Africans alone, but also by the larger global society. However, while most of the suggestions put forward by scholars and development planners have been of immediate and short-term relevance, little appeared to have been done in terms of working out enduring or sustainable interventions targeted at addressing the root causes of underdevelopment and low industrialization. It is to this lacuna that this study strives to respond to by exploring a possible intervention in a proactive way. It is therefore, at once theoretical but equally policy-oriented for the relevant governments and actors involved in development and industrial planning. Japan-Nigeria cooperation in the iron and steel sector is being proposed as feasible, and possibly a reference point in the future for development cooperation involving governments and the private sector.

It has been observed that the development challenge facing Africa requires a radical approach that should be embodied in a growth-promoting, market-accelerating model, but which is human centered in other to be able to address the multifarious problems relating to poverty in the continent (World Bank, 1994). Ideas are emerging about a partnership with the international community and the issue of debt forgiveness. Already, there is in existence the New Partnership for Africa's Development (NEPAD), which aims to create some sort of partnership between the advanced industrialized countries and Africa with the purpose of reducing poverty in the continent (Agbu, 2003b; 2004). Poverty has much to do with having the human and material capacities to produce goods and services, and the manufacturing sector, which depends significantly on iron and steel products as inputs play a major role. According to Gelb (2002), NEPAD is an attempt by African leaders to promote collective action within a coherent framework to address the continent's lack of development. It is intended both to respond to global systemic risks originating from Africa, and to establish conditions for the continent's integration with global markets. As observed by the World Bank, NEPAD advocates the development of a market-driven, private sector-led economy to achieve its goals of accelerated growth, sustainable development and the eradication of poverty. It canvasses new terms for Africa's engagement with the world based on a co-equal relationship and dialogue (Agbu, 2004). It is from perspectives like these that this study believes that it is possible to negotiate cooperation in strategic industries with advanced industrialized countries targeted at particular sectors that have implications for sustainable industrial growth and regional poverty reduction. This approach cannot easily be faulted against the background of a global political economy characterized by many disadvantages, especially as being experienced by the developing countries.

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3. Perspectives on Industrialization and Development

There are several perspectives on the nature of economic development, of which industrialization is very critical. However, of these perspectives, three clearly stand out. These are the views of the modernization school, the dependency school and more recently the emphasis on export-led growth. Each of these perspectives boosts of a different industrial development strategy. For the modernization school, import-substituting industrial development is the preferred model. This is expected to result in a state of mass consumption that relegates traditional life and the subsistence economy to the background. In this model, the developing countries are urged to manufacture goods locally by importing capital equipment and semi-processed materials, substituting locally produced inputs for imported ones and locally manufacturing the capital goods. Unfortunately, this has not worked in most of the developing countries, rather, import-substituting industrial development stopped at the assembly stage (Mudenda, 1995). This led to criticisms of this model, especially by the dependency school. From the Political Economy perspective, the preferred model for this study, it is observed that income distribution in the developing countries is often skewed in favour of the elite who dominate the consumer goods market. The elite consumers demand nearly the same kinds of goods as consumers in the industrialized countries. The technologies required to manufacture these goods are already in existence and are owned by firms in the industrialized countries. Sometimes the technology owners set up the new enterprises through direct investment but, even when they are independent of foreign capital, foreign technology is normally purchased through license agreements or other contractual methods (Agbu, 2004: 373). For the Dependency School however, the industrial development strategy is concerned more with the development of those industries that use locally generated raw materials and are able to meet the demands of local consumption. Significant effort is made at integrating industrial and agricultural activities, and the establishment of small-scale and labour-intensive industries. Again, this approach does not seem to have worked well, and not much achieved in terms of industrial growth or economic development. A major problem with this perspective was how to measure the supposed level of dependency, especially in these days of intricate web of global interdependence.

The more recent view of industrial development places more emphasis on the need for export-led growth. This view could be found encapsulated in the NEPAD document for Africa’s economic revival and poverty reduction. Underlying this industrial development strategy is the notion of comparative advantage. It is believed that the comparative advantage of most developing countries lie in the availability of cheap labour and raw materials, that could be exploited to maximize comparative advantage in the international market. This has resulted in the undue emphasis on the export market as against the domestic market, resulting in distortions in the local economy. It is not uncommon to find critical shortages of domestic goods in countries taking this approach, and high rate of inflation induced by international prices putting excessive pressure on domestic prices (Mudenda, 1995). Nigeria for instance, which has been undergoing economic and political reforms since 1999 is beginning to experience shortages of cassava required for making ‘garri’ and ‘akpu’, the staple food in the southern part of the country due to the demand for cassava in the international market. In addition, the country since the period in question has been experiencing incessant labour unrests as a result of the government policy of constantly increasing the local price of fuel as dictated by the international oil market. Usually the slightest increase in the local pump price of petroleum products, trigger increases in transportation costs and prices of consumer items.

3.1 The Political Economy of Industrialization and of the Iron and Steel Industry

In the first instance, this enquiry utilizes the Political Economy Framework in the understanding of the gamut of issues relating to industrialization and development, and its related components of technology cooperation and development cooperation considered imperative in this era of global interdependence. From a global level of analysis, international political economy could be seen as a perspective in the social sciences and in history that analyses international relations in combination with elements of political economy. This area of study arose in the 1970s after the oil crisis of 1973, which made academics, especially in the United States to have a critical re-think of the economic foundations of the world order which evidently collapsed following the crisis. In realizing that previous studies of international relations had placed too much emphasis on law, politics and diplomatic history, scholars found in international political economy a fusion of economic and political analysis that made for a more comprehensive understanding. The perspective went beyond the focus on the territorial state as a unit of analysis to include the international system. Fundamentally, scholars of International Political Economy study trade and financial relations among nations, trying to understand how nations have cooperated politically to create and maintain institutions that regulate the flow of international economic and financial transactions (Wikipedia, 2005). There is therefore emphasis on the global level of analysis, though state level analysis is also necessary to determine constraints, capabilities, and potentials. The construction of a global economy could be understood firstly, in terms of a world of individuals and firms who in their pursuit of their self-interests, engage in market exchanges that enhances overall efficiency. Secondly, we have a world of competing nation-states seeking security and prosperity by enhancing their power and wealth relative to rival states; and thirdly, is a world where inequalities of power and wealth are structured by relations of class, by a global division of the world into ‘developing” and “developed”: countries, and by relations of gender and race. Often, the behaviour and dynamics of visible and invisible actors within the global system could be understood in terms of power and class position in the larger global political economy. This framework encourages us to examine how power differentials, policy and political decisions affect choices in the public realm. While recognizing this, this study goes a step further to locate development cooperation within the dynamics of global relations and partnerships as a proactive approach at enhancing the economic capacity of the weaker partner and therefore, contributing to overall global harmony.

Today's global economy is one of inequalities characterized by the globalization of trade, technology and finance, one in which the developed market economies have immense advantages. Others are largely passive subjects of globalization, unless they decide to do something about it. According to Samir Amin (2000), today's globalized values are expressed in the following new monopolies – the control of technology, control of global financial flows (through the banks, insurance cartels, and pension funds of the center), access to the planet's natural resources, media and communication and weapons of mass destruction. This is just a reflection of the indices of inequality between the developed and developing countries.

In a very interesting way, the literature on globalization itself, an important feature of the international political economy, has been characterized into three waves, all of which appear to be relevant for critical analyses of contemporary international political economy. From the first wave globalization literature, economic globalization is seen as a process characterized by the establishment of global markets, global prices and global production systems. As a consequence, the state has been severely compromised as an actor in its role in the domestic political economy with repercussions for 'policy' and 'real' outcomes (Bruff, 2004). Today sees capital in a largely marketised political economy enjoying heightened mobility and structural power, and therefore exerting a powerful influence on state activity. As a result of this, the costs of 'going it alone' in today's global economy are prohibitively high (Lairson and Skidmore, 1997:422). Though the state has not necessarily been completely overwhelmed, it is being forced to act in a certain way. From the second wave literature, a country's competitiveness and ability to adapt to change is less based on deregulation, marketisation and policy disarmament, but more related to the ability of the system to adapt to economic challenges over time, whatever the best way forward may be. According to Weiss (2003), an institutional perspective does not have to emphasize path-dependence, but could also incorporate notions of transformative change in its architecture. In the third wave literature, scholars began to recognize that the concept of globalization involves multiple levels of analysis – economics, politics, society, culture and ideology (Steger, 2000; Hay and March, 2000). Fundamentally, the third wave literature implicitly agrees with the empirical position canvassed by the second wave that the state has not been overwhelmed as it still has some autonomy, however, it recognizes that this may not make any difference to how subjects act.

At the state level, many heavy industries including the science and technology involved in production are oftentimes, overwhelmingly a state activity in many of the developing countries in contrast to what obtains in most developed economies (Parthasarathi, 1984: 227). So far, the post-colonial state in Africa as it were, though it is gradually changing, has proven to be a poor manager of knowledge, men and machines. It is obviously a state in need of re-invention and assistance. Quite a number of theories have been postulated, some of these had earlier been mentioned to explain why some countries are not developing or what they should do to develop – these include amongst others, the modernization and dependency theories of the 1950s and the 1960s; Basic Needs Approaches, Neo-Malthusian theories, Women and Development, Neo-liberalism and Grassroots Approaches in the 1970s and the 1980s; and Post-Development, Sustainable Development, Culture and Development Approaches of the 1990s and 2000s (Dos Santos, 1970, Willis, 2005: 27). Still, I find the explanatory power of Radical Political Economy Framework incisive for understanding the African predicament vis-à-vis the global environment, but especially its ability to integrate state-level analysis with global dynamics.

Basically drawing from this perspective, which had some influence from Marxist Political Economy, science and technology and industrialization should be seen as part and parcel of the dynamics of the global production system and the global economy heavily influenced by the already developed market economies. This approach opines that every system of production consists of - (various artifacts, psychic and physical power of human beings), tools of production (various artifacts including technology), objects of labour (the land, sea, air and their contents which human beings fashion for their own needs), and the social relations of production (who determines what is produced, when and how it is consumed, that is, the status and power relations of people within a certain production system). Not surprisingly, those who control and direct the global production system set the agenda and the goals and greatly determine and influence the direction of development. This includes the determination of what goes into the acquisition, adaptation and development, which research and development is carried out and where; and the information, reward and punishment systems (Ogban-Iyam, 1988: 74). The politics of technological acquisition, development and industrialization invariably becomes apparent as the various actors - states, the multinationals and transnationals, Non-governmental Organizations (NGOs) and other amorphous actors jostle to wrest or have some control over a particular production process (Thorndike, 1978: 55). The question of who has control, and therefore, the power to define, appropriate and supervise production and distribution spaces become uppermost. The impact of this contest on many an unsuspecting developing country has sometimes been most undesirable. See below, diagrammatic representation of what could be termed the political economy of interdependence. Increasingly, new actors and variables are being enveloped in the social relations of global capitalist production seen to be fundamentally unequal, and therefore in need of some balance in the sense of extending development cooperation to the less competitive.

On the political economy of Africa's technological crisis and development, no meaningful view can be canvassed without first espousing the nature and character of the post-colonial African state. The post-colonial African state is seen as a product of colonialism; the colonial African state was designed to achieve certain selfish ends, ends that are now in conflict with the people's desire for progress and the good life. The post-colonial state in Africa has in the past two decades or so been subjected to a barrage of invectives in which it has been described by largely unprintable words such as being prebendal, overgrown, rentier, weak, corrupt, neo-patrimonial, nepotic, patronizing, collapsing and collapsed amongst others. Though, not out to challenge or glorify any of these views, it is however important to note on the other hand, that it is also a post-colony that could be said to have largely been enduring. Enduring in the sense that inspite of its travails, it has survived and remained standing, compared to instances in Eastern Europe and the Middle-East where states have either disintegrated or been sacked by external forces. Nigeria is a case in point, it does not pretend that it has no problems, but has increasingly sought ways to harmonize the disparate interests in the country, the result of the forceful agglomeration of completely different cultures and world views. The efforts made so far, should be able to attract collaborative partnership towards its industrial development. Increasingly, even in the 21st century, it is becoming evident that the forceful act of bringing together the different peoples of Africa into political and geographical units by the colonial governments for purposes of administration and economic exploitation is a major impediment to political stability and economic growth in the continent. These countries invariably spend a significant amount of time and scarce resources on integration matters rather than on knowledge acquisition, industrialization and economic growth.

On the subject matter of technology choice and technology acquisition, which are important issues in any collaboration in the iron and steel sector as these impact directly on industrialization and development, the role of the state as an actor or facilitator is all important as the experiences of the East Asian countries showed. Fundamentally, since change and development are imbued or located in the production system and the process itself which usually takes on a social character in action, a rational approach to understanding technological acquisition and development is to first understand the forces at work in the particular formation, in this case, in the post-colony. Both the character of the state itself and the character of the elite on the one hand; and the nature of the external interests impacting on the state become important in this understanding. This makes it easier for us to understand the reason for state incapacity in Africa or its inability to effectively respond to the global dynamics of trade, technology, communication and politics generally referred to as globalization. It is in recognition of the nature of International Political Economy and changes that require policy choices, and of the role expected of firms, states and global structures of production and trade that this study believes that in considering the predicament of countries of developing world in the contemporary period – countries like Nigeria, it is imperative that they explore development cooperation positively even as globalization presents opportunities and constraints. Hence, the thinking is that strategic cooperation should be explored in the iron and steel industry, an industry that is very critical to industrialization.

Development cooperation, a product of global political and economic relations is considered fundamental at this juncture in global relations for the industrial development of the developing parts of the world. Development cooperation as a strategy of development and of relations between states is largely self-explanatory, and basically seeks solutions to for instance, the problem of organizing and executing or effectuating development and its paraphernalia in the relevant sectors - in this case, in the iron and steel industry. However, in line with the reality in the global economy, certain minimum requirements are expected of a country seeking development assistance. These include - a healthy macro-economic environment necessary for generating goods and services, the state serving as a facilitator and limiting its role in the marketing sectors of the economy, and a policy or strategy to promote the development of the basic industries and small enterprises with linkages to these basic industries.

Two key areas of development cooperation involve human resources development and technological cooperation. Human resource development should ideally be an important part of any agreement at salvaging or developing a particular industry. This ensures the sustainability of the investment. On the other hand, technological cooperation is an important component of the overall effort at achieving sustainable development in the particular industry. It has often been defined as a process by which two or more partners identify individual and common interests and agree to share information, knowledge, know-how and managerial skills regarding the utilization of technologies. In the present times, it is usually a cooperation aimed at using technologies that are more environmentally-friendly, more energy efficient, less resource intensive, less polluting and invariably oriented towards recycling in order to contribute to the aim of sustainable development (United Nations Commission on Sustainable Development, 1998). Generally, technology cooperation includes the machinery and equipment involved in the production process, and an understanding of the science and technology, the transmission of skills, know-how and related organizational and institutional arrangements. Usually, technology capacity building, and the knowledge and need of a particular firm or industry are important in order to be able to acquire, assimilate, use, maintain, adapt, change and create technology. These are essential dimensions of this cooperation. In this case, development cooperation means a situation where a technologically superior partner like Japan, an important player in the global economy, cooperates in a positive and beneficial manner, with a requesting partner towards the development of a particular firm or sector, in this case, the iron and steel sector. This cooperation is expected to be mutually beneficial to both partners, the object being to tap into and utilize the experience acquired over the years by the invited partner, in this case, Japanese firms through the encouragement of their government for intervention in the of the iron and steel industry in Nigeria. This is expected to lead to the successful revitalization of this sector in Nigeria, which invariably dovetails positively to other sectors of the Nigerian economy.

Considering the weakness of the economic bases of many African countries, or of countries of the developing world, there is the recognition of the need for technological assistance targeted towards those sectors that are necessary for the growth of other sectors of the economy. This assistance is however, sort in the form of cooperation, a cooperation that is targeted principally at a strategic sector in terms of its impact nationally and regionally. This approach also has the elasticity of seeking the cooperation from all levels, but more especially from sources that have proven record of achievement in the particular sector of interest. For this cooperation to be meaningful, it is expected to be mutually beneficial to the parties involved, with more intangible benefits (political) to the partner providing the technical or technological component. The whole gamut of human resource development, knowledge creation and modification, education, technological acquisition, domestication, innovation, and market outlets are expected to be part and parcel of this development cooperation. Further, because of the elasticity of the partnership that may eventually be evolved, it is possible to build up a “cluster of technological and industrial partnerships” with regional scope all geared towards the purposes of enhancing industrialization. In this instance, industrialization would be enhanced because of the strategic nature of the iron and steel industry in terms of its backward and forward linkages.

The benefits from this sort of cooperation will not only accrue to the cooperating countries, but will also ramify to the nearby regional markets in a positive way. This not only contributes to regional economic growth, but also has significant implications for the reduction of poverty. Extending this cooperation to regional markets falls in line with the current thinking that this will help developing the countries to participate more effectively in the competitive global market. This strategy has also been articulated in the largely Africa-owned New Partnership for Africa Development document in which Regional Economic Communities (RECs) are to be regarded as the focal points for development efforts. This emphasis on regional cooperation is a recognition of the changing times and of the fact of globalization. This is a truism that cannot be easily ignored. Societies are being impacted on by the motive force of history embodied in the hydra-headed phenomenon we call globalization.

It is from this perspective that this study talks of cooperation between Nigeria and Japan, and believes that it is potentially possible for African countries to strike up partnerships with the advanced industrialized countries and their companies aimed at developing those sectors of their economies necessary for further growth and industrialization. This approach has been necessitated by the fact of globalization and the nature of the international political economy. In the process of carrying out this study, there is no doubt that we will come across some concepts that require clarification in the context of our enquiry. Let us therefore briefly discuss the following concepts for a better understanding.

3.2 Development

Development is a multidimensional and contested concept. Lucian Pye et.al (1966) was to define it as a multidimensional process of social change. Within the national and international levels, it has been conceived of as the mobilization, adoption and use of human and other resources within an entity to meet the needs and possibly wants of a people (Fadahunsi, 1986: 6). Todaro (2000: 739) defines it as the process of improving the quality of all human lives, raising the people's standard of living, and creating conditions conducive to the growth of people's self esteem through the establishment of social, political and economic systems and institutions. Often defined as an economic process, and also from the human development perspective, what is evident is that development in one place may not necessarily be development in another. Indeed, industrialization does not necessarily mean development. However, it suffices to assume that there are certain irreducible denominators that are necessary to live in the modern times. These no doubt include some reasonable level of development of the infrastructure and industrial base, availability of clean water, availability of food and affordable housing for the people. Of course, the ability of governments and of societies to provide these will require some minimum level of industrial development of which the basic industries including the iron and steel industry are crucial.

In principle, development could also be taken to mean the culmination of strategic compound of private and collective actions, with their intended and unintended consequences through which a society moves from one state of organization, one system of ideas, beliefs and traditions, and stock of equipment, to another. Conceived in this way, development for Nigeria at this historical juncture for instance, should focus on the study and understanding of the country's political economy and what it requires to improve upon the existential conditions of its peoples. It should entail efforts at the development of technologies applied to critical areas in the society that are necessary for economic progress and the alleviation of poverty. In this effort, cooperation with industrialized countries like Japan becomes a necessity.

3.3 Technology

In its original conceptualization, technology meant the systematic knowledge of the industrial arts, which was then implemented by means of techniques. However, in the modern times, technology is often taken to comprise both the knowledge and the means of its utilization (Ina Spiegel-Rösing and Derek de Solla Price, 1977). Therefore, in a wider sense, technology is the elaboration of techniques and methodologies for the solution of defined problems of a given society in a given environment. It is usually fundamentally assisted by basic scientific research, which provides the basis for sustainable transformation of research findings into use-value. However, it is important to note that technology is not necessarily applied science all the time. Whereas, science is a codified and systematized knowledge that has the power of explaining certain phenomena, it is not necessarily technology per se, and technology is not always a product of science. Advances in science are mainly dependent on the state of the art of technology itself and especially of old technology (Thisen, 1993: 12). Technically, the concept of technology has two basic parts. The first consists of all kinds of tools, machines, vehicles and buildings. The second comprises all kinds of knowledge required for the use, maintenance, repair, production, change and innovation of the first. The two parts could be termed as 'equipment' and 'technological knowledge'. Equipment is often denoted by the term (hardware) and technological knowledge by the term (software). Technological knowledge is often divided into two – the knowledge of how to do things (know-how), and the knowledge of why certain things have to be done in certain ways (know-why). Given a certain configuration of equipment and knowledge, knowledge embodied in human beings is the more decisive factor in technological growth and has both quantitative and qualitative components. Though, technology is embodied in most human activities, its direction and shape is largely determined by the systems of mode of production in which it is located, produced, distributed and regulated (Agbu, 2003). Today, this mode could be seen embodied in the capitalist market economy, which has become so globalized that countries have little option but to maneuver within it. For this study, our interest is in all knowledge and hardware that have to do with the development of the iron and steel industry and its use in the social and economic transformation of Nigeria through the path of sustainable industrialization.

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4. State of Nigeria's Industrialization

Nigeria is located on the west coast of Africa. It is geographically large, approximately 923,768 square kilometers, and a multi-ethnic country with enterprising peoples who could be found dispersed all over Africa and beyond in various trades and professions. With a population growth rate of about 2.37 percent (estimated 2005) and over 130 million people as at 2005, Nigeria no doubt has a potentially large market by African standards. It is blessed with such natural resources as petroleum, natural gas, tin, iron ore, coal, limestone, niobium, lead, zinc and arable land (BPE, 2005). Its political clout and economic potentials have tremendous influence and impact regionally and continentally. It is a major oil producing country, in fact, the sixth largest producer in the world, with the United States as its biggest market. It is therefore not surprising that three American companies, Chevron, Exxon-Mobil and Texaco are among the six joint-venture partners of state-run Nigerian National Petroleum Corporation (NNPC). The others are Agip, Shell and Elf. Together they accounted for 85 percent of oil production in the country. The Nigerian government through the NNPC holds 57 percent equity interest in these joint ventures leaving 40 percent to the joint venture partners. Until quite recently, the oil sector provided 20 percent of the GDP, 95 percent of foreign exchange earnings and 65 percent of budgetary revenues (ExpoGroup, 2005). It however employs only about 3 percent of the labour force (Akpobasah, 2004:2). There is therefore, little doubt that oil is presently the mainstay of the Nigerian economy. Not surprisingly, oil has also been fingered as the major reason for the underdevelopment of other sectors of the Nigerian economy. With the enormity of developmental problems facing the country, of which the economy and its management are uppermost, efforts are being made to diversity the economy in such a way that there is less dependence on crude oil sales. Diversifying away from emphasis on oil and gas mining should ideally look to those sectors that could catalyze industrial activities and lead to the production of further goods. The iron and steel industry is obviously strategic from this line of thinking.

In retrospect, it suffices to note that industrialization was not a key objective of the colonial government in Nigeria. The colonies were regarded as only sources of raw materials and markets for the firms of the home government. The colonial administrators were technically and politically not in a position to plan or execute industrial projects, subsequently, the pre-colonial development plans of Nigeria were said to have excluded the would-be beneficiaries *ab initio* at the planning stages (FRN, 1970:6). Though industrialization was attractive to the Nigerian nationalists who took over administration of government agencies with the departure of the British officials beginning mid-1950s, they were however, handicapped by the lack of indigenous technological capability. The period 1956-60 was economically speaking only notable for the set of rules and incentives that were designed to stimulate domestic manufacturing. The government encouraged domestic manufacturing through engaging in joint ventures with foreign companies (Adejugbe, 2004:19). The 1962 - 68 National Development Plan was the first to be drawn up immediately after Nigeria's independence in October 1960. While earlier development plans placed emphasis on utilities, educational institutions and basic infrastructure against the background of regional competition for development amongst the defunct Governments of Eastern, Northern and Western Nigeria, the planners of this particular development plan were acutely concerned about the conflicting programmes of the various regions and the need to divert resources to productive sectors rather than just utilities and social overheads.

The 1970-74 and 1975-80 Plans could be understood against the vicissitudes of the post Nigerian civil war (1967-1970), and the false sense of opulence created by the expanding crude oil economy (Adejugbe, 2004:20). The 1970-74 Plan sought to promote a more self-reliant industrial development, and reduce foreign dominance of the industrial sector. It was therefore instructive that the Nigerian Enterprises Promotion Act was enacted in 1973 to reserve some businesses for Nigerian entrepreneurs and to restrict foreigners to the more technologically demanding industries and joint ventures. Some of the manufacturing industries that sprang up in the sixties and seventies included textiles, synthetic fabrics, footwear, soft drinks, beer and stout, cement, soap and detergent, sugar confectionary, paints and refineries. In the sixties and seventies, the growth rate of the manufacturing sector was quite impressive ranging between 9 and 19 percent. This appeared to have encouraged the government to design more comprehensive development plans for 1975-80 and 1981-85, in addition to the rolling plans of the 1990s (Fashola, 2004:308).

It is important to observe that before the oil boom of the 1970s, the Nigerian economy could be described as being predominantly agrarian, with agriculture accounting for an average of over 60 percent of the national output between 1955 and 1965. While manufacturing experienced a rather sluggish growth from the 1970s (7.5 percent in 1970, 8.9 percent in 1980 and 8.5 percent in 1990), infrastructure and services experienced persistent growth interrupted only by the economic recession of the 1980s (Ogun, 2005). Recent government economic policy place emphasis on “agro-allied industries”, with definite statements regarding steel mills, petrochemical industry, machine tools and other core projects with respect to building synergies targeted at an envisioned industrial complex. The current official policy of Nigeria remains to create a market-oriented, private sector-led economy that is highly competitive internationally, particularly in areas of comparative advantage. The country seeks an economy that is expected to be technology-driven, broad-based, humane, open and globally significant (FEC, 1999). This is the classical neo-liberal outlook of many leading economies today. The government intends to do this through the use of stabilized market-responsive exchange rate within narrow bands and with sufficient predictability, reduced interest rate (to single digit), institutional rationalization of government, privatization, general incentives for local and Foreign Direct Investment (FDI) and the reduction of Nigeria's external burden through negotiations (FEC, 1999). It is safe to say that the Nigerian state today is strongly committed to the promotion of a free market economy characterized by privatization and deregulation. Numerous state-run firms have been scheduled either to be privatized or commercialized with mandates to operate as profitably as possible without recourse to the state for assistance. Some of these state-run firms include the Nigerian Telecommunications Plc (NITEL), Mobile Telecommunications Plc (MTEL), National Electric Power Authority (NEPA), the Nigeria Airways, and the Nigerian Railways. Plans are at advanced stages at deregulating the banking sector, reviewing the country's shipping policy, and privatizing road transportation and the nation's five major seaports (Anyikwa, 2004:1). Prior to this policy, the government had invested in certain targeted industries that included paper mills, assembly plants, iron and steel, petrochemical plants, oil refineries, fertilizer plants, liquefied natural gas plants and cement plants. Most of these investments eventually failed to generate significant foreign exchange or compete effectively with imported products, except for the natural gas projects (CBN, 1988:34), for reasons we will come to see later.

In brief, the broad thrusts of Nigeria's trade and industrial policies followed the mainstream ideas of development. Immediately after political independence in October 1960, the successive governments adopted the model of import-substitution industrialization and five-year development plans like many other developing countries with some financial assistance coming from the international financial institutions. It was the case in the 1970s that the nationalization of foreign industries was in vogue, and Nigeria was no exception with the oil boom providing the needed impetus for a deepening of the import-substitution strategy. From the 1980s onwards, especially following the publication of the Berg Report of 1981, there was the introduction of the Structural Adjustment Programmes (SAP) in many countries of Africa, including Nigeria. The broad direction of policy was characterized by liberalization, with emphasis on exports and competitiveness (Ikpeze et.al, 2000). At this period Nigeria engaged itself with economic diplomacy. However, it is important to observe that apart from the intrinsic shortcomings of SAP as a development strategy, the political economy of the Nigerian environment severely constrained the ability of the country to gain from the envisioned economic liberalization. Indeed, specific policy choices and implementation in the policy regimes largely reflected personal and special interests, often bereft of economic rationality. Such interests determined the nature of tariff and non-tariff barriers to trade and the frequent reversals, the structure and administration of incentives, the timing and administration of the indigenization of enterprises; the location, size and the management of public sector investment in core industrial projects (CIPs). These included iron and steel, paper, fertilizer, petrochemicals, oil refineries, machine tools, liquefied natural gas and aluminum smelting. The decision on where to locate the iron and steel projects was a case in point. Political and sectional interests rode roughshod over economic considerations as to location, fuel technology and number of rolling mills (Ikpeze et.al, 2000). The principle of even spread of core projects around the country led to increased transportation costs for raw materials and the finished products, resulting in poor performance and poor international competitiveness.

4.1 Phases and Current Features of Industrialization

Nigeria’s industrialization process so far could be categorized into three major phases. The first phase was from the pre-independence period to the end of the Nigerian civil war in 1970. During this period, there was minimal industrial planning but higher industrial activities in the regions, which were in competition with each other. The second phase was from 1970 to 1986, that is from the end of the civil war to the period of the Structural Adjustment Programme (SAP). This period witnessed the centralization of industrialization by the Federal Government, with the government opening up the Nigerian economy according to the dictates of the World Bank and the IMF. The third phase, from 1986 to the present saw the government rationalizing direct participation in the economy and in industrialization. This was the period of economic reforms involving the deregulation and privatization of key public sector industries, and the rationalization of the public service (Soludo, 2004). To say that Nigeria underwent some sort of political and economic revolution between 1999 and 2005 will not be far from the truth. Since 2003 Nigeria’s economic development policy could be said to have been be focused on promoting industrialization, especially targeted at the middle and small-scale industrialists. Efforts were made to diversify the Nigerian economy, with increasing emphasis on the manufacturing sector. There are presently twenty-one industrial development centers in Nigeria including an Export Processing Zone (EPZ) in Calabar, South Eastern Nigeria.

In order to properly focus its economic reform efforts, the government produced a document known as the National Economic Empowerment and Development Strategy (NEEDS) in 2003 which emphasized industrialization and the creation of jobs for the teeming number of unemployed youths in the country. The document was launched in May 2004, and replaced the rolling plans of the 1990s. Fundamentally, the NEEDS document encourages the participation of the people at all levels of the Nigerian society in a positive and proactive manner towards the attainment of its goal of reducing poverty in the country. NEEDS gained inspiration from the Poverty Reduction Strategy Paper (PRSP), whose preparation actually began from 2001 (Akpobasah, 2004:2). NEEDS is designed under a framework of broad-based market-oriented economy that is private sector-led, in which people could be empowered through wealth creation so that they can afford the basic necessities of life.

Also, in line with its new economic policy, the Nigerian government under Olusegun Obasanjo was quite vigorous in its pursuit of FDIs. However, most of the capital investments went to the oil and gas sector and the telecommunications industry rather than to agriculture and manufacturing which would have had more immediate impact on the lives of the ordinary people. Suffice it to note that not all FDIs are beneficial, but only those that target those sectors from which the ordinary people make their living. Therefore the nature of the investments and the sort of linkages that could be created with the local economy (South Centre, 1996:11), are issues of utmost importance in the pursuit of FDIs for developing countries. Unfortunately for Nigeria, the foreign investments have been going disproportionately to the oil and gas sector. The over-reliance on oil exports has generated the concomitant problems of import dependence, capital flight, and lack of motivation for backward linkages in the production process. Import dependency has therefore resulted in Nigeria generating output and employment growth in other countries, while its own industries are underutilized. In fact, the most critical problem facing Nigeria's economic planners at the moment should be how to increase productivity of the domestic economy (Ashaolu, 2004:2). Re-energizing the local economy through investment in the human and material resources of basic industries like the iron and steel industry should be one of the rational options.

It is also interesting to note that while Nigeria was until recently, Africa's most indebted country, purportedly owing about US$36 billion, it cannot however, be categorized as a poor country in economic terms. As the seventh largest oil exporter, it does not meet the World Bank's definition of a low-income country. This created many problems for the country in respect of its relations with international financial institutions. It was therefore not surprising that Nigeria was in the forefront of the campaign for debt cancellation for the poor countries of the developing world. Very recently, and in line with the increasing understanding amongst leading industrialized and creditor-countries, the finance ministers of the Group of Eight (G-8) richest nations agreed that 18 of the heavily indebted poor countries of the developing world would have their debts written off 100 percent. For Nigeria, which got a different offer of respite, it was a great achievement, even though it got only a promise that it own debts would be reduced by 80 percent. It is interesting to observe however, that while Nigeria accumulated a total debt profile of $17 billion within a twenty-year period, it had repaid $22 billion, but was still accused of owing about $37 billion as a result of the accumulated interests and penalties (Okwe and Daniel, 2005). Infact, Nigeria under the Olusegun Obasanjo administration paid a total of US$7 billion to its creditors between 1999 to mid-2005 (Agbu, 2005). The country is indebted to the Paris Club, London Club and also had multilateral, promissory notes and Non-Paris Bilateral debts. No wonder, Nigeria had often argued that the debt issue is a no-win situation for developing countries unless the debts are out-rightly cancelled as it deprives poor countries of the resources needed for socio-economic development and poverty reduction.

4.2 The Manufacturing Sector

In Nigeria, there are four industrial sectors that are considered priority areas of development because of their catalytic role and linkage effects to the other sectors of the economy. The priority areas which are in the forefront of government industrial policy through a series of incentives include agriculture, manufacturing industries, mining and mineral extraction (non-oil), and export manufacture. Unfortunately, manufacturing has added less than 5 percent to Nigeria's GDP in the past five years (1999-2004). However, there has been marginal improvement as a result of government policies of banning the importation of certain items and the effective monitoring of industrial activities by government agencies like the National Agency for Food and Drug Administration and Control (NAFDAC) and the Standard Organization of Nigeria (SON). As we know, manufacturing as an important aspect of industrialization deals with the process by which materials are transformed by means of specified skills and technology into the intermediate or final stage of development. The aspects which are favored by the Nigerian government and hence have promulgated government's packages include industries which can either immediately or in the short-run source their raw materials locally, for example, the agro and agro-allied sub-sectors for which there are vast natural resources and opportunities, including food preparation, fruit drinks, milling feed milks and vegetable oil processing. Others include industries that support food production through local manufacture of chemical, equipments and light commercial vehicles in particular and chemical as well as petrochemical based manufacturing industries generally. Other industries that are encouraged include those with multiplier effects such as flat sheet mills and machine tools industry that include foundries and engineering industries for spare parts production; basic industries for petrochemical and liquefied gas projects for which the government encourages foreign partners and the processing of local agricultural produce and minerals into industrial raw materials as manufactured intermediate goods required by the existing industries (Expogroup, 2005).

In the area of mining and mineral extraction (non-oil), Nigeria has exploitable quantities of barites, coal, diatomite, lignite, and columbite and iron ore. For instance, it has about 82.2 million, 189 million and 32 million tonnes (total 303.2 million tonnes) of coal reserves in three locations respectively, which could be used as fuel in the iron and steel industry, and in industrial production of tar, gas and edible oils. It also has exploitable quantities of iron ore totaling about 258.7 million tonnes in three different locations in the country, which could be used in the steel industry that feeds the automobile industry with the relevant products, in addition to producing ferrous sulphate, hydrated salt and iron oxide pigments. Export market potentials exist in agriculture produce processing, food and beverages, textiles, woods, consumer durables and iron and steel and non-ferrous industries (Expogroup, 2005).

TABLE 4.0

Growth and Share of Manufacturing Sector Output Selected Years 1970-2000

Indicators/Period	1970	1975	1980	1985	1990	2000
Index of Manufacturing Output (1985=100)	24.1	43.9	102.4	100	162.9	142.2
Output Share of Manufacturing Sector in GDP	7.20%	5.50%	9.20%	8.70%	5.50%	3.40%
Growth rate of Manu-	1959-1970	1970-1975	1975-80	1980-85	1985-90	1999-2000
facturing sector per annum	9.40%	12.70%	18.50%	-0.50%	10.30%	-1.30%

Sources: FOS, Annual Abstract of Statistics, 1972, 1975, 1987, 1998
CBN Statistical Bulletin, 1999 & CBN Annual Reports, 2001, for basic figures on index of output and GDP Figures. Growth rate of manufacturing sector per annum for 1970 is actually from 1959/60 to 1969/70.
M.A Fashola," A Schema for Nigeria's Optimal Industrial Development", M.O.A Adejugbe (2004), Industrialization, Urbanization and Development in Nigeria 1950-1999, Lagos, Concept Publications Ltd.

The ultimate objective of the industrial policy of Nigeria is social and economic development as set out in the Fourth National Development Plan 1981-85. The Plan stated "every effort will be made to mobilize the industrial potential of the country with a view to setting the stage for sustained social and economic development of the country". As earlier observed, the manufacturing sector performed well during the 1960s and '70s, but stagnated beginning from the 1980s onwards as a result of several factors, which included a lack of access to foreign exchange and poor infrastructure base. See below a summary of the performance of the manufacturing sector in selected years 1970-2000 (Table 4.0).

The apparent excellent performance of the manufacturing sector in the 1960s and 70s hid serious defects that existed in the industrial sector. This was the lack of technical and technological knowledge and skills upon which viable industries could be run. In addition, the sector lacked international competitiveness (Fashola, 2004:312). By the 1980s, especially towards the late 1980s many of the industries in the manufacturing sector performed poorly, operating much below capacity. In terms of details, the major industrial projects operated at ridiculously low levels of capacity, such as 1.6 percent (in 1988) for the steel plants light section and bar mill, 5.5 percent for the steel plants wire rod mill, 11.1 percent for the Jos Rolling Mill, 15 percent for the Katsina Rolling Mill, 15 percent for the Petrochemical Polypropylene Plant and 12.9 percent for Petrochemical carbon black (CBN, 1988:34). On the average, capacity utilization in the manufacturing sector in 1988 was only 32.l4 percent. The vegetable and grain mills operated at 12.2 percent, drugs and medicine 16 percent, paper manufacturing 27.9 percent, textiles 33 percent, soft drinks 31 percent, motor assembly 30.5 percent and basic metals industries 20.8 percent (CBN 1999:134). In summary, many of the core industrial projects failed due to a combination of factors such as inadequate foreign exchange to procure inputs and inadequate infrastructure, especially electricity apart from the delayed implementation of some of the projects.

However, in recent times particularly since the inception of civil governance in Nigeria beginning 1999, the country has undergone what may be considered very rapid economic and political reforms concurrently. The government showed seriousness with its deregulation and privatization of public utilities and government interests in commercially viable companies, while the public service was subjected to downsizing, re-alignment and re-focusing. The innocent victims of these reforms in the short-run have been the ordinary Nigerians whose sources of livelihood vanished, while their purchasing power continued to deteriorate to ridiculously low levels, especially with the incessant increments in the local pump price for petroleum products in response to developments in the global oil market. What however, appeared to be a positive development was President Obasanjo's claim that the manufacturing sector had started to reap the dividends of the economic reforms as capacity utilization in the industries rose from an average of 25 to 50 percent in September 2005. This assertion was made through the Nigerian Minister of Industry, Fidelis Tapgun at the launching of a N5.6 billion all steel radial truck factory built by Dunlop Plc, Nigeria (N140 exchanges for $1 US as at December 2005). The Chairman of Dunlop did agree with the Minister that the reforms had indeed created a more conducive environment for the manufacturing sector. In summary, it is safe to assume that the future is getting brighter, *ceteris paribus*, for the manufacturing sector in Nigeria. With the appropriate policy framework and good management Nigeria may yet be able to achieve its projected industrial capacity utilization of 70 percent by the year 2007.

Since this study is multidisciplinary in nature, there is therefore the logical expectation that individuals from backgrounds other than engineering, metallurgy, technology, business and economics may be interested in it. I have in the next segment of this chapter included an overview of the steel making process for the benefit of those without the necessary knowledge or training.

4.3 Overview of the Steel Making Process

It is safe to say that there are many processes for making steel, especially considering the development of these processes over the centuries beginning with the production of iron bloom or sponge iron, to wrought iron and to higher quality steel produced in India through the crucible technique some centuries ago. This was a system that allowed broken ingots of bloom to be heated in crucibles for long periods of time. Suffice it to say that the art of making iron and steel was developed over 2000 years ago in many civilizations, but the processes have become rather standardized in modern times, however, what may vary is the quality of raw materials used in the production. Crudely put, the major intermediate goods in making pig iron and steel products are iron ore and scrap, which are processed and result into a definite quantity of output; and coke, limestone, electricity and water, which are consumed during the production process. In general, there are three stages in producing final steel products when using iron ore (iron making, steel making and rolling) and two stages when using scrap (steel making and rolling). Iron making is operated in blast furnaces and steel is made in open hearth furnaces (OHF), basic oxygen furnaces (BOF) or electric arc furnaces (EAF) (Sato, 2005:643).

Steel may be defined as an alloy of iron and carbon. In steel, the carbon varies from 0.04 – 1.7 per cent. No steel contains only iron and carbon – by nature of the raw materials and method of manufacture all steels contain varying amounts of sulphur, manganese, phosphorus and traces of other elements. If other elements are added to the steel, such as chromium, cobalt, or nickel, the steel becomes an alloy steel (Sharp, 1966:11). Steel making may therefore be defined as the production of an extensive series of complex alloys of iron and carbon and other elements from raw materials usually contained in pig iron, and normally the addition of further alloying materials. The size of the steelmaking unit and the method of manufacture are largely governed by the quantity of steel required and the raw materials available. Steelmaking falls broadly into two categories known as acid and basic. This division is brought about by the fact that some ores contain large amounts of sulphur and phosphorus. The terms acid and basic may be regarded as being derived from the chemical nature of that part of the furnace lining with which the molten metal and slag are in contact.

Steelmaking in integrated plants is a complex of at least five industrial units related vertically to each other. There are also a number of ancillary facilities not directly involved in the production of steel but which are essential to the plant's operations. A typical steel mill consumes four basic raw materials, namely, coal, iron ore, fluxes and scrap. It also consumes a number of other essential inputs like refractories, water and electric power as earlier mentioned. The first stage invariably begins with good quality coal or coking coal, mixed if necessary with unwashed coal fed into the coke ovens, which is the first major unit of a steel plant. In addition to the coke produced from the coke ovens, important by-products such as coal tar and coke oven gas are also produced which maybe sold or used as fuel by the plant itself.

The second major unit is the Blast Furnace. It produces molten iron either by smelting lump ore or artificial iron bearing materials such as sinter and pellets. The reduction of ore or artificial inputs require a fuel, coke. Coke also serves as a reducing agent, its carbon forming a chemical union with the oxygen in ore. Fluxes are a third essential input of the blast furnace. It facilitates the separation of metal from impurities in iron ore. The most commonly used fluxes are limestone and dolomite. The desired combination of iron bearing materials, coke and fluxes is known as the charge. Hot air could be blown through the bottom of the blast furnace and, passing upwards through the charge facilitates reduction of iron bearing materials. The principal product of the blast furnace is hot metal. This may then be cast into pig iron and sold. More often, it is transported as hot metal to the next major unit of a steel plant, the steel melt shop. The blast furnace also produces gas as a by-product, which is usually consumed by the plant itself; and slag, a mixture formed by the action of the flux on the fuel and impurities in ore. In the blast furnace, slag serves as a vehicle for separating impurities from metal. When solidified it may have some commercial value, especially in the construction industry. The steel melt shop adjusts the composition of carbon and other impurities to form steel. Melted scrap could also be used to produce steel, especially through the use of the electric arc furnace.

A most important part of any steel plant that uses the blast furnace method of production is the converter. This is usually a pear-like shaped vessel with a spherical bottom, cylindrical middle portion and a conical top. It is lined in the interior with basic refractories usually tar-bonded unburnt dolomite and magnesite, and magnesite- chromite bricks. The converter is solely used to effect the conversion of molten pig iron into steel without the use of fuel for heating the metal. This is achieved by blowing a current of air (oxygen or other gaseous matter capable of evolving oxygen) to the molten pig iron contained in the converter. The large amount of heat needed for the reaction is generated in the vessel during this process. This mode of steel manufacture is known as pneumatic, LD or converter process. The LD converter is the best known and most widely used oxygen process. It is essentially a top-blown Bessemer converter and takes its name from Linz and Donawitz, the two Austrian cities where the process was developed. Generally, for other converters, air could be blown in different ways – from the top, side or bottom of the converter. It was Henry Bessemer in his quest at finding a solution to the tendency for big canons, which were made from cast iron to explode during firing that discovered the converter. He had the genius idea of making steel by getting carbon out of cheap, carbon-rich cast iron, rather than trying to get carbon into low-carbon wrought iron (A Brief History of Steel, 2005). The then, serious problem of how to mass produce steel was therefore, solved by Bessemer with the introduction of the Bessemer Converter at his steelworks in Sheffield. The key “trick” in this process was to stop the process when the temperature reached a particular point, which meant that the steel had particular carbon content (Quicksilver Metaweb, 2004). Though open hearth furnaces largely displaced the Bessemer Converters at the beginning of the twentieth century, the Converter gained some prominence since the mid-1950s after the development of the oxygen steel making processes (Johnson, 1966:5).

Generally, steel maybe cast into ingots. The ingots are then cooled, removed from their molds, reheated, and sent to the fourth major unit of the steel plant. Once again, there has been a major technological change since the Second World War, the development of continuous casting. Continuous casting allows the casting of molten steel directly into intermediate forms. The intermediate action produced depends on the targeted product of the steel plant. A mill manufacturing rails or heavy structurals will first produce blooms, the mill manufacturing bars and light structurals, billets; and the mill manufacturing flat products, slabs. However, there is little precise distinction among the three types of intermediate sections, their size and shape depend primarily on the general size and shape of the finished product. Blooms and billets have round or square cross-sections, whereas the cross-section of a slab is wider and rectangular. Some steel could also be cast into ingots and rolled into blooms and billets for forging in such finished products as wheels and axles.

The last major units of an integrated steel plant are the rolling mills. Only a relatively small amount of additional rolling is necessary to produce bars, structurals, rails and plates. To produce sheets, slabs may first be rolled into strips, then, finished in a cold rolling mill, and in some plants, galvanized, tinned, or corrugated. In modern times, steel is classified on the basis of its mode of manufacture, usages, quality and also on its composition. On the basis of its mode of manufacture, steel could be classified as electric steel, open hearth steel, converter steel and steel produced through combined processes.

As an aside, Quenching, a poorly understood method of producing steel was fairly common during the middle ages. In Japan, it supposedly evolved into a whole mythology that was carefully guarded by the master sword smiths then. Using this method, Japanese pattern-welded steels were for several centuries the best in the world as they made use of manual processing and attention to detail that could not be bettered by automated processing until the 20th century. Quenching, very common in the17th century amongst blacksmiths entailed the repeated heating and quenching of iron while adding carbon by placing the working material directly in a charcoal bed. Although the quality of steel produced through this method could not often be replicated, it was possible now and then, to produce excellent steel! By the beginning of the Edo period in Japan, there were approximately 100,000 rifles as this particular knowledge of steelmaking enabled sword smiths to become gunsmiths and mass produce firelock rifles.

In concluding this segment, it is germane to note that steelmaking has had a long history that included constant improvements in the techniques of making and using steel products. The three key inventions of coke, the blast furnace and the Bessemer converter virtually unlocked steel production globally. Beginning from the postwar period, there have been significant changes in technology from the introduction of BOF in the late 1950s, introduction of Continuous Casting (CC) techniques - developed in the 1950s but proliferated in the 1970s, to the use of continuous strip-mills and finally the automation of the production processes through the use of computers (Fine, 2005:49). By the turn of the 20th century, the production level for steel had increased tremendously to 22 Kilotonnes as at 1867, 500 in 1870, 1 million in 1880 and 28 million by 1900. World-wide production is today estimated to be hitting the 1 billion tonne mark per annum (Quicksilver Metaweb, 2004). Let us remember that it was the availability of large amounts of inexpensive steel that powered the industrial revolution and even the modern society as we now know it now. Today, we have the introduction of value-added newer steel products in the form of alloys and special steels designed for several purposes.

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5. The Development of the Iron and Steel Industry in Nigeria

The Iron and steel industry in Nigeria was first conceptualized in 1958 when the idea was mooted by Nigeria's national development planners. At this period widespread consultations took place both within and outside the country with western experts as to the viability and economic advantages of large-scale steel production. The general opinion however, was that Nigeria was not yet ready for a project as demanding and sensitive as a steel plant. The primary reason canvassed was the high cost of the technological and associated infrastructural development necessary for a full-scale steel industry in Nigeria. In addition, it was thought that the country would be unable to provide the required manpower and skills necessary to put a steel plant into successful and continuous operation. Igwe (1983: 4) was to note that between 1961 and 1965, the first republic government of Nigeria was to receive several suggestions from foreign companies on why steel production in Nigeria was not feasible ranging from purported lack of domestic market to overriding diplomatic interests and international politics. This pessimism notwithstanding, proposals were received from various organizations and countries between 1961 and 1966. The proposals ranged from those of small plants of the order of 100,000 tonnes per annum to medium capacity plants up to 300,000 tonnes per annum (Agbu, 1992:66). According to the National Council on Science and Technology (NCST), the initial attempt was to build rolling mills and to establish the market potential for the steel products, before the efforts became directed towards the establishment of an integrated iron and steel plant (Ogban-Iyam, 1981:49). Some of the companies that submitted proposals included the consortium of Westinghouse and Koppers in 1961, Demag, Ferrostal - Wellman, Mckee and David Ashmore all in 1963. While Westinghouse and Koppers proposed the use of Strategic Udy process (Direct reduction process using coal/lignite and electricity and Basic Oxygen Converter) for a plant of 143,000 tonne per annum capacity to produce merchant bars, squares or round bars and sheets; Mckee proposed the use of the blast furnace and basic oxygen furnace for a 300,000 tonne capacity plant to produce rounds and squares, wire rod, hoop, small rails, sheets, tin plate and pig iron (Agbu, 1992: 67).

It was however, from 1967 that significant progress was made towards the establishment of an iron and steel plant in Nigeria following the involvement of the then Soviet Union. In 1967, a team of Soviet experts arrived in Nigeria to conduct a feasibility study on the establishment of an iron and steel plant, as a follow-up on a technical/economic agreement between the governments of Nigeria and the Soviet Union (Ogban-Iyam, 1981). In their report, the use of the blast furnace process was recommended for the proposed steel plant. The report also observed that the then known iron deposits in the country were of poor quality and suggested further geological surveys to see if better ores could be found. Therefore, in 1968, the Soviet geological experts after a general geological investigation of

Nigeria reported that there were high prospects for finding rich iron ore and coal deposits in the country. Consequently, Nigeria signed a contract in 1970 with Technoexport of the then Union of Soviet Socialist Republics (USSR) under which they agreed to provide specialists and equipment to carry out further geological surveys in order to determine the quantity of the deposits of iron ore and coal resources that could be used in the proposed iron and steel industry (Chukwumerije et.al., 1982). In brief, the main achievement of the survey that followed was the discovery of Itakpe ore deposits in the then Kwara state, but now located in Kogi state; and the establishment of the Nigerian Steel Development Authority (NSDA) and the first furnace steel plant at Ajaokuta in the middle part of the country. The location of the project at Ajaokuta may not have been the best choice available as political considerations took upper hand in the decision, even though there is some point in having the project near to the source of iron ore at Itakpe. It is on record that there were eleven possible locations for this project, later whittled down to three, namely, Warri, Onitsha and Ajaokuta (Ogbu et.al, 1995). The NSDA report in 1974 actually recommended Onitsha, a commercial town sitting on the banks of the River Niger in South Eastern Nigeria. However, South Eastern Nigeria was just coming out of a civil war she lost to Nigerian federal forces, and it may have been politically unwise to locate this multi-billion project in this part of the country. Ajaokuta, a virgin land was subsequently chosen with the implication that all or most basic infrastructure had to be built from the scratch. This contributed immensely to the overall cost of setting up this plant and the eventual cost escalation it experienced.

5.1 Developments in the 1970s

The Federal Government of Nigeria in pursuance of its policy in the steel sector on April 14, 1971 promulgated Decree No.19 setting up the Nigerian Steel Development Authority (NSDA) charged with the responsibility for the planning, construction and operation of steel plants in the country. It was in addition tasked with carrying out investigations related to geological surveys, market studies and metallurgical research. The NSDA also embarked on short and long-term training of staff in overseas countries such as India and the Soviet Union on the operation and management of an iron and steel plant. In 1973, Tiajpromexport (TPE) of the USSR was commissioned to prepare a preliminary project Report (PPR) on the iron and steel industry in Nigeria. The Report submitted in 1974, studied alternative production schemes based on both local and imported raw materials and was accepted in 1975.

A contract for the preparation of the Detailed Project Report (DPR) signed in 1975 with the USSR was submitted to the Nigerian government in October of 1977. With the assistance of Sofresid of France as consultants, a variant of the steel plant was accepted in June 1978. The DPR specified broadly the general layout, composition and requirements as well as a tentative master schedule of the Ajaokuta Steel Plant. It was on the basis of this Detailed Project Report that the Global Contract was signed on the 13th of July 1979 between Nigeria and Tiajpromexport of the Soviet Union for the construction of the Ajaokuta Steel Plant. The signing of this contract signified major commitments on the part of the Nigerian government and the USSR to the development of an iron and steel industry in Nigeria.

The Nigerian government on 18th of September 1979 promulgated the National Steel Council Decree No.60 dissolving the NSDA. The new decree provided for the formation of the Ajaokuta Steel Plant as well as five other limited liability companies. These are the Delta Steel Company Ltd., Aladja; the Jos Steel Rolling Mill, the Oshogbo Steel Rolling Mill, the Katsina Steel Rolling Mill, and the then Associated Ores and Mining Company Ltd., now, National Iron Ore Mining Company (NIOMCO) at Itakpe. Today however, the country's steel infrastructure include these in addition to the Nigerian Metallurgical Development Center in Jos, the National Steel Raw Materials Exploration Agency in Kaduna, and the Nigerian Metallurgical Training Institute at Onitsha (Agbu, 2004: 374). It was in 1979 that contracts were signed for the three rolling mills at Katsina, Jos and Oshogbo. While Kobe steel of Japan served as technical partners during the erection of the Katsina plant, the Oshogbo and Jos plants were constructed by German companies. Each of the plants was designed to produce bars and wire rods at a capacity of 2.1×10^5 tonnes/year. The rolling mills were to be fed with billets produced at the Delta Steel Company, Aladja. The Katsina Steel Rolling Mill for instance, was designed to also produce long products covering the product range from 6mm to 40mm (plain and ribbed). It was established primarily to produce reinforcing and general-purpose steel from billets for construction and wire associated industries. However, the poor capacity utilization of Delta Steel Company and the very long gestation period of the Ajaokuta project meant that the rolling mills had problems of inadequate supply or lack of billets to operate optimally. This contributed significantly to the poor performance of the Nigerian steel sector. The steel companies, rolling mills and the mining company have all now been incorporated as limited liability companies and are expected to be self-funding while the research and training centers are still being funded by the government (BPE, 2005).However, the government of Nigeria wishes to fully divest its equity holdings in the rolling mills. It seeks prospective core/strategic investors with an initial sale plan of acquisition of 80 per cent shares of the rolling mills, while the remaining shares will be offered to the staff of the company as well as the local community (Bureau of Public Enterprises, 2003).

Apart from the public sector steel concerns, there are also other privately owned companies, mainly Mini steel companies engaged in the re-rolling of billets. These are mini-mills, some of 50,000 and 100,000 tonnes capacities or less. However, the combined efforts of all these mills, over ten of them, have never really added more than 300,000 tonnes annually to the overall production capacity in the country mainly due to either operational inefficiency or the lack of working capital or sufficient electric power (Mohammed, 2002).

TABLE 5.0
Location and Installed Capacity of Privately Owned Mills in Nigeria

Firm	Location	Capacity 10, 000 t/yr
Qua Steel	Eket	10
Universal Steel	Ikeja	8
Continental Iron and Steel	Ikeja	15
Sels Metal	Ikeja	10
Federated Mills	Ofa	14
Allied Steel	Onitsha	10
General Steel Mill	Asaba	5
Nigerian - Spanish Engineeering	Kano	19
Mayor Engineering	Ikorodu	29
Oro Steel	Ilorin	n.a
Kwara Commercial Metal and Chemical Industry	Ilorin	4
Union Steel	Ilorin	n.a
Asiatic Manjarin Industries	Ikorodu	6
Niger Steel	Enugu	3
Metcom (Nigeria) Ltd.	Owerri	3
Others (estimated)		2

Source: Osita Ogbu et.al (1995), Technology Policy and Practice in Africa, Canada, IDRC.

See Table 5.0 below for a functional list of privately owned rolling mills in Nigeria.

5.2 Raw Materials Development

The availability of raw materials is a key consideration in the establishment of an iron and steel plant since it usually takes some time for steel companies to break even. In this case, the Nigerian authorities started early to look for sources of raw materials within the country in other to be able to select the appropriate technologies that could be used and ensure that the industry is viable. The Soviet specialists and the NSDA exploration division worked extensively over a large area of the country exploring for deposits of iron ore, coking coal, limestone, dolomite and refractory clays. Areas of the country explored in detail included Birni Gwari and Ayagba in Kaduna state, Ejigbo anomaly in Oyo state and Agbado-Okudu in Kwara state for iron ore deposits. In addition, Afuze in Edo state, Danduya and Gombe deposits in Bauchi state were also explored for coking coal.

However, it was the discovery of the Itakpe iron ore deposit in 1973 by the soviet aero-magnetic survey team that catalyzed the development of the steel industry in Nigeria. Fairly good iron ore deposits were discovered at Itakpe, Agbaja, Ajabanoko and Chokochoko all in the region around Okene, Kabba and Lokoja in present Kogi state of the country. British surveyors, who were earlier appointed by the Federal Government of Nigeria to carry out initial feasibility studies, also found that there were large iron ore deposits at Agbaja near Lokoja and Udi near Enugu. Coal was also discovered in large quantities at Enugu and limestone at Jakura near Lokoja (Tarbunde, 1983:3). Coal deposits from Lafia/Obi were also investigated, but the quality of the coal was impaired by high ash and sulphur contents with the deposits occurring in seams that are difficult to mine. Overall however, Nigerian coal is said to be one of the most bituminous in the world owing to its low sulphur and ash contents and therefore the most environmentally-friendly. There are nearly 3 billion tonnes of proven coal reserves in the country presently (BPE, 2005). In a study carried out by a business consultant, SKOUP and Company involving extensive chemical testing of various samples of coal from deposits from the South and North locations, it was found that some Nigerian coal were suitable for coking using the direct reduction method in steel-making (SKOUP and Company Ltd, 2004). The study recommended increasing Nigeria's import substitution in steel manufacturing beyond the planning of projects by establishing a sponge iron mill fired by Nigerian coke. The study further showed that tar and coke could be produced at competitive prices in the country.

Other raw materials required in the industry that were discovered and found suitable included Jakura limestone, Ubo marble, Mfamosing limestone, Burum dolomite, Osara dolomite and Onibode/Oshiele refrtactory clay (Chukwumerije et.al 1982). The picture emanating from these successful explorations, especially the Soviet-Nigerian joint efforts, which arose from the Moscow Protocol of 1970 proved contrary to the then prevailing view that Nigeria had no iron ore nor coking coal suitable for steel production.

See Table 5.1 below for the location of raw materials and their possible uses in the development of the iron and steel industry in Nigeria.

It is fairly common knowledge that the nature, quality and availability of raw materials dictate the technology type that should be used in the development of a particular steel industry. Nigeria has fairly large deposits of iron ore but closer scrutiny indicates a paucity of good coking coal. The available coal has significant percentages of ash and sulfur. The iron ore could be improved upon to meet the requirements of the Ajaokuta Plant, even as the Delta Direct-Reduction plant demands high quality iron ore of about 66 per cent ferrous content (Ogbu et.al, 1995: 9). The Delta plant uses natural gas as fuel. This resource is so abundant in Nigeria, which is a major oil producing country that the iron and steel industry will hardly lack for gas as fuel. For the main coal deposits in Nigeria, these are found at the Enugu and Lafia-Obi coal fields. The Lafia-Obi coal has coking properties but is high in ash and sulfur, and the deposit has structural problems. On the other hand, the Enugu deposit is reasonably free of impurities but is non-coking. It was therefore decided by

TABLE 5.1
Raw Materials for the Development of the Steel Industry in Nigeria

Raw Materials	Source	Role	Requirements 10 000t/yr Ajaokuta	Delta
Iron ore	Itakpe Hill, Ajaba Noko, Shoko-shoko, and Agbaja	Sinter; sent to blast furnace to produce pig & molten iron	2,200	1,550
Coal	Enugu, Lafia, and imported	Carbonized in coke ovens; fuels furnace	1,300	0
Limestone	Jakura, Mfamosing, and Ubo	Used in sintering and heating iron ore	690	130
Scrap	Recycled and imported	Melted in electric-arc furnace; used as coolant in the steel-making shop	293	250
Bauxite	Imported	Used to maintain slag fluidity	13	---
Dolomite	Osara and Burum	Low grade used as flux in iron making; high grade used in brick refractories	250	---
Refractory Clay	Onibode, Oshiele and Ozubulu (Imo)	Used to produce bricks in aluminosilicate plant	---	---
Manga-nese	Imported	Used to control quality of metal in blast furnace	85	---
Water	Widespread	Used for cooling	120	83
Natural Gas	Widespread	Powers furnace	370,000	2,000

Source: Osita Ogbu et.al (1995), Technology Policy and Practice in Africa, Canada, IDRC.

the planners in this industry that, initially, it would be necessary to import coking coal, until a better blend is made from the Enugu coal. Research has shown that a 20 per cent fuel blend of the Enugu coal is possible, which would contribute significantly to foreign exchange savings on imported coking coal (Ogbu et.al, 1995).

The National Iron Ore Mining Company (NIOMCO), which was established in 1979 was to supply Ajaokuta Steel Co.Ltd. with about 2.2 million tonnes of super concentrates per annum. The company's name was initially Associated Ores Mining Company, but later changed to National Iron Ore Mining Company Limited on the 13th of February 1987 when its activities were streamlined towards exploration, exploitation, processing and supply of iron ore concentrate to the country's steel plants at Ajaokuta and Aladja. The industrial processing plant here was designed to supply ore of 63/64 ferrous grade super concentrate to ASCL and 550,000 metric tonnes per annum of 67/68 per cent ferrous grade super concentrate to Delta Steel Company Limited (DSC). The supplies of iron ore to DSC started in October of 1994, though this was grossly inadequate. As at April 1991, the beneficiation plant which was to produce iron ore concentrates and super concentrate was about 40 per cent ready at the Itakpe Mining district (Okorocha, 1991:1). The beneficiation plant was expected to have been completed and commissioned by the end of 1992. In 1989, about 59,176 tonnes of iron ore was produced by NIOMCO, 359,136 tonnes in 1990 and 245,000 in 1991 (Adeniji, 1991:18). The total iron ore stockpile as at the end of 1991 was about 1.8 million tonnes (CBN, 1991:84). The company was 100 per cent equity owned by the Federal Government of Nigeria with staff strength of 1,892 until it was acquired by Global Infrastructure Holdings Ltd. (GIHL), in 2005. This company is decisive in determining the ability of Ajaokuta to produce steel in a sustainable manner. GIHL was awarded a long term mining concession to the Itakpe and Ajabanoko iron ore mines. NIOMCO iron ore mines have an estimated reserve of about 300 metric tonnes together with a 2.7 metric tonne beneficiation plant and possibilities for further expansion (Adepoju and Olaleye, 2001). GIHL is expected to refurbish and operate the mine as the primary source of materials for the Ajaokuta plant.

5.3 The Ajaokuta Steel Project

The Ajaokuta Steel Co. Ltd. was formed on the 18th of September 1979, charged with the responsibility of constructing and operating the Ajaokuta integrated iron and steel plant. Prior to this time, an agreement had been signed between the Nigerian government and M/S/V TiajPromexport (TPE) of the Soviet Union known as the “Global Contract”, for the operation of working drawings, supply and erection of equipment, structures and the training of personnel for the steel plant (FRN, 1979). The project at inception was envisaged to produce 1.3 million tonnes at its first stage, 2.6 million tonnes at its second stage, and 5.2 million tonnes per annum at the third phase of long and flat products. The civil works was contracted to three multinational civil engineering construction firms of Dumez, Fougerolle - Fougerolle (Nig.) and Bilfinger + Berger. A consortium made up of Pan African Services (Nig.) Ltd. and Metallurgical Engineering Consultants (India) Ltd. served as the project management consultants. This Company is unique in the completeness and spread of its integration, going beyond the scope of conventional iron blast-furnace basic oxygen steel-making to encompass several other independent full-fledged ancillaries. It is by design a multifaceted industry with at least 21 companies encapsulated within it.

The principal units of the Ajaokuta Plant include the iron making plant, steel making plant, the rolling mills, repair facilities, auxiliary facilities and the electric power supply system. The envisaged features of the Plant include 150mm Wire Rod Mill, 320mm Light Section and Bar Mill, 700mm Medium Section and Structural Mill and 900/630 semi-continuous Billet Mill (ASCL, 1990). The Ajaokuta integrated plant, which is based on the blast furnace process of iron making, has a raw materials preparation unit that includes the Sintering plant, Coke-oven and By-product unit under the iron-making unit. The rolling mills are four, two of which, namely, the light section and Wire Rod mills were supposed to be the priority rolling mills. In terms of product mix, the Preliminary Project Report (PPR), proposed equal amounts of flat and long products. However, during this period, the national economy was buoyant with the construction industry enjoying a boom, and this led to the decision that the first stage of the plant would be devoted to long products only, while the second stage - an expansion to 2.6×10^6 tonnes, would be for the production of flats. The first phase was therefore designed to produce long products like iron bars, wire rods, angles, squares, channels, beams, and structures. Most of the products were expected to be used in the civil engineering construction industry. However, hindsight shows that the change of the original concept of the plant was a serious error (Ogbu et.al, 1995). Overall national interest of the country would have been better served by a mixture of flat and long products. Today, there is increasing demand for flat products, while long products are more in the market. The Nigerian government is therefore much interested in making flat products available in the country.

Due to the scarcity of skilled manpower in Nigeria for the steel industry at this period, a strong emphasis was placed on personnel training right at the inception of the industry, especially since the industry concept was based on the transfer of technology. Various training agreements were entered into which resulted in the training of large numbers of the steel sector workforce abroad. The manpower estimate for the operation of the Ajaokuta plant at peak was 9,000 (Agbu, 1992). The contract with Tiajpromexort provided for the training of about 1500 Nigerian Engineers, technicians and operational staff for the operation of the plant (Agbu, 1995; Ogbu et.al, 1995). According to Ogbu (1995) and Agbu (1993), many NSDA staff were sent for preliminary training in steel-design and operations in countries like the then Soviet Union (Zaparozhye, Cherepovetse, Lipetsk, Krivoi Rog, Makeyevka and Novokuznetsk), Italy (Italsider-Taranto), Canada (Stelco), United States (US Steel), Japan (Nippon Steel), France (Sofresid), Britain (BSC-Corby) and India. The first training was initiated with the Steel Authority of India Ltd. (SAIL) in 1974 which offered the most economical training programme. Indeed, TPE had been involved in the construction and operation of two integrated steel plants in India - the Bhilai and Bokaro, and the success of Bhilai, a publicly owned steel plant undoubtedly influenced the decision to send trainees to India (Ogbu et.al, 1995). There was also local training in metallurgy and related fields in some of the local universities like the University of Lagos. There was also the Metallurgical Training Institute (MTI) set up in Onitsha in 1981, as well as the Training Institute of the ASCL with a capacity output of about 2000 students offering courses in 27 specialties (Agbu, 1993:115). Studies indicate that manpower training in terms of technology acquisition for the Ajaokuta plant was successful as Nigerians understood and could replicate the various processes involved in iron and steel making and maintenance of equipment. The problem however, was the poor remuneration in the industry and poor job satisfaction which led to many of the trained personnel resigning, and probably joining other private sector companies. The trainees came home to Nigeria, only to discover that the units they were supposed to operate were not ready. This led to idleness and poor job satisfaction. For example, though over 2000 steel workers were trained in India and the Soviet Union by the ASCL, about 75 per cent left the ASCL as a result of delay in the payment of their salaries (Agbu, 2004:377). It is regrettable to note that though planning and facilities for manpower training in the industry was considered top priority by the government, the implementation showed poor coordination as allowance was not made for optimal utilization of trained personnel and future developments.

5.4 Developments so Far

With the restoration of democratic rule in Nigeria in 1999 under the Olusegun Obasanjo administration, interest in the Ajaokuta Steel project, which had waned beginning from the mid-1990 was rekindled, as the project once again became a core industrial project. Recognizing that fifteen years delay before the commissioning of the Plant may have led to deterioration in plant facilities, the Federal Government of Nigeria decided to carry out a technical audit of the plant to determine the state, requirements and cost implications of rehabilitating, completing and commissioning the first phase. Messrs. V/O Tiajpromexport (TPE) of Russia was invited to carry out the technical evaluation of the plant at a cost of US $1.2 million. In December 2000, TPE submitted its findings to the government indicating that the plant was in a commendable state of preservation. In this report, the TPE put forward an estimate of about US $460 million to complete, rehabilitate and commission the first phase of the steel plant (Federal Ministry of Power and Steel, 2002).

However, the current completion philosophy for the Plant is predicated on the backward integration strategy in which the Rolling mills and Repair shop complex are to be completed before the primary plant units. In line with this philosophy, the Ajaokuta Steel Company Limited (ASCL) formed a joint venture company with Ferrostaal AG of Germany (ASFERRO), with the aim of operating the workshops at Ajaokuta commercially. The workshops include the forge and fabrication shop, machine tools shop, foundry and pattern making shop, steel structural workshop (erection base) and the power equipment repair shop.

The rolling Mills at Ajaokuta which consists of the Light Section Mill (LSM), Wire Rod Mill (WRM) and the Medium Section and Structural Mill (MSSM) have been down for about 14 years until the government recently allocated more resources to the company with about N899.13 committed to the mills (N140 = US $1). Due to the paucity of working capital to run the mills, the government invited the private sector through conversion agreements negotiated and signed with a number of private entrepreneurs whereby they buy billets and get them rolled at Ajaokuta for a fee. To make this commercialization attractive, the government approved the adjustment of tariff on all types of rolled steel products from 30 per cent to 65 per cent and billets from 10 per cent to 5 per cent from fiscal year 2001. This policy change provided a more attractive environment for partner entrepreneurs and made operations at the government owned mills viable (Federal Ministry of Power and Steel, 2002).

5.5 Efforts at Completing the Ajaokuta Steel Project

In very recent times and in line with the industrial policy of the civilian administration under Olusegun Obasanjo, efforts were made at involving the private sector in the completion of the Ajaokuta Steel Project. Initially four private steel producers indicated interest and engaged in discussions with the Nigerian government. They included V/O Tiajpromexport (TPE) of Russia, Solgas Energy Incorporated of USA, Kobe Steel Limited of Japan and Voest-Alpine Industrial Services of Austria. The negotiations with TPE arrived at a commercial offer of US $421.125 million, and that with Solgas was approximately US $986 million. Solgas offered rehabilitation and commissioning as negotiated with TPE, complete automation of the steel plant, personnel training, provision of working capital including raw materials procurement and housing development. This sounded very attractive and may have made the government to eventually give the management of the Plant to Solgas. However, there was also a proposal from Kobe Steel of Japan, which proposed the introduction of the FASTMELT process of iron making technology into the Ajaokuta Plant. The implication of this is that the existing Blast Furnace facilities will be replaced by the fast melt technology. Kobe Steel claimed that the new technology was capable of being operated with non-coking coal that are available in Nigeria thus making production costs cheaper and profitability higher (Federal Ministry of Power and Steel, 2002). Kobe Steel estimates the completion cost of the project to be about US $916 million for a 3-unit plant having a 1.5 million tonne capacity. A joint venture company was proposed by Kobe Steel with ASCL of Nigeria for the production and marketing of steel blooms and/or billets in a ratio of 60/40 for ASCL and Kobe respectively. Though Kobe Steel later submitted an alternate proposal, which starts with only one unit of Fast Melt Plant with 500,000 tonnes capacity, the offers did not include the complete automation of the Plant and training of personnel. Perhaps the idea of totaling discarding the use of the Blast Furnace facilities did not appeal to the Nigerian government as most of the equipment required for the erection of the second coke oven battery was in place, while the iron making plant (Blast furnace) and the steel making plant were ready.

For Ajaokuta, the government was interested in the reorganization of this project into autonomous business units within a holding company framework. While some units should run as profit-oriented subsidiaries (engineering workshop, rolling mills, iron and steel making plants, alumino-silicate refractory plant, thermal power plant), others like the training center, steel township and utility facilities should be commercialized as much as possible. Commercial activities are currently in place in the light section mill, wire rod mill, the power plant, the engineering workshop complex and the manufacturing and erection base. Solgas was later chosen for the completion of the project which with the benefit of hindsight was a wrong decision.

In brief, the government of Nigeria later entered into a concession agreement with Solgas Energy of the United States for a period of 10 years renewable for another ten years to manage and operate the plant. The $282 million, about N36, 096 billion was signed on 13 October 2003. The agreement was expected to run for 18 months. Under this agreement, SOLGAS was to rehabilitate, complete, commission and operate the steel plant. It was expected to build and operate a gas processing plant, as well as an electricity generating plant with all the plants coming on stream within two years. According to the agreement, the electricity plant was to generate about 2,300 MW within 18 months and provide 11,000 jobs, while the steel and gas processing plants will provide 9,000 and 10,000 jobs respectively (Business News, 2003a). Solgas was also expected to provide all the financing for the projects. The plant on completion was to produce steel at 55 per cent cost of global steel production. However, some were of the view that the deal was too good to be true as Solgas was an energy company with little or no experience in steel production. Fears were expressed, even up to the level of the Nigerian Senate, about the likelihood of Solgas converting the integrated steel plant mainly into an electricity generating plant rather than a steel plant (The Nation, 2003). It was argued that the consequences of this would be that the viability of the inland rolling mills and the Itakpe Iron Mining Company would be jeopardized. The African Iron and Steel Association (AISA) also voiced concern about the ability of Solgas to deliver on the contract. AISA doubted the company's ability to execute a $3.6 billion project citing its inexperience in steel making, and the fact that it apparently had only a company turnover of only six million dollars (Business News, 2003b). However, it was later discovered that Solgas did not have the required technical capacity to deliver on its promises, and the Nigerian government terminated the agreement with it. Solgas reportedly failed to start production even after one and half years of assuming control (Business line, 2004).

However, in mid-August 2004, the Nigerian government handed the management and operational rights of the project to Ispat Industries of India under Mittals. Mittals acquired operational rights over the Ajaokuta Company through Global Infrastructure Holdings Ltd. (GIHL), the holding company of the Ispat group controlled by Pramod Mittal. This group currently controls a total of about 10 million tonnes of steel making capacity and raw material processing capacity in the Philippines, Libya, Bosnia, Nigeria and India. With this agreement, Mittals acquired control over Ajaokuta Steel Company, with assets valued at about $3 billion for a period of 10 years renewable for another 10 years. The Ajaokuta Steel Plant comes with a power plant, a sponge iron plant and a coke oven battery and as we saw manufactures long products like light and medium structurals and wire rods. The group also holds the first right of acquiring the company as and when the Nigerian government decides to disinvest. As at November 2004, the new management had put on stream the Wire Rod Mill of Ajaokuta using billets supplied from Ukraine. GIHL has also fired the Blast Furnace, which was expected to start producing iron and steel a few months later (Business line, 2004). Indeed, by early 2006 it had started production and even exported some products to Ghana and Sierra Leone.

5.6 Delta Steel Company Limited, Ovwian-Aladja

It was in 1977 that the Federal Government of Nigeria signed a turn-key contract with a German-Austrian consortium for a Direct Reduction (DR) plant to be located in Ovwian-Aladja, Warri. This company became the Delta Steel Company (DSC). It was actually established in March 1979 as an integrated plant, and designed to produce steel using iron ore through the Midrex Reduction cum Electric Arc Furnace technology. It was 100 per cent owned by the government of Nigeria until its agreement with GSHL of India in 2005. Delta Steel maybe regarded as the pioneer steel producer in Nigeria and in West and Central Africa. It produces Cold Briquettes Iron (CBI), Direct Reduced Iron (DRI) and billets. It was officially commissioned on 29 January 1982 with the rolling mills completed on a turnkey basis (Ogbu, 1995).This was inspite of the travails of this industry in the country which led to many of the other steel projects having long gestation periods. Ajaokuta was a case in point. Nonetheless, insufficient releases of working capital from commissioning date until around May 1996 never allowed the plant to produce beyond 25 per cent of design capacity (Mohammed, 2002).

It was therefore not surprising when the Nigerian government under the civilian administration of Olusegun Obasanjo went into some arrangement with Voest Alpine (the original builders) and Osaka Steel of Japan under a partial privatization programme to refurbish and operate the plant. The intention of the government was to sell off all the steel plants and the rolling mills to private sector operators. The Nigerian government made a commitment of US $45 million, while Voestalpine component of the consortium promised to source a loan of US $55million to repair the plant. Osaka Steel was supposed to come up with a working capital of US $40 million, and brought its letter of commitment. But while the Nigerian government provided its own component of the finance, Voestalpine had problems in sourcing its loan, as MIGA, the mitigating institution of the World Bank refused to guarantee the loan to Voestalpine (Daily Trust, 2002). Meanwhile the Nigerian government had to release the sum of N900 million to the DSC for the settlement of backlog of staff salaries (Agbu, 2002: 13). Eventually, this agreement was terminated and the Nigerian government continued to search for another investor.

However, by late 2005 the government came into agreement with Global Steel Holdings (GSHL) of India for the revitalization and operation of this plant. The P.K Mittal-controlled GSHL acquired 80 per cent stake in the plant. It was estimated that GSHL would pay $30 million for the stake (Kapur, 2005). GSHL holds a 6 per cent stake in Ispat Industries. The DSC plant manufactures longs and structurals, has a 2 million tonne pelletisation plant, a 1.4 million tonne per annum directly reduced iron (DRI) plant and a 1.8 million tonne per annum electric arc furnaces. It also has a captive port with annual material handling capacity of 4 million tonnes. The Port could be used for both inbound and outbound traffics. It is important to observe that GSHL also took over the management of the Ajaokuta Steel Company in August 2004, and negotiated iron mining leases of the Nigerian Iron Ore Mining Company (NIOMCO). The iron ore linkages are expected to be used for both the Delta and Ajaokuta plants. The DSC resumed operations, which had stalled in April 2005 with the switching on of the pellet plant. Inspite of misgivings about the state of the plant, the Indians only needed to service the rolling mills without changing major components for the plant for it to become functional (Okafor, 2005). The company has now started production of commercial quantities of liquid steel and its conversion into billets since December 2005, after about 10 years of inactivity. According to its Managing Director, Lalit Senghal, the Company targets a production output of 800,000 tonnes for the year 2006, and intends to start exporting finished steel products from Nigeria. All the key aspects of the plant, the power plant, oxygen plant, lime plant and the steel making shop are all producing at high capacities (Aderinokun, 2006).

It is important to note that Delta steel is producing largely from indigenous raw materials. The raw materials in particular iron ore, is being supplied by Nigerian Iron Ore Mining Company Ltd. (NIOMCO). Delta Steel appointed a concessionaire to manage NIOMCO along with ASCL. NIOMCO presently has in stock over 2 million tonnes of raw iron, while mining is still going on. However, it is recognized that the ore reserves at Itakpe could only last for about six years, so there are plans to begin simultaneous mining at Ajabanoko, Enugu and other mines which are to be blended to supply ASCL with iron ore for at least 25 years (Aderinokun, 2006). The implication of Delta Steel coming on stream is that soon it may become unnecessary for the smaller rolling mills around the country to import billets from abroad since Delta Steel will be able to supply them.

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6. The State, Steel Industry and Industrialization

There is little doubt about the important role that the state could play in the development of a steel industry, especially at its early stages. In this case, as we saw the Nigerian state spared no effort in ensuring that the country was able to produce steel, even though minimal. However, this took an unusually long time, almost twenty five years for this dream to materialize. Whereas the effort took place under a cold war environment from the mid 1960s to 1990, today, most countries of the developing world are faced with an entirely different environment in which global capital has triumphed and globalization holds sway. The experience from Japan also showed the importance of the state in steel development, and also the fact that the environment has a role to play. In the case of Japan, the need to support the war effort in the1940s and 50s contributed to the seriousness with which matters relating to coal, iron and steel were treated.

Seeing that most steel projects cannot easily be erected without cooperation from outside sources involving countries and sometimes financial institutions, many governments were and are now forced to seek financial and managerial assistance from firms and countries that are capable and willing to assist. Examples here include India and Brazil during the construction of the Bokaro and Usiminas steel plants. This was also the case with the Nigerian state as we saw in its various efforts at equity and concessionary arrangements with investors for the Nigerian steel industry. However, it is still imperative to reiterate that the state is still very much instrumental in the planning and development of the steel industry. Let us take the development of the steel industry in Korea for instance, which clearly showed the necessity for a strong interventionist state at the early periods of the growth of this industry. In setting up its plants, foreign technical assistance was purchased in preference to depending wholly on foreigners to run the various plants in the country. This included even the shipyards and the automobile plants. The Pohang Iron and Steel Company Ltd. (POSCO) of Korea which was established by the government in 1968 at the cost of $3.6 billion began exporting technology just 20 years after its founding. Indeed, the Korean government invested around $42 million for POSCO's infrastructure that included land, ports, and electricity subsidy, which amounted to one-fifth of the initial investment. The Korean government was very desirous of POSCO operating successfully as it was expected to form the basis for the pursuit of industrialization in South Korea. Hence, even though domestic demand continued to be excessive, POSCO continued to export technology and some amount of products to earn hard currency (Sato, 2005:649). The 'Japan Group' made up of staff of Nippon Steel and Nippon Kokkan then, acted as consultants. As observed, right from its inception, POSCO's profitability was ensured by the government subsidization of costs of capital and investments in infrastructure such as roads, habours and electricity generation (Amsden, 1989:297).

Since iron and steel is a key input in the industrialization process in any country, the state should of necessity have some leverage over the development of this industry, especially at the early stages. Indeed, the availability of steel in various forms (bars, sheets, and plates) is considered a key to the industrialization of countries because iron and steel form more than 80 percent by weight of all metals in general use. Little doubt therefore, that the production of steel quickens industrial development and encourages local manufacture of capital goods (Oyelaran-Oyeyinka and Adeloye, 1995). These days, it is necessary for the state to engage in partnership with the private sector, both local and international in developing this sector. The onus is on the government interested in developing this industry to provide the right environment and incentives that will make the private sector to invest in the industry. It is increasingly becoming evident that what determines the performance of steel industries is the type of management model adopted *ab initio*. There are generally two basic models, the market and bureaucratic models, and the market models have proven to be more efficient as seen in the cases of China Steel, POSCO and Usiminas Steel of South Korea and Brazil respectively (Ugochukwu, 1992:13). For the Ajaokuta project, cold war politics, bureaucratic politics, undue pressure and political interference all combined to stall the project resulting in cost over-run and the long gestation period of the project (Agbu, 1992). The current effort by the Nigerian government is therefore geared towards salvaging the project and ensuring that it contributes towards Nigeria's industrialization, which was the original intention for the project. After the initial intervention by the state, its operation should then be left to the private sector investors to manage.

It was observed that prior to this period that the problem with steel development in Nigeria had to do with poor planning and implementation, including the political will to commit funds to the various projects. In almost all of the companies in the industry, the problem had been that of a lack of working capital, which constrained efforts to remain in production for sustained periods of time. With this state of affairs, technological transfer and development which were expected to have been by-products of this industry were stifled or, at best, manifested in fits and starts. Beginning from 1999, the Nigerian government was desirous and determined to produce steel in Nigeria, to at least satisfy the domestic market. This determination manifested in the agreements with Voest alpine and Osaka Steel for the Delta Plant, and later with GSHL and GIHL holdings for Delta and the Ajaokuta plants.

In otherwords, the state is still a very important actor in the establishment of heavy and basic industries. However, it is clear that for technology to be acquired and adapted such industries need to be functional or be in operation. The state should therefore be able to create the right environment by designing the framework for transition from wholly state-owned to private enterprises that can benefit both sides. This requires finding solutions to the complex problems of political, social, financial, legal, institutional, technical and management dimensions (ECE, 1996:4).The onus lies on the state to remove all currently existing restrictions or obstacles that do not fit into its commercialization or privatization policy. This does not of course, mean that the state should loose total ownership since it had invested so much and is still investing, except in a situation of outright sale of the industry. The Nigerian government has in recent times, shown the political will that it is ready to do what must be done to attract foreign investments and salvage non-performing public enterprises. The country is undergoing economic and political reforms, which began in 1999 when Olusegun Obasanjo was elected President. Fundamental changes, akin to a silent revolution were executed in Nigeria, which obviously affected the way business was done in the country. From a reform of the administration of justice, to a war on corruption and the promotion of sectoral and financial re-organization, the environment is now better for foreign investors. And from all indications, there is a renewed and robust interest of investors and tourists in the country, which is evidence that the right thing had been done. The institutional bodies responsible for overseeing foreign participation in the Nigerian economy, the Nigerian Investment Promotion Council (NIPC) and the Nigeria Export Promotion Council (NEPC) have been re-engineered and repositioned towards providing all necessary support in this regard.

6.1 Demand and Market Potentials for the Steel Industry

This study is in no doubt about the demand and market potentials of the Nigerian steel industry. This is why the opinion is canvassed and indeed, invitation extended to investors to take a critical look at the Nigerian steel industry with a view to benefiting from investments in this industry and therefore contributing to the further development of the industry. This call looked to Japan for possible cooperation. Studies indicated that an adequate market exists in Nigeria for products from the Nigerian steel industry. Nigeria's consumption of steel (1995) was estimated at about 9.2 million tonnes of general steel. In principle, an aggregate of about 1,000,000 tonnes of general steel justifies investment in the two integrated plants of Delta and Ajaokuta. Infact, for the Ajaokuta steel plant, estimated gross revenue of N20.10 billion was expected to have accrued to the plant annually from the sale of its products and services at the first phase (Agbu, 1988). Contrary to the opinion especially expressed by the World Bank that the Nigerian steel industry was not viable, the consumption of steel and steel products has been on the increase over the years. According to Ugochukwu (1992:11), while statistics reveal that the local demand for steel products annually in Nigeria was about 3.5 million tonnes, actual production was a far cry from the expectation.

In terms of projected demand and capacity for saleable steel products in Nigeria between 1985 and 1995, statistics indicated that for the year 1985, the projected demand for iron and steel products was about 4.6 million tonnes per annum. There was thus envisaged to be an excess demand for steel of about 60 per cent, a substantial proportion (Survey Report, 1981:7). Even in the mid-1980s, this indicated the viability of this industry in Nigeria. In 1995, the projected demand was 9.2 million tonnes per annum for bars, structurals, flats and casts (PRC, 1981). Infact, Nigeria recorded an annual production of 320,000 tonnes in 1985, a far cry from the 3.5 million tonnes then demanded. This meant that the extra demand was being met by imports from abroad. Statistics of steel exports to Nigeria between 1978 and 1987 revealed the importance of the Nigerian market and pattern of steel imports by the country. The composition of the imported products included ingots, blooms, billets, coils, bars, rods, angles, shapes and sections, plates and sheets, hoop and strip, rail and railway track construction materials, wire, tubes, pipes and fittings of iron and steel, and iron and steel castings and forgings (Hatch Associates Report, 1989). In 1978, Japan was the largest exporter of steel products to Nigeria with over 310,000 tonnes of products, followed by the United Kingdom with exports of 161,900 tonnes. By 1983, Japanese exports to Nigeria though still the highest fell from a 1982 figure of 441,000 tonnes to 189,000 tonnes. This could be explained by the fact that it was in 1983/84 that the Ajaokuta rolling mills briefly produced some long products which fed into the domestic market. By 1987, Japan was still the leading exporter of steel products to Nigeria with 112,000 tonnes of products followed by Italy with 96,900 tonnes. Total steel exports from Japan, South Korea, Australia, Brazil and the countries of Europe in 1978 was 942,700 tonnes, 1,478,600 tonnes in 1980, the highest within this period; 603,700 tonnes in 1983 and 407,600 tonnes in 1987. There was little doubt that Nigeria was a viable market in the West African sub-region. Infact, the country in 1987 imported $140 million of steel from the Western countries (Mbonu, 1990:12). According to the Economic Commission of Europe (ECE), in comparison to other leading steel user countries in Africa like Morocco, Algeria, South Africa, Kenya and Tunisia, Nigeria in 1997 led in the use of wire rods (I million tonnes of 39 million tonnes of Africa’s total), sheets (1.2 million tonnes of 49 million tonnes of Africa’s total), tin plate and tin-free steel (.007 million tonnes of .026 million tonnes of Africa’s total), and tubes, hollow purple and fittings (.23 milllion tonnes of Africa’s total)(Agbu, 2000:35). This further justified the importance and potentials of the Nigerian market.

On the issue of market for flats in Nigeria, it is an area that the Nigerian government is willing and ready to encourage foreign investors. It is a priority for the Nigerian government as the development of this will help stimulate user industries like the auto and shipping industries. As far back as 1989, market surveys by Enterprise Consultants (part of the steel Sector study Group) predicted that the annual flat rolled market in Nigeria would increase from 375,000 to 661,000 tonnes by 1998. In fact, there were various projections by the World Bank (doubtful), Economic Commission for Africa (ECA) and others which indicated that there was a viable market in Nigeria for flat products.

The Planning Research Company (PRC), a consultancy group for example had projected a demand volume of 3,513,000 tonnes for 1990 and 4,060,000 tonnes for 1995 for flats. ECA put it at 1,407,000 tonnes for 1990 and 3,559,000 tonnes for the year 2000. Going

TABLE 6.1
Projected Steel Demand for Nigeria (up to the year 2000)

Projection	World Bank 1990	PRC Nig..Ltd 1990	PRCNig.Ltd. 1995	(10^3/year, 1981), ECA 1990	ECA 2000
Ingots	n.a	n.a	n.a	18(222)	417(689)
Bars,rods, Light Structurals	1440	2222	3306	948(1148)	2156(3559)
Medium Structurals	350	803	1251	n.a	n.a
Flat Products	1880	3513	4060	1162(1407)	2156(3559)
Tubes, Pipes	250	n.a	n.a	764(926)	1739(2870)

Source: Oyeyinka Oyebanji (1989), '"Nigeria's Steel Needs in the 1990s", Journal of the Nigerian Institute of Management, Vol25, No.2, November/December.

by these projections it could be seen that flat products outstripped the demand for long products even when the projectors did not envisage a much wider gap in demand as exists now.

Stelteh, a subsidiary to Hatch Associates reviewed various flat rolling alternatives that would satisfy the market demands and came up with some suggestions. One was that for the existing Nigerian flat rolled market neither the conventional high productivity hot rolling facilities nor the low productivity alternative are justifiable; two, that backward integration was the most feasible entry into flat rolled production, starting with the installation of a cold rolling and steel distribution complex; and three, all of the alternatives with particular attention to thin slab casting development should be further studied before plans are finalized to install strip rolling (Hatch Associates, 1989:3). However, placed side by side with the general objectives for which the Ajaokuta plant was set up, the suggestions should be evaluated with caution. The large capital outlay for erecting steel companies and the sensitivity of the issue makes any mechanistic recommendation difficult to accept.

Suffice it to observe at this juncture that the Ajaokuta project had as its objective amongst other things to accelerate the pace of Nigeria's industrialization. It was and is still considered very vital for the growth and development of ancillary industries necessary for industrial growth. It was supposed to stimulate supplier and user industries, provide employment, accelerate the rate of infrastructural development, save scarce foreign exchange and enable the acquisition of technological know-how since it requires the services of skilled personnel in all trades of operation, maintenance and administration (Agbu, 1988:52). Indeed, the potentials of Ajaokuta is evident when downstream users of bars, rods, structural shapes and products are surveyed in the manufacturing sector in Nigeria. This was done in 1989, and included several companies producing nails and fencing wires, cables, electrode manufacturers, auto assembly companies, and user companies of cold-rolled sheets and galvanized, tinned and other coated sheets (Agbu, 1992: 208). The point being made here is that Ajaokuta even as at late 1980s could not have lacked market as the World Bank laboriously tried to say. Infact, had Ajaokuta been completed, it could have cut Nigeria's steel imports by 60 per cent (Newsweek, 1991).

As at 2005, figures available indicated that whereas Nigeria's two integrated steel plants had a total capacity of about 1.85 million metric tonnes, local demand alone was estimated to be about 2 million metric tonnes. In otherwords, steel produced locally, could be consumed locally even without exporting to nearby West African countries. However, the African Iron and Steel Association (AISA), puts the iron and steel consumption in Nigeria at about 4.5 million tonnes per annum, while that for the whole of Africa is averagely 11 million tonnes per annum. It is estimated that about 7 million tonnes of steel per annum is consumed in West Africa alone, compared to the rest of Africa (Bureau of Public Enterprises, 2003). So far, the Nigerian government had as of 2005 invested about US $10 billion and hopes to reap some benefits in cooperation with the private sector. The government is trying to put in place rail lines and port facilities that would facilitate the manufacture and trading in steel.

6.2 Investment Opportunities and Cooperation

Tremendous opportunities exist in the iron and steel industry for the government of Nigeria and private investors at this period of economic reforms in the country. Though immediate investments in equipment and human resources have to be made, and have actually been made to a significant extent in the past 40 years, the viability of this industry in a fast growing Nigerian economy powered by oil money cannot be ignored for long. Generally, steel has great advantages for Nigeria. It will not only enable the country to build a strong industrial base, it will also provide employment opportunities for thousands of Nigerians as well as foster the transfer of technology to Nigerians. It is also expected to conserve foreign exchange since the country may be able to export steel to the neighbouring countries. The development of this industry in the country will also help to jump-start an agricultural revolution, while also contributing to the defense capability of the country since it will be easier for the country to make its own weapons. It is therefore quite logical to state that given the attention of the government to this industry and the cooperation from private investors, this industry is indeed, a strong basis for industrial take-off and economic development of Nigeria. When fully on stream the industry together with its spread of industrial expansion could provide jobs for between 400,000 and 600,000 Nigerians whose effective demand for consumer durables and non-durables could generate a multiplier-market effect. In a survey carried out by a consultancy agency of the Obafemi Awolowo University, Ile-Ife, it was discovered that over 100 downstream industries sprung up as a result of the Ajaokuta Steel Plant. As at 1989, there were over 121 associated industries including the rolling mills in the Nigerian steel sector (National Concord, 1989). In addition, the industry has the potentials for forward linkages. For example, slag impurities from the integrated steel plants could serve as good materials for cement making in the viable Nigerian construction industry. Argon, packaged by Delta Steel is indispensable in the production of electric lamps, while burnt and hydrated lime is used for water treatment and fertilizer production. Ajaokuta's scrap metal requirements could exceed 273,000 tonnes annually, enough to make scrap-salvage a lucrative multi-million dollar enterprise. While Delta Steel could make between 4-5 billion Naira on direct sales of primary and auxiliary products, Ajaokuta could make at least N100 million annually from de-mineralized water alone even if the company sells at 50 per cent market value. In terms of technology acquisition and expertise, a lot could be gained by the country from this industry in respect of maintenance costs of heavy equipment. For instance, one of the ancillary plants at Ajaokuta assisted the Nigerian National Petroleum Corporation (NNPC) to effect required mechanical fabrication at a reduced cost of N40 million, compared to the N1 billion estimated by the foreign contractors (Agbu, 2002:11). For this industry, there has been an increase in activities associated with the use of iron and steel. The construction industry is still very much active in the major cities of the country, while the assembly plants are increasing in number. The demand for flats in the country has outstripped that for long products. Indeed, at a point in the early 1990s import of flat sheets was as much as 58 per cent, 20 per cent for beams and 20 per cent for rods and other products (Agbu, 1992:145).

As mentioned elsewhere, as a way of encouraging the participation of the private sector in this industry, the Nigerian government increased the tariff on finished steel to 65 percent as against 35 per cent as incentive to those bringing in billets for rolling in the existing rolling mills. This margin is felt to be adequate in order for those producing locally to make profit. Perhaps, this policy is responsible for the recent interest shown by the private sector, which has resulted in the privatization and concessioning of the Delta and Ajaokuta Steel Plants. If the business environment in Nigeria is not conducive, what could be the reason for Mittals taking over the management of the Delta and Ajaokuta plants or for Peuogeot Assembly Nigeria to continue to do business in Nigeria. Several other opportunities and points of entry still exist for many who will like to take advantage of the forward and backward linkages generated by the re-activation of the Delta and Ajaokuta Plants. Apart from the viable domestic and regional markets for iron and steel products, the power sector which is also associated with this industry is potentially highly lucrative in Nigeria. For now, only about 40 per cent of Nigerians have access to electricity, and the government is serious about the commercialization and the privatization of power sector. Also, the Nigerian government is set to revitalize the seaports and the troubled Nigerian Railways through invitations to private investors. The reconstruction and extension of these infrastructures would increase demand for iron and steel products, thereby making this industry active in the next couple of years. In addition, the country's investment in the oil and gas sector, especially its Liquefied Natural Gas Project (LNG) will continue to make demands on the infant iron and steel industry, which potentially has a large scope for expansion.

The attractiveness of Nigeria as a destination for FDI is not really in doubt despite some problems relating to security and poor state of infrastructure development. The advantages of investing in Nigeria when contrasted with its disadvantages are enormous. Infact, Nigeria has consistently remained among the top recipients of FDI between 1999 and 2003. In 2003, the country received a total of $1200 million in FDI generating profit remittances worth $1316 million, and had a cumulative total of $12.387 billion of FDI (United Nations, 2005:8). See table below for total FDI, greenfield FDI inflows and profit remittances for Nigeria within this period.

So far, the Nigerian government has in place various incentives for private investors wishing to establish or do business in the country. Generally, incentives for investors in Nigeria are available from two sources – the Federal government and the State governments. The Federal Government incentives include the Pioneer Status Tax Relief and the abolition of Excise Duty on certain locally manufactured goods. The Pioneer Status Tax Relief is a tax relief for a period of not less five years for investors adjudged as "pioneer" by the Federal Government and. This status is granted any company that has a business not sufficiently being done in Nigeria. Another incentive is the Export Promotion Relief, which involves waivers on import duty paid on raw materials and intermediate products imported for use in the production of export products, special tax waivers for enterprises located in Export Processing Zones, additional annual capital allowance of 51 per cent on plant and machinery to manufacturers who export at least 50 per cent of their annual turnover with at least 40 per cent local content or 33 per cent local value added, while dividends received from investments in wholly-export oriented business are tax exempt (Enugu State, 2006a, Nasarawa State, 2006).

TABLE 6.2

Total FDI, Greenfield FDI Inflows and Profit Remittances for Nigeria 1995-2003

Million dollars

Years	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
FDI inflows	1079	1593	1539	1051	1005	930	1104	1281	1200	10784
Greenfield FDI inflows	1079	1593	1539	1039	987	915	1103	1281	1200	10738
Profit Remittances	1330	1598	1477	1427	1621	1832	802	984	1316	12387

Source: UNCTAD Secretariat computations based on World Bank GDF online data

In addition, Foreign Direct Investment architecture in Nigeria is regulated by four principal statutes, namely: The Nigeria Investment Promotion (NIPC) Act, The Foreign Exchange Monitoring and Miscellaneous Provisions (FEMMP) Act, The Companies and Allied Matters Act (CAMA) and the Immigration Act. The NICP Act for instance, permits foreign investors to hold 100 per cent equity in Nigerian companies or to set up new companies in Nigeria with 100 per cent foreign equity participation, the only restrictions however, are in respect of defense related enterprises. This act, which repealed the Nigerian Enterprises Promotion Act that restricted the level of foreign participation in Nigerian companies/businesses, also set up the Nigerian Investment Promotion Commission (NIPC), which has the responsibility for promoting investment in Nigeria. In addition, it has the responsibility for registering and facilitating the procurement of all basic regulatory approval for new foreign investors (Enugu State, 2006b). Therefore, from all indications, the Nigerian government has tried as much as is possible to create a conducive environment in the country for foreign investors, and the response though positive in recent times is still far from expectation, especially in non-oil related sectors like iron and steel, solid minerals and agriculture.

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7. The Development of the Iron and Steel Industry in Japan

As in everything in life, the fact that Japan is a major iron and steel manufacturing and exporting country today has a history. It is imperative that this history be understood, in order for us to appreciate the mobility of technology and the unity of production systems world-wide. It is on this basis that others, especially countries of the developing world could also hope to grow their own industries. The development of the iron and steel industry in Japan had roughly the same tangent as the development of this technology in what is referred to as the West. This could be said to be an incremental development of processes from mining technology to manufacturing technology, and further to what has been referred to as scientific technology (Lida, 1980:3). The major technological developments, which served as turning points in the growth of the iron and steel technology were the switching from charcoal to coke (coal), and the shifting of power source from hydraulic (water wheels) to thermal energy (steam). This occurred with the advent of the industrial revolution which took place in the eighteenth and nineteenth centuries in the West and the beginning of the twentieth century in Japan. These two critical changes induced the mass production of pig iron in coke-burning blast furnaces, the mass production of melted steel in converters, open hearths and electric furnaces; and the establishment of an integrated system for production of steel from ore. This led to iron metallurgy evolving into a scientific process or technology, thus presenting greater opportunities for processing and automation.

In short, it could be said that the iron and steel technology of modern Japan basically evolved from transplanted western technology, though the traditional practitioners of this trade very early in Japan showed their ingenuity in adapting the processes from the West. Note for instance, the *tatara* (foot-bellows) age of iron making from antiquity to around 1857 in Japan. However, the beginning of Japan's acceptance of modern European technology could be traced to the introduction of the matchlock guns brought to Japan in mid-sixteenth century, when in 1543 a Portuguese ship drifted to *tanegashima*, one of the southernmost islands of Japan (Lida, 1980:17). The proliferation of tanegashima guns to other parts of Japan by swordsmiths using Japanese steel known as *tama-hagene*, and imported steel stimulated and influenced the development of iron-making and processing technologies. However, this contact with Europe lasted for less than a century before Japan's self-imposed isolation in 1639. The western influence notwithstanding, the technical capabilities of the Japanese in iron forging was never really in doubt, even in the days of experimentation of new processes. By the 1880s, Japan already had capacity for critically absorbing western know-how and adapting it to the conditions of Japanese environment and materials from a scientific point of view. It had indeed, been pointed out that the capabilities of the Japanese in science and technology derive on the one hand from their creative intelligence, and on the other, from their organized productive force (Lida, 1980:6).

The importance of the iron and steel industry was very early recognized in Japan, and it was felt that its establishment was imperative for the growth of the Japanese economy. However, the birth of modern steel industry was delayed until 1800s as a result of a combination of factors, namely, undeveloped conditions of steel consuming industries, undeveloped technological bases and poor prospects of financing. With increasing demand and military pressure by western powers for the opening up of Japan by around the 1850s, it was vital for Japan to embark on a fundamental reform of her iron-making process and its modernization into a mass production system. Though various efforts were made by the pioneers led by Oshima Takatō, the government and other pioneers to improve techniques, many failures were recorded, until pig iron was successfully produced at Kamaishi. The experience gained from Kamaishi was utilized in the construction and operation of the Yawata Iron Works in the early 20th century.

The evolution of the iron and steel industry in Japan could effectively be divided into five major phases. The first phase was the age of tatara-based iron making. According to Lida (1980:16), iron makers in the sixteenth-century Japan created their own way of extracting and concentrating iron sand by using water, a natural resource (or gift from heaven), as something like a tool. By this new technique known as *Kanna-nagashi*, water was set to flow down a particularly steep mountain slope to degrade weathered granite rocks containing iron sand along the slope so that the washed-out sand iron was deposited by gravity in a pond at the foot. It was a method of concentration using the specific gravity of iron sand. This method served to save time and labour. From *kanna-nagashi*, which involved ore extraction, the process evolved to the use of *tatara-ro* or bellows-blown furnaces, also called *takadono-tatara* by some researchers in smelting. These were iron-making furnaces erected in factory-like settings.

The second phase was the traditional phase from tatara-based iron making to western-style iron making (1858-1900), which began in December of the fourth year of Ansei (January 1858 by the solar calendar). This was when the operation of a western-style blast furnace (charcoal-burning blast furnace) was started at the Ohashi Mine in Kamaishi in the Nambu Fief (Iwate Prefecture) (Lida, 1980:7). This was in the Edo period when no machinery or equipment could be imported from advanced countries, therefore, the pioneers under the leadership of Ōshima Takatō who had the opportunity to learn modern European theory on iron making; only depended on locally available know-how, materials and labour, guided only by Dutch technical books and engineering dictionaries and supported financially by local industrial capitalists (Lida, 1980:39). With the introduction of western-style blast furnaces, the mass production of iron began replacing the traditional tatara-based method, which was heavily dependent on manual work. A most significant development in this phase was the establishment in Kamaishi of the coke-burning blast furnace, a technique for the production of pig iron, which supplanted the iron of the Chūgoku region, the previous production centre in Japan.

However, it could be said that modern iron and steel industry in Japan took root in 1901 when No.1 blast furnace was blown in at Yawata Iron Works (Lida, 1980; Toda, 1981). The No.2 and No.3 blast furnaces were commissioned in 1905 and 1909 respectively. The Yawata Iron Works was built by the Japanese government and officially named the Imperial Japanese Government Steel Works under the supervision of the Ministry of Agriculture and Commerce. This was the first integrated steel works in Japan and marked the beginning of the third phase of the history of iron and steel development in Japan. With the inauguration of Yawata Iron Works, the technology of ferro metallurgy became basically that of metal manufacturing rather than metal mining. Industrial steel demand was met by the increasing use of an integrated production system involving pig iron, steel making and rolling through the use of open hearths, converters and electric furnaces. It is important to observe that at this period of developing a modern steel industry in Japan that the budget earmarked for the construction of the state-owned Yawata Iron works accounted for one-tenth of the national budget (Toda, 1981:2).

The fourth phase in the development of the Japanese iron and steel industry was associated with the modernization of the structures of technology governance and technology processes through the building of synergy involving research and development (R&D). This occurred with the establishment of the Iron and Steel Institute of Japan, the first engineering society specializing in iron and steel research; and the Research Institute for Iron and Steel (Research Institute for Iron, Steel, and other metals) of the Tohoku Imperial University in February 1915 and 1919 respectively. The establishment of the Iron and Steel Institute of Japan was at the initiative of Noro Kageyoshi, Imaizumi Kaichirō, Tawara Kuniichi and others with a view to "studying and investigating scientific, economic and all other problems concerning iron and steel thereby contributing to the improvement and development of iron and steel undertakings in Japan" (Lida, 1980:55). This development eventually resulted in a shift from manufacturing technology to scientific technology. However, further development in this industry, as in almost all facets of Japanese economy was halted with the outbreak of the Second World War in 1939. This notwithstanding, the operation of the Yawata Iron Works in a way proved the feasibility of the steel industry in Japan, and led to private sector involvement in the erection of steel mills. Until mid-1920s however, Japan had to depend on imports of steel products, while providing incentives for the expansion of the industry in the 1930s. It is important to observe that by early 1930s, private enterprises had come to account for a greater share in Japan's crude steel output than state-run mills. In the first half of fiscal 1933 however, the financial position of open hearth steelmaker like Nippon Kokan was better than that of integrated steelmakers belonging to the zaibatsu groups (private producers) of Mitsubishi and Mitsui for instance (Lida, 1980:53). In 1943, in the midst of the Second World War, Japan's production of crude steel reached 7.65 million tonnes, the highest figure ever attained up to the Second World War (Toda, 1981:2).

Find below, a summary of the development of iron and steel in Japan and the accompanying technology from 1858 to Post-1945. See also below, a table of the estimates of Japan's production of pig iron, rolled steel products and steel ingots between 1912 and 1940.

TABLE 7.0

Phases in the Development of Iron and Steel in Japan

Phases	Important Developments
Phase1(1858) Pre-industrial phase Antiquity - 1857	- Until independence of iron and steel technology. Period of raw-materials-siting – iron, sand and charcoal. - Construction of first western-style furnace in Kimaishi - Phase of tatara iron-making process - Mining technology: self sufficient in iron, sand and charcoal supply. Power derived from man-driven bellows.
Phase 2 (1858 – 1900) Industrial Revolution phase 1901	- Until the independence of iron and steel technology. Period of raw materials-determined siting. - Phase of transition from tatara to western-style iron making. - From mining technology to manufacturing technology: self sufficient in iron ore, charcoal and coal supply. Power source shifts from water wheel to steam engine. - Inauguration of state-run Yawata Steel Works.
Phase 3 (1901 -1914) Industrial Revolution Phase 1915	- Until independence of iron and steel technology. Period of raw materials-determined siting. - Central role of the state-run Yawata Steel Works. - From mining technology to manufacturing technology: Iron ore and coking coal import begins. Power source shifts from steam engine to electric motor. - Establishment of the iron and steel Institute of Japan.
Phase 4 (1945 – Present) Technology Innovation Stage 1915 - 1945	- After independence of iron and steel technology from raw materials-determined siting (proliferation of electric energy). - Phase of simultaneous development of integrated steel making and electric furnace steel making. - From manufacturing technology to scientific technology: importation of American scrap iron and Indian pig iron activated (stopped by war). Power mainly derived from electric motor.
Phase 5 (Present) Technology Innovation Stage I946 to Present	- After independence of iron and steel technology. Period of market-determined siting (proliferation of petroleum energy). - Phase of integrated steel works in littoral states - From manufacturing technology to scientific technology: supply of iron ore, coking coal and heavy oil almost wholly depends on import as rationalization proceeded. - Significant renovation in transport means, including introduction of large ore-carriers.

Source: Adapted from Ken'ichi Lida (1980), Origin and Development of Iron and Steel Technology in Japan, Japan, The United Nations University.

TABLE 7.1

Production of pig Iron, Rolled Steel Products and Steel Ingots：Reference Data on Iron and Steel Industry (Volume of Production 1912 – 1940)（`000 m/t）

Year	Pig Iron	Rolled Steel Products	Bars	Shapes	Sheets	Plates	Steel Tubes & Pipes	Rail Fish Plate	Wire rods	Tin Plates	Others	Steel Ingots
1912	238	220	69		46		0.2	68	16			376
1913	240	255	76		58		1.2	49	26			436
1914	300	283	78		46		5.9	67	29			483
1915	318	343	93		87		10	59	35			586
1916	**389**	**325**	**134**		**72**		**13**	**52**	**28**		**26**	**555**
1917	451	452	124	94	77		15	76	33		33	773
1918	583	447	141	81	91		23	66	32		13	813
1919	596	469	119	69	144		16	68	19		34	813
1920	521	452	124	89	124		19	57	27		12	811
1921	**473**	**483**	**126**	**113**	**135**		**19**	**50**	**30**		**10**	**832**
1922	550	593	166	137	145		22	65	28		29	909
1923	600	695	209	122	174		28	96	40	1	26	959
1924	586	776	276	138	189		35	83	32	4.2	19	1100
1925	685	963	345	138	28	207	36	138	49	5.9	16	1300
1926	**810**	**1180**	**427**	**170**	**44**	**236**	**43**	**174**	**50**	**12**	**24**	**1506**
1927	896	1336	461	208	88	247	50	179	54	15	34	1685
1928	1093	1624	552	252	101	317	64	213	58	16	49	1906
1929	1087	1928	684	256	174	352	78	271	68	18	26	2294
1930	1162	1837	484	251	214	334	88	290	122	22	32	2289
1931	**917**	**1602**	**467**	**203**	**252**	**280**	**63**	**110**	**177**	**27**	**22**	**1883**
1932	1011	2010	568	252	257	316	96	234	215	34	37	2398
1933	1437	2616	774	331	271	476	117	272	285	36	53	3198
1934	1728	3114	778	430	325	603	137	368	348	61	64	3844
1935	1907	3737	18	468	389	713	167	367	413	95	108	4704
1936	**2008**	**4264**	**1027**	**555**	**520**	**878**	**189**	**289**	**487**	**139**	**180**	**5223**
1937	2308	4674	1201	728	442	1063	224	217	447	166	185	5801
1938	2563	4871	1315	664	328	1280	226	283	401	183	180	6472
1939	3179	4641	1260	574	254	1177	270	361	383	169	194	6696
1940	**3512**	**4522**	**1248**	**635**	**388**	**822**	**261**	**367**	**329**	**184**	**288**	**6856**

Note: The figures above are in thousands of tonnes. The figures for bars and shapes between 1912 and 1917 are combined figures for both products. Also, the figures for sheets and plates between 1912 and 1924 are combined figures for both products.

Source: Adapted from Miyohei Shinohara et.al (1972), Estimates of Long-term Economic Statistics of Japan Since 1868 (Mining and Manufacturing), Tokyo, Tokyo Keizai Shinposha, P.233.

Due to the fact that there was no specific classification for iron and steel in *Factory Statistics* during the period represented in the table above, the commodity items for iron and steel were collected from the wider "metal industry" in the *Factory Statistics*. The rough estimates in the data above indicate that as far back as 1912, Japan had started producing rolled steel products in thousands of tonnes. By 1921, it produced 832, 000 tonnes of steel products, and by 1940, it was producing 3.5 million tonnes of pig iron and about 6.9 million tonnes of steel ingots. Suffice it to say, that Japan's exploits in the iron and steel industry went a long way in assisting its war efforts.

Also, available statistics with respect to the value of production in the manufacturing industry in Japan between 1874 and 1940 (at current prices) indicated the increasing importance of iron and steel in the manufacturing industry during this period. In 1874, the value of production for iron and steel in the manufacturing sector was only about ¥1.806 million. However, by 1905, the value rose significantly to about ¥21.29 million. By 1919, it was over ¥459 million, while by 1940, it had reached ¥4.66 billion not only competing with food products and chemicals, but also textiles. At this period, textiles contributed about ¥5.6 billion to the manufacturing sector of Japan, out of a total production value of ¥33.25 billion in 1940 (Shinohara et.al, 1972:142).

After the Second World War in 1945 activities resumed in this industry with efforts at integrating imported techniques with technical knowledge built up in the pre-war period which aimed at improving the economies of scale. This characterized the fifth phase in the development of the Japan iron and steel industry. The technological paraphernalia at this period included the pretreatment of materials, erection of large blast furnaces, oxygen top-blown converters (LD converters), continuous casting and also continuous high-speed rolling. Problems of environmental pollution and public hazards became topical in the industry, while deliberate efforts were made to strengthen the engineering sector and enhance the export of steel-making technology. This in a way led to the internationalization of the Japanese steel industry.

With the Japanese economy suffering from the effects of the war, there was an urgent necessity to rehabilitate and reconstruct the iron and steel industry considered germane to the revamping of the economy. The Japanese government took certain measures to rehabilitate this industry, including what has been referred to as the "inclined production method". It placed preferential emphasis on increased production of iron and steel and of coal as energy sources for transportation. This subsequently resulted in a faster growth of the iron and steel industry and an increase in the production of steel. By 1953, Japan's production of crude steel reached 7.66 million tonnes, which exceeded the pre-war record of 7.65 million tonnes in 1943 (Toda, 1981). The rapid growth in the development of the iron and steel industry in Japan could also be understood in terms of the competition Japan had with the United States. Japan at this period was able to overtake the United States in steel production as a result of the differences in the technology in use. Whilst the United States had invested heavily in

OHF in the early 1950s with incremental improvements in the technology, Japanese and European producers had modern Greenfield mills with optimal layouts, large blast furnaces double the size of the ones in the US that made steel through the BOF method and continuous hot-strip mills. In addition, these modern mills had well-matched component parts and were sited at deep water ports to take advantage of the new bulk ore and coal carriers (Fine et.al, 2005:49). So, by 1980 Japan was the second largest producer of crude steel in the world overtaking the United States with a total production figure of 111.41 million tonnes, behind the USSR which produced 149.10 million tonnes. The United States produced 103.00 million tonnes. In the 1950s and 1960s, the industrial structure of the industry in Japan led to intense competition for market shares among the six integrated firms, which were more or less of the same size, at least, until the1970s. This competition forced firms to adopt new innovations and increase capacity (D'Costa, 1999:142). However, some sort of cooperation was later established with the formation of the Nippon Steel Corporation in 1970, following the merger of the first and second largest integrated producers (Yawata and Fuji) (Fine et.al, 2005:54).

In terms of early modernization, the first-phase modernization of the iron and steel industry in Japan was from 1951 to 1955 when old and obsolete facilities, especially rolling facilities were renewed with efforts made to match this with expansion of iron making and steel making facilities (Toda, 1981:4). Of particular interest, was the introduction of facilities for the production of flat rolled steels through the use of hot and cold strip rolling mills. It is important to note that it was at this phase that non-integrated steel producers like Kawasaki Steel Corp. and Sumitomo Metal Industries joined the integrated steelmakers.

Green-field construction of several integrated steel works took place during the second phase modernization period from 1956 to 1960. As pointed out, these integrated works had large blast furnaces and LD converters, in addition to continuous strip mills. This development enabled the Japanese iron and steel industry to quickly catch up with the state of technology of the advanced steelmaking countries.

By the third-phase modernization period from 1961 to 1970, the Japanese steel industry had established itself boosting of the most modern production facilities and advanced operation management, ranking number one in the world! This phase witnessed the construction of steel works on the seacoast and the rationalization of transportation of raw materials through bulk carriers thereby substantially reducing production cost. It also witnessed the introduction of automation or the use of computer control in production systems.

However, from 1973 onwards, especially with the impact of the oil crisis, the pattern of quantitative expansion of the steel industry in Japan was replaced by a new pattern of qualitative improvement with capital expenditure shifting to investments aimed at cost reduction through energy and labour savings and improvement in production yield as well as a concern for the environment. Suffice it to observe that throughout the post-war period, it was the quick expansion of the steel-consuming industries that led to the rapid progress of the steel industry in Japan (Toda, 1981:5). These industries included the machinery, refractories, electricity and transportation industries. An effective education system also played a very important role, since without the input of highly qualified personnel, the industry's digestion of, mastery and innovation of imported technologies could never have been possible.

In the very modern times, the influence of the Japan Steel industry could be found spread out all over a range of sectors in the Japanese economy. Let us take for instance, the automotive industry in Japan. This industry stands at the top of the manufacturing sector in Japan. Usually these automobiles are made up of more than 100 types of steel, including sheets for the body and speciality steels for the engine and drivetrain with each type tailored to a specific purpose. Nippon Steel is particularly strong in this area as it had captured 50 per cent of the domestic market for high-strength automotive sheets (Nippon Steel Corporation, 2005b). For the Japanese shipbuilding industry that generally targets high-tech, high-value-added vessels, there is currently a high demand for steel plates, particularly for constructing the deck and outer hull from the steel industry.

There is also a high demand for electrical steel in Japan. Nippon Steel maintains the world's top position for electrical steel, with respect to quality as well as quantity. Electrical steel is a speciality steel that facilitates the efficient conversion of electricity into motive force. This steel is to be found in the hearts of motors, which change electrical energy into mechanical motion. It is used to run electrical home appliances, industrial equipment and other machinery. Also, in recent years, automakers have begun to use electrical steel in the motors of hybrid cars, generally seen as environment-friendly. In response to this development, Nippon Steel developed electrical steel that maintains high motor output through high magnetization. It has achieved high sales in the supply of this speciality steel. Indeed, in 2003, approximately 100,000 hybrid cars that use this product were produced in Japan (Nippon Steel Corporation, 2005b:4). This number is expected to increase sharply in the next decade, and so will be the demand for electrical steel.

Steel cord is also another product that is in high demand within Japan. Steel cord is a steel fiber used to reinforce radial tires. Wire rods made by Nippon Steel for steel cord account for approximately 65 per cent of the domestic market and roughly 25 per cent of the world market (Nippon Steel Corporation, 2005b:5). There is really a point to be made about the fact that Japanese steel producers mainly focus on high value-added steel, as against ordinary steel. This is not to say, that ordinary steel lacks market.

The performance of the iron and steel industry in Japan between 1970 and 1980 showed continuous increase from 1970 to 1974, after which production started declining only to pick up again from 1979 through to 1980. In 1970, Japan produced 68 million tonnes of pig iron, 93.3 million tonnes of crude steel and 1.6 million tonnes of ferro-alloys. In 1978, Japan produced 121.1 million tonnes of crude steel exceeding the 100 million mark for the first

TABLE 7.2

Crude Steel Production: Japanese Steel Industry and Nippon Steel (1971-2005)

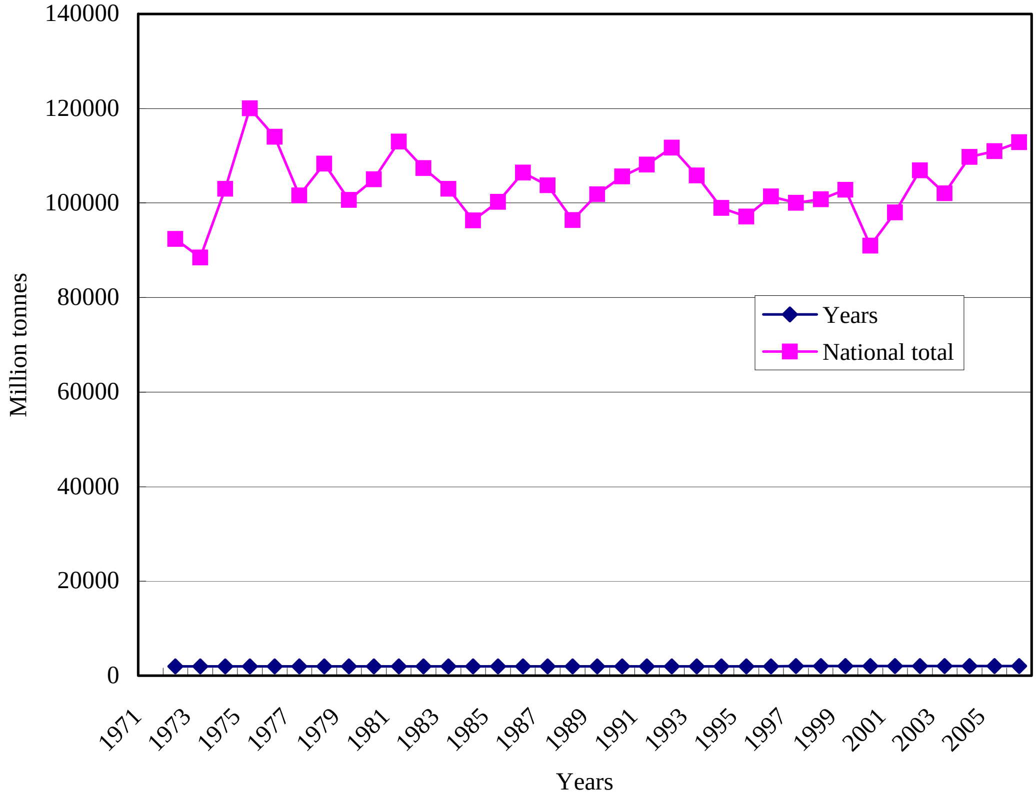
(1,000 tonnes, %)

Years	National total	Integrated Steelmakers		Electric Steelmakers		Nippon Steel	
			% of total		% of total		% of total
1971	92,406	76,999	83.3	15,407	17	32,982	36
1972	88,441	72,910	82.4	15,530	18	29,971	34
1973	102,972	84,625	82.2	18,347	18	35,369	34
1974	120,017	99,672	83	20,345	17	40,989	34
1975	114,035	95,107	83.4	18,929	17	36,899	32
1976	101,613	84,792	83.4	16,821	17	32,293	32
1977	108,326	88,358	81.6	19,968	18	34,394	32
1978	100,646	81,464	80.9	19,182	19	31,655	32
1979	105,059	82,822	78.8	22,237	21	31,994	31
1980	113,010	87,231	77.2	25,779	23	33,582	30
1981	107,386	82,331	76.7	25,054	23	31,682	30
1982	103,029	78,100	75.8	24,929	24	29,970	29
1983	96,299	70,964	73.7	25,334	26	27,051	28
1984	100,200	73,075	72.9	27,125	27	27,727	28
1985	106,470	77,944	73.2	28,526	27	29,596	28
1986	103,758	74,671	72	29,087	28	27,981	27
1987	96,379	68,697	71.3	27,682	29	25,567	27
1988	101,877	73,280	71.9	28,597	28	27,157	27
1989	105,656	75,637	71.6	30,019	28	28,217	27
1990	108,139	76,472	70.7	31,667	29	28,362	26
1991	111,710	78,099	69.9	33,611	30	28,993	26
1992	105,853	75,333	71.2	30,521	29	27,687	26
1993	98,937	69,466	70.2	29,471	30	25,320	26
1994	97,095	69,072	71.1	28,023	29	25,123	26
1995	101,363	70,869	69.9	30,494	30	26,565	26
1996	100,023	68,482	68.5	31,541	32	26,173	26
1997	100,793	68,309	67.8	32,484	32	25,706	26
1998	102,800	70,352	68.4	32,449	32	26,619	26
1999	90,979	62,512	68.7	28,467	31	23,201	26
2000	98,002	69,193	70.6	28,809	29	25,620	26
2001	106,901	77,095	72.1	29,806	28	27,838	26
2002	102,064	74,264	72.8	27,800	27	26,140	26
2003	109,789	79,771	72.9	30,018	27	29,902	27
2004	110,997	81,401	73.3	29,596	27	30,416	27
2005	112,896	82,734	73.3	30,161	27	30,432	27

Note: Underlined figures: Highest and lowest since 1971. Percentage of total for Electric-furnace steelmakers and Nippon steel are rounded to whole numbers.

Source: The Japan Iron and Steel Federation

Crude Steel Production: Japanese Steel Industry 1971-2005



Source: The Japan iron and Steel Federation 2005

time in history, while the 1980 production was 111.4 million tonnes. The increase in crude steel production in Japan from 1970 to 1980 was 18.08 per cent, and Japan's share in the world was 15.6 per cent in 1970 and 15.5 per cent in 1980 (Toda, 1981:10). In terms of contribution of the different steel mills to crude steel production, in 1979 the integrated steel mills accounted for 77.2 per cent, non-integrated steel mills 20.1 per cent and others 2.7 per cent. During this period, there were 9 integrated steel mills that used pig iron produced by blast furnace as iron source for steelmaking. The top five companies accounted for 71.9 per cent of the national crude steel production in the 1979 fiscal year (Toda, 1981: 11). These were Nippon Steel, Nippon Kokan, Sumitomo metal, Kawasaki Steel and Kobe Steel.

See above, figures of crude steel production of the Japanese steel industry and Nippon steel from 1971 to 2005 as presented by the Japan Iron and Steel Foundation. Please note that the figures cited could sometimes vary depending on the source of the data. Here, Nippon steel products accounted for over 30 per cent of total national production, while the integrated steelmakers accounted for over 70 per cent of the total production.

Generally, steel imports from abroad into Japan are on the low side. This could be explained by the fact that the Japanese steel industry can provide a stable supply of almost all types of steel products that can meet the requirements of users. The industry is also highly competitive, producing steel at the lowest cost per unit in comparison to other major producers. In 1980, Japan's total steel import was only 2,430,000 tonnes. In Japan, shift from domestic supply to imported steels is not a generally common practice as the Japanese end users are highly technical in their requirements, and therefore have strict specifications which only domestic suppliers can meet at the appropriate cost.

It has been mentioned elsewhere that the Japanese steel industry depends almost entirely on imports of raw materials to survive. It depends on imports of iron ore and coking coal from abroad. In 1979, Japan imported 98.6 per cent of iron ore and 88.9 per cent of its coking coal requirement. The supplies came mainly from Australia, Brazil and India. Other sources include Chile, Canada and the Philippines. The major sources for the supply of coking coal were Australia, the United States, Canada, the then USSR, China and Poland.

7.1 The State of Japan's Iron and Steel Industry

The state of Japan's iron and steel industry could be better appreciated against the background of the overall economy of Japan and in particular, the manufacturing sector as in the case of Nigeria. As much as is possible, effort is made to present information on the state of the manufacturing sector and the iron and steel industry in Japan. The manufacturing sector has consistently played an important role in the development of the Japanese economy, though the tertiary industry has gradually increased its importance in the economy. However, the manufacturing sector still accounts for a large portion of activities in the domestic economy. In 2002, there were 290,848 establishments (with four or more employees) in the manufacturing sector and a total of 8.32 million employees. On the whole, the companies in this sector shipped 269.4 trillion worth of manufactured products, with value added amounting to 97.5 trillion yen. The iron and steel industry, had a total of 4, 589 companies, with 209, 087 employees and shipped goods worth about 11.0 trillion yen (Statistics Research and Training Institute, 2004:66).

Other leading industries in this sector include transport, general machinery, food, chemical and allied products, electrical machinery etc., electronic parts and devices, and information and communication electronics equipment. A critical look at these leading industries in the Japanese economy show that two of them, the transport and general machinery industries have close links with the iron and steel industry, and may indeed, not survive without collaboration from the iron and steel industry. In terms of details, the 2003 Indices of Industrial Production (2000 average = 100) show that production of iron and steel increased 4.1 per cent from the previous year reflecting the strong demand from the industrial machinery and automobile industries. This increase was reflected in all areas except crude steel (including semi-finished steel) and steel pipes and tubes. Shipment rose by 4.3 per cent from the previous year, which was the second consecutive year of increase. Also, inventory increased in all areas except steel castings and forgings. Indeed, the inventory index increased 5.2 per cent from the previous year-end, the first increase in three years, while the inventory ratio decreased by 1.4 per cent from the previous year (Statistics Research and Training Institute, 2004:75). Generally, national crude steel production for 2004 reflected the growth of steel demand worldwide, increasing 1.90 million tonnes over the 2003 figures to reach 112.89 million tonnes in fiscal 2004 (Nippon Steel Corporation, 2005b). In Japan, the demand graph has traced an upward path since fiscal 2003 and steel consumption topped 70 million tonnes in fiscal 2004, due to the demand from the domestic manufacturing sector, particularly the automotive and shipbuilding industries. See table below for Steel production figures in Japan between 2000 and 2003 from the Ministry of Economy, Trade and Industry (METI).

TABLE 7.3
Steel Production in Japan 2000 -2003

('000)

Products	2000	2001	2002	2003
Pig iron	81,071	78,836	80,979	82,091
Ferroalloys	918	922	903	828
Crude steel	106,444	102,866	107,745	110,511
Ordinary steel	81,630	77,702	79,315	80,162
Special steel	15,060	15,280	16,984	18,273

Source: Ministry of Economy, Trade and Industry.

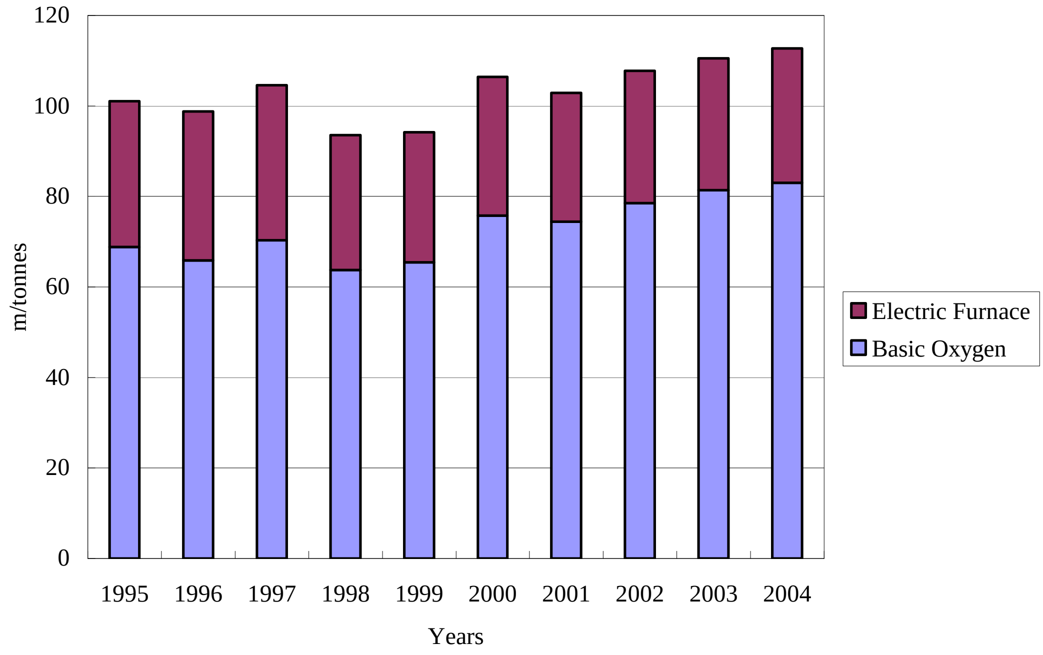
TABLE 7.4
Crude Steel Production in Japan 1995-2004

(million tonnes)

Product	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Basic Oxygen Furnace Steel	68.84	65.85	70.3	63.72	65.45	75.78	74.44	78.53	81.35	82.96
Electric Furnace Steel	32.2	32.95	34.25	29.83	28.74	30.66	28.43	29.22	29.16	29.76
Total	101.64	98.8	104.54	93.55	94.19	106.44	102.87	107.75	110.52	112.72

Source: "Monthly of Iron and Steel, Non-ferrous Metal, and Fabricated Metals Statistics, Ministry of Economy, Trade and Industry.

Crude Steel Production in Japan (1995 - 2004)



There has been a steady improvement in the production levels of crude steel in the iron and steel industry of Japan. In 2004 for example, crude steel production totaled 112.72 million tonnes according to the source above. This was a 2.0 per cent increase over the previous year. This was partly because domestic demand grew for the first time in four years as the manufacturing sector, particularly motor vehicles, shipbuilding and industrial machinery showed steady growth, while the construction demand recovered as building construction recovered. Production gain was also enabled by export shipments to Asian countries like South Korea and China. All these contributed to production exceeding the 100 million tonne mark for the fifth consecutive year. Indeed, the third largest tonnage per year was achieved during this period after the 119.32 million tonnes attained in 1973 and 117.13 million tonnes in 1974 (the figures vary slightly depending on the source). A year-to-year comparison of quarterly figures show that production topped the previous quarters level in 2004, rising 1.8 per cent to 27.58 million tonnes in January-March; 1.1 per cent to 28.22 million tonnes in April-June; 2.4 per cent to 28.16 million tonnes in July-September; and 2.7 per cent to 28.75 million tonnes in October-December (The Japan iron and Steel Federation, 2005). Special crude steel production in particular, totaled 23.58 million tonnes, a gain of 1.40 million tonnes or 6.3 per cent over the previous year, that is 2003 which had 22.18 million tonnes. On a year-to-year basis, this was the 33rd consecutive month of growth. Production of hot-rolled ordinary steel products totaled 83.35 million tonnes, up 1.58 million tonnes, hot-rolled special steel production amounted to 19.84 million tonnes, an increase of 1.11 million tonnes or 5.9 per cent over the previous year (The Japan Iron and Steel Federation, 2005).

Examination of the domestic consumption of ordinary steel products by market in Japan in 2004, in thousands of tonnes indicate the increasing importance of some sectors for the Japanese iron and steel industry. In 2004, the construction industry comprising building construction and civil engineering construction consumed a total of 28,075,000 tonnes of ordinary steel products. This was 44.9 per cent of the total demand of steel. Of this, the construction industry accounted for 33.2 per cent of total demand. For the shipbuilding industry, the consumption was 4,868,000 tonnes (7.8%) of total demand, automobiles 13,083,000 tonnes (20.9%), industrial machinery 5,454,000 tonnes (8.7%), electrical machinery 3,924,000 tonnes (6.3%), secondary processing 3,617,000 tonnes (5.8%), and others 3,529,000 tonnes (5.6%). In all, domestic consumption was about 62.550 million tonnes (JISF, 2005).

7.2 Technology, Equipment and Raw Materials

In terms of technology and equipment, especially production facilities, it could be said that the Japanese iron and steel industry is relatively speaking new compared to those of say, the United States. As at 1980, while the age structure of facilities averaged 17.5 years in the United States, it was only 7.5 years in Japan (AISI, 1980). In the field of rolling operations, there is a desire towards saving energy through the introduction of new technologies like direct rolling, hot charge and continuous annealing. In Japan, electronic computer controls are used, especially in the integrated steel mills to enhance efficiency and reduce safety risks. The common steelmaking process involves the use L.D Converters and Electric Arc Furnaces. Whilst the total hot-rolled steel products in 2003 and 2004 were 100,503.7 thousand metric tonnes and 103,182.0 thousand metric tonnes respectively, steel by L.D Converter was 73.6% in both years. 26.4% of steel produced in both years on the other hand, was through the use of Electric Arc Furnace. A major observation about most integrated steel mills in Japan is that they are located on the seacoast, thereby providing advantages in transportation for the import of raw materials and export of products.

As at the end of 2004, the major types of steel production equipment installed consisted of 28 blast furnaces, 62 basic oxygen furnaces, and 353 electric furnaces (JISF, 2005). The average capacity of blast furnaces in operation in Japan now exceeds 4,000m^3 mainly due to increased capacity as some of the blast furnaces had been relined. In addition, the pulverized coal injection (PCI) ratio dropped to 120kg/tonne of pig iron because of recent increases in production runs and blast furnace repairs. From the viewpoint of achieving zero emissions, efforts have been made to develop recycling technology to utilize furnace dust, as well as sludge from the rolling mills as raw materials. Efforts are also being made to develop technology within the steelworks to recycle waste plastics and waste tires.

In terms of Research and Development (R&D), in fiscal 2003 SCOPE 21 a national project to develop a next-generation coke oven that is environment-friendly, energy-saving, and of high productivity was concluded. Also, research has also been concluded on ultra steel, new steel that offers more than double the strength and service life of ordinary structural steel; and on making effective use of steel slag in marine environment. In general, R&D is ongoing on the matter of environment-friendly, high-value-added products like high-strength steel featuring excellent press formability and weldability, weather-resistant steel providing outstanding corrosion resistance and coated sheets without environment-loading substances as chromium or lead. And, steel products with surface coatings that provide enhanced fungus resistance, heat radiation and light reflection.

With respect to standardization, the Japan iron and Steel Federation has been in the forefront of enhancing standardization on a continuous basis through providing leadership for all JIS standards and ISO standards related to the steel industry. These standards cover a wide range of items from iron ore to steel products. There are in existence about 280 JIS standards and 460 ISO standards (JISF, 2005). The JISF produces and sells Japanese Iron and Steel Certified Materials, known as JSS materials that are accepted locally and internationally.

It had been mentioned that the Japanese iron and steel industry depends almost entirely on imports of raw materials from abroad. In 2004 for example, Japan imported a total of 134.89 million tonnes of iron ore, 2.1 per cent or 2.81 million tonnes more than in the previous year. The top suppliers to Japan include Australia with 63.3 per cent of all imports, followed by Brazil and India. The coal imported in 2004 totaled 65.00 million tonnes, up 1.8 per cent or 1.16 million tonnes over the previous year. Again, Australia was the supplier with 64.4 per cent of all imports, followed by China, Canada and Indonesia. With regard to ferrous scrap, exports have exceeded imports in Japan since 1996, making the country a net exporter. In 2004, the exports amounted to 6.82 million tonnes, which was a record high. The destinations for Japanese scrap include China, South Korea and Taiwan, the three markets accounting for about 93.6 per cent of all exports (JISF, 2005). See table below on imports of iron ore and coking coal by major supply source for the Japanese steel industry and Nippon steel. The data comprises information from Customs Clearance Statistics of the Finance Ministry and Nippon Steel Statistics.

It is important to note that it was Japan's lack of raw materials for the iron and steel industry that necessitated the construction of the integrated plants at the coastal areas, thereby not only reducing the cost of bringing in raw materials but also reducing the transportation cost of finished products to the markets.

TABLE 7.5: Imports of Iron Ore and Coking Coal by Major Supply Source: Japanese Steel Industry and Nippon Steel

	1999	2000	2001	2002	2003	2004	2005
Iron Ore							
Australia	64.88	66.61	71.3	69.61	77.33	81	85.79
	54.7	54.1	54.2	55.6	58.7	61.2	63.6
Brazil	24.03	25.24	26.74	24.61	24.71	23.97	24.92
	20.3	20.5	20.3	19.6	18.7	18.1	18.5
India	15.52	15.2	16.25	15.7	15.97	13.25	11
	13.1	12.4	12.4	12.5	12.1	10	8.2
Others	14.18	15.96	17.2	15.38	13.76	14.19	13.21
	100	13	13.1	12.3	10.4	10.7	9.8
Total	118.61	123.01	131.47	125.3	131.77	132.41	134.92
	100	100	100	100	100	100	100
Nippon Steel	**40.71**	**40.1**	**42.82**	**41.39**	**45.67**	**45.47**	**45.07**
	34.3	**32.6**	**32.6**	**33**	**34.7**	**34.3**	**33.4**
Coking coal							
Australia	34.01	40.81	46.28	45.07	42.52	42.41	43.8
	48.3	55.9	58.9	58.2	54	54.3	59.4
USA	3.86	2.16	1.08	0.88	0	0.04	4.71
	5.5	3	1.4	1.1	0	0.1	6.4
Canada	14.98	13.25	12.61	9.52	8.52	7.74	5.44
	21.3	18.1	16.1	12.3	10.8	9.9	7.4
China	3.32	3.46	4.73	7.6	11.74	10.69	6.95
	4.7	4.7	6	9.8	14.9	13.7	9.4
Others	14.3	13.38	13.85	14.41	15.97	17.23	12.8
	20.3	18.3	17.6	18.6	20.3	22.1	17.4
Total	70.47	73.06	78.55	77.48	78.75	78.11	73.7
	100	100	100	100	100	100	100
Nippon Steel	**20.4**	**20.38**	**20.98**	**21.45**	**22.3**	**21.3**	**22.84**
	28.9	**27.9**	**26.7**	**27.7**	**28.3**	**27.3**	**31**

Note: Upper figures are the tonnage in million tonnes; lower figures are the percentages of the total. Nippon steel refers to Nippon steel's imports of the total.
Source: Customs Clearance Statistics of the Finance Ministry and Nippon Steel Statistics, 2005.

From this table, the major sources of raw materials import are Australia, Brazil, and India for iron ore; and the USA, Canada and China for coking coal. Nippon steel for example, invested in iron ore procurement in the Robe and Beasley Rivers in Australia; and in NIBRASCO and MBR in Brazil. It also invested in the procurement of coking coal in Australia and coke from China (Nippon Steel Corporation, 2005a:44).

According to the International Iron and Steel Institute (IISI), of major global steel producers like Federal Republic of Germany, Italy and Turkey in Europe; Russia and Ukraine in the Commonwealth of Independent States (CIS), the United States in North America, Brazil in South America, South Africa in Africa, Iran in the Middle East, and China, India and South Korea in Asia, Japan continues to be a major player in this industry going by the production statistics for iron and crude steel in the first nine months of 2004. Within this period, Japan produced 61.909 million tonnes of iron and 83.966 million tonnes of crude steel. China, the leading producer country produced 182.633 million tonnes of iron and 200.397 million tonnes of crude steel. For Africa, only South Africa appears somewhat to belong to this league. It produced 4.456 million tonnes of iron and 7.049 million tonnes of crude steel in 2004. Algeria produced only 779,000 tonnes of iron and 806,000 tonnes of crude steel. Egypt with 3.547 million tonnes and Libya with 730,000 tonnes showed signs of potential growth in the production of crude steel. Nigeria's production level is still quite insignificant, though it is showing signs of growth since the arrival of Mittals Global Infrastructure (Nigeria) Limited, which took over the management of the Ajaokuta Steel Company in August 2004. As at March 2006, the Ajaokuta Company was able to supply about 100,000 metric tonnes of rolled products to the Nigerian market, while exporting about 4800 and 510 metric tonnes of rebars to Ghana and Sierra Leone respectively (Ezigbo, 2006). It is possible with further improvement for this company to become the market leader in West Africa.

In sum, as steel demand is rising centered on China and the nearby markets, world steel production is also rising, thereby putting pressure on the supply and demand for raw materials. Therefore, in order to secure long term supplies of raw materials, Japanese steel companies, and infact, steel companies all over the world are engaging in quantitative contracts aimed at securing mining rights and interests like JFE Steel Corporation of Japan that signed an agreement with BHP Billiton, Itochu Corporation and Mitsui & Co., Ltd on the establishment of a joint venture for iron ore mining at the BHPB Yandi Western 4(W4) Mine in Australia (JFE Steel Corporation, 2005). The same thing applies to Mittal of India, which took out concessions on Nigeria's biggest integrated Steel plants, Delta Steel and Ajaokuta Steel, with the Iron Ore Mining Company at Itakpe in the bargain.

7.3 Some Key Players in Japan Iron and Steel Industry

7.3.1 Nippon Steel Corporation

A very important player in the Japan Steel Industry is the Nippon Steel Corporation.

Though officially created in 1970, the Corporation has a long history dating back to 1857 when Japan's first blast furnace went into operation at Kamaishi. In 1934, Japan Iron and Steel Co. Ltd. was founded through the merger of Yawata Steel Works with Wanishi Iron Works, Kamaishi Mines, Mitsubishi Iron, Fuji Steel, Kyushu Steel and Tokyo Steel. The growth of what eventually became Nippon Steel Corporation continued in 1950 when Japan Iron and Steel was dissolved to form Yawata Iron and Steel Co. Ltd and Fuji Iron and Steel Co. Ltd. Eventually, Nippon Steel Corporation was inaugurated in March 31, 1970, through the merger of Yawata Steel and Fuji Steel (Nippon Steel Corporation, 2005a). In between these developments up to the present, there have been several structural and managerial changes, which were part and parcel of the growth of this corporation.

At present, the Nippon Steel Corporation which in reality is a consolidated business conglomerate has ten steelworks spread all over Japan. These are located at Yawata, Muroran, Kamaishi, Hirohata, Hikari, Nagoya, Sakai, Kimitsu, Oita and Tokyo. The relining of the No.2 blast furnace at the Oita works, at a cost of approximately ¥30 billion was completed in May 2004. With a capacity of 5,775 m^3, the No.2 blast furnace is the world's largest in terms of volume. As at 1970, Nippon Steel Corporation had a total employment figure of 79,638 persons, this reduced to 27,689 in 2000 and 20,432 in 2005. Nippon Steel has no doubt, contributed immensely to the growth of human capacity in the manufacturing sector in Japan. Nippon Steel Corporation is Japan's No.1 steelmaker and the third largest globally, in terms of crude steel production with an annual consolidated output of approximately 33 million tonnes. Steelmaking and steel fabrication form the core operations of the Nippon Steel Group and lays the foundation for related businesses in engineering and construction, urban development, chemicals and non-ferrous metals, and systems solutions. About 70 per cent of all steel shipments go to the domestic customers and 30 per cent of the shipments go overseas. The domestic shipments are mostly high- and middle-grade steels for manufacturers, primarily automakers and shipbuilders, while approximately 80 per cent of shipments to other parts of Asia go to manufacturers also (Nippon Steel Corporation, 2005b). Nippon Steel uses its experience and expertise to support domestic manufacturers in Japan, while meeting their specialized product needs. These products include sections, flat-rolled products, tubulars (seamless, butt-welded, electric-resistance welded, electric-arc welded, cold-drawn and coated pipe and tubes); speciality steel products like stainless steel, structural alloy steel, heat-resistant steel and high-strength steel; pig iron and steel ingots amongst others. The Corporation also engages in other businesses incidental to steelmaking and steel fabrication, including a range of engineering and construction activities like erection of iron and steelmaking plants, making industrial machinery, industrial furnaces, environmental plants, water works and water treatment facilities (Nippon Steel Corporation, 2005a). Evidence of its activities and performance could be seen in its consolidated financial position for fiscal 2004. It posted record-high performance, on a consolidated basis with net sales reaching ¥3,389.3 billion, operating profit amounted to ¥429.9 billion, ordinary profit totaled ¥371.4 billion, and net income was ¥220.6 billion (Nippon Steel Corporation, 2005a or b :6). This performance reflected rewards of long-term rationalization efforts and increased steel demand and supply to East Asia, particularly China.

In terms of future plans and strategic planning, the corporation formulated a medium-term consolidated business plan for FY 2003-2005 that aimed to improve the corporation's international competitiveness and profitability in its core business of steelmaking as well as in other business sectors that the group is engaged. On the steelmaking and steel fabrication sector of the group's activities, it intends to carry out measures to strengthen and deepen strategic alliances and also forge partnerships with steel makers in Japan and abroad. For now, it has strategic alliance partners like Arcelor in the field of automotive steel sheets, and POSCO in the field of steelmaking technology as part of joint research for improved efficiency. It is also engaged in corporation with Sumitomo Metal Industries Ltd. in the supply of hot-rolled coils, and Kobe Steel Ltd., where Nippon Steel's Hirohata Works and Kobe Steel's Kakogawa Works are cooperating in the area of cost reductions to improve efficiency.

With respect to technical coorporation, Nippon steel is well respected for its high level technology in iron and steelmaking and technology transfer, based on its accumulated experience over the decades. Its cumulative record of technical cooperation so far amounts to 1,278 projects for 166 companies in 50 countries as at 31 March 2005 (Nippon Steel Cooperation, 2005a). It provided general technical assistance to USIMINAS and COSIPA of Brazil in 2005. The records also show that 6 companies in Africa had cooperated with Nippon Steel on 76 projects. On the whole, it appears that Nippon Steel is very conscious of developments in the global steel industry, and is predisposed to engage in alliances and technical cooperation ventures of interest to it.

7.3.2 JFE Steel Corporation

Another example of a modern Japanese steel company is JFE Steel Corporation. This Corporation has two of the world's most modern integrated steel plants located in two important industrial areas on Tokyo Bay, Keiyo in Chiba Prefecture to the east of Tokyo, and Keihin on the Kawasaki/Yokohama side to the west. Its two "urban steel works", boosts of state-of-the-art computerized equipment for steel production. JFE Steel East Japan Works (Chiba) for example, is the first modern integrated steelworks constructed in Japan after the Second World War. It was opened in 1951 through the merger of Kawasaki and Nippon NKK. The East Japan Works covers a site area of approximately 2.6 million sq. metres out of 8.2 million sq. metres for the two steel companies. It is located where the former Hitachi Company which produced fighter planes for Japan during the Second World War was located. Reasons for its present location include the fact that it is situated in an industrial area, has access to industrial water, which is a very important input for production in a steel company, in addition to having access to the sea for the transportation of raw materials and finished products. By concentrating production facilities from iron making to hot-rolling, through continuous casting, hot rolling and cold rolling, East Japan Works produces steel through what may be seen as a smooth-flowing process.

Designed as an energy-saving and environmentally-friendly urban works, the company carries out resource-saving and recycling projects in line with the present stage of development of this industry in Japan. In 2004, the corporation as a group produced 28 million tonnes of steel, while the East Japan Works produced 8 million tonnes of this figure (JFE Steel Corporation, 2003). Its main products include pig iron, hot and cold-rolled sheets, tubes, galvanized sheets, electrical steels and special steels. These products are variously used in the manufacturing industry to produce tinplated steel cans, stainless steel kitchen sink, automotive steel sheets, and large-diameter steel pipelines. It exports about 45 per cent of semi-processed products to China, Korea and other Asian countries. Its export figure is relatively higher than those of the other steel companies in Japan. Now, it is abundantly clear that considering the volume of its products, about 28 million tonnes, for only one steel company, compared to the total volume of steel produced in Nigeria per annum which is in the range of 1.85 million tonnes**,** Japan is indeed, well-equipped to engage in profitable corporation with Nigeria in this industry.

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8. Iron and Steel and Japan's Industrialization: Lessons

There is little doubt from the study of the development of the Japanese iron and steel industry and the present state of the industry, about a hundred years after that a lot of lessons could be learnt from the Japanese experience. This is especially with respect to the introduction of steelmaking technology, domestication of this technology, synergy with the end-users, and the current state of R&D in the industry making it one of the world's leading producers of steel products. These lessons are very relevant for many of the developing countries like Nigeria who are still grappling with how best to develop this industry that is very essential for energizing industrialization and growth of the economy.

A very clear indication that the Japanese steel industry is not only buoyant but an important contributor to industrialization and growth of the Japanese economy is the picture that emerges from the domestic steel market, especially in terms of the linkages, and global steel trade. As we saw, in 2004 for instance, the domestic demand for ordinary steel products were quite significant, led by the demand from the manufacturing sector. Thus, there was increasing shipment to domestic users. Domestic shipments increased 3.0 per cent to 59.60 million tonnes, whilst export shipments totaled 82.20 million tonnes, up 2.9 per cent showing a steady recovery in that year. Though domestic demand for special steel products from civil engineering projects remained stagnant and that from shipbuilders declined, the increased demand from motor vehicle makers and the industrial machinery sector was a reflection of new capital investments in the industry and improved market conditions in

TABLE 8.0
Supply and Demand of Ordinary and Special Steel Products on Annual Basis 2000 -2004

(Million tonnes)

Year	2000	2001	2002	2003	2004
Steel products					
Ordinary Steel					
Export Shipments	20.9	19.4	22.5	22	22.6
Domestic Shipments	60.3	58.6	57.4	57.9	59.6
Production	81.6	77.7	79.3	80.2	81.9
Special Steel					
Export Shipments	3.8	4.4	5.7	5.5	5.8
Domestic Shipments	11.1	10.6	10.9	12.3	13.2
Production	15.1	15.3	17	18.3	19.2

Note: The Production figures do not necessarily equate to the total shipments per annum.
Source: Adapted figures from The Japan Iron and Steel Federation.

other Asian countries. Indeed, export shipments exceeded the previous year's level by 5.1 per cent rising 5.82 million tonnes. This was as a result of increased demands from China and other Asian countries in products related to motor vehicle production and high-strength steel products. See table below for the supply and demand of ordinary and special steel products on annual basis from 2000 to 2004.

The domestic orders for ordinary steel products by type indicate that heavy and medium plates, bars and flat bars, shapes, cold-rolled sheets and coils and surface-treated and coated sheets are in high domestic demand. For instance, out of a total domestic order of 55.22 million tonnes of ordinary products in 2004, the order for heavy and medium plates was for 12.9 million tonnes, while that for bars and flat bars was for 10.0 million tonnes. For the domestic order for special steel products in 2004 which totaled 12.2 million tonnes, structural carbon steels, structural alloy steels, stainless steels and high tensile strength steels constituted those with the highest orders of 3.8 million tonnes, 2.4 million tonnes, 1.73 million tonnes and 1.45 million tonnes respectively. A point which needs to be emphasized at this stage is that because Japan has transcended the early industrialization stage, and approaching what one may regard as a post-industrial society, the demands of its economy are markedly different from that of a developing country like Nigeria where the basic infrastructure are yet to be fully developed. Therefore, the type of products that are required for the Nigerian market may not be the same as that required or produced by the Japanese steel companies. However, this does not rule out the fact that companies in Japan could still exploit the Nigerian market in a collaborative manner by producing semi-finished products like billets and blooms that could be transported and rolled in Nigeria. In the pursuit of this corporation, short of new facilities in the Nigerian steel industry, which will cost a lot of money, a viable alternative is to invest in already existing facilities and utilize these optimally. Another major lesson from examining the Japan steel industry is that investments in this industry abroad is more likely if the major Japanese auto producers move to that particular country. For instance, if the Toyota group was to say, open a new production line in Nigeria, Japanese steel producers who supply products to the Toyota group, may be forced to invest in the domestic steel industry. A major intent of this study has been to expose the features and potentials of both the Japanese iron and steel industry and the Nigerian economy with a view to encouraging corporation and partnerships in this industry. It is my belief that this industry indeed, has the potential of not only yielding immense benefits for investors, but also, is critical to Nigeria's industrialization, which in its growth will throw up spin-off businesses that could still be exploited by the partners.

In retrospect, the development of the Japan iron and steel industry including the measures taken by the government, contributed immensely to overall industrial growth. After World War 11 the Japanese steel industry grew very rapidly, including improving its technology, especially from the1950s through to early 1970s. It was observed that Japan's post-war industrial system basically rested on a grand settlement in which the government pursued a high-growth economic strategy of low interest rates, tight fiscal policy, and transfer of personal savings into industrial policy, augmented by a political strategy in which it compensated specific constituent groups, notably farmers and small businesses through protection, subsidies and public works spending (Vogel, 1997). During this period, raw steel output increased markedly, especially in the 1960s and 1970s, while domestic steel prices declined generally, and steel exports increased steadily within the same period (Komiya et.al 1988:281). It was about 1949, that the Japanese economy was transformed into a market economy, in accordance with the economic thrust of the American occupation authority. At this time, most of the economic controls and subsidies were abolished, though the role of the government continued to be substantial (Okazaki, 1996). A major plank of the economic policy at this period was that the growth of the machinery industry based on exports should be the driving force for the revitalization of the Japanese economy. The reason being that newly developing Asian countries were expected to catch-up with Japan in the textile industry which had been Japan's leading industry in the prewar period. The machinery industry was therefore, expected to absorb redundant labour force and to earn foreign exchange. However, at this period in time, the machinery industry did not have enough competitiveness in the international market as a result of the high price of iron and steel products due to the high importation cost for iron ore. In what became a vicious cycle, the uncompetitiveness of the machinery industry constrained the growth of the iron and steel industry, especially with regards to production size. Part of the measures taken by the Japanese government was the rationalization of the steel and coal industry, along with the rationalization of the shipbuilding industry in order to make the industry internationally competitive. This led to the first iron and steel rationalization plan (1950-1951) and the second rationalization plan (1955). As a result of the measures taken under the second rationalization plan which gave birth to basic infrastructure for this industry, the production cost of the iron and steel industry decreased to be lower than that of the US iron and steel industry in the late 1950s (Yamawaki, 1984:263). This became the basis of competitiveness of Japan's machinery industry. This period therefore, saw this industry becoming the primary target of the Japanese government and the various ministries in their formulation and implementation of the industrial policy. The government intervened in support of this industry through a variety of protective and promotion instruments. For example, the Ministry of International Trade and Industry (MITI) during this period implemented a number of policies designed to encourage the strategic allocation of resources to the steel industry as the lynch-pin of its heavy and chemical industrialization policy.

Generally, the measures taken were quite comprehensive in scope and included some of the following – allocation of funds for rationalization through the Japan Development Bank (JDB), provision of designated allowances for designated equipment, special corporate income tax deductions for income from exports and the establishment of an approval system for the licensing of foreign technology based on foreign exchange allocations. The goals of the measures undertaken included encouraging investment in the industry through the strategic supply of funds and tax reduction, promoting technical change and exports through tax reduction provisions, importing strategic technologies and protecting the industry from foreign competition (Komiya et.al 1988:286). The steel industry benefited from the synergy between the approval system for foreign technology licenses based on the May 1950 Law Concerning Foreign capital and the August 1950 Cabinet approval of the Outline of Measures for the Rationalization of the Steel Industry. The importation of foreign equipment and technology was given favourable treatment through preferential allocations in the foreign exchange budget to the steel industry. Due to this preferential allocation of foreign exchange to the steel industry, the foreign exchange licensing system helped to encourage the importation of technology. It suffices to say that bureau-pluralism, especially the decentralization of decision making and horizontal coordination worked well in Japan at this period to rectify coordination failures between the ministries and industries, and chart a path-dependent evolution of the economic system. According to Okazaki (2000), bureau-pluralism was behind the success and failure of the Japanese economy from 1950s to 1990s.

An interesting observation during this period also, was that though international competitiveness of the Japanese steel industry was still inferior to that of the West, imports were nevertheless minimal. This was possible due to the nature of the foreign exchange allocation system and the existing regime of high level of tariffs. In other words, the Japanese steel industry was protected from competition from imports, especially in the1950s. What is however clear from this introspection is that the industrial policy in existence at this period was quite effective at the early stages of the development of the Japanese steel industry.

8.1 Japan in Global Steel Trade

The global steel industry dominated by big multinationals, is increasingly becoming difficult for the small producers. The availability and prices of raw materials remain a constant headache. However, in recent times, the huge appetite of China's industrial growth, and therefore demand for iron and steel products has greatly improved global steel trade, with the major players smiling to the banks. There are however, worries about the sustainability of this market situation. In 2004, China was the major producer of crude steel, as well as the major destination country. It produced a total of 245 m/tonnes followed by Japan with 112 m/tonnes, then the USA and South Korea respectively. While China's steelmaking capacity was only 11 per cent of the world total in 1994, it is now roughly 25 per cent.

In terms of apparent consumption of finished steel products, the forecast shows that for 2006, Asia will continue to lead with a demand of about 553.3 m/tonnes followed by the

EU-15 with a demand of 149.4 m/tonnes. Asia's high steel demand is attributable to China's annual demand of about 320 m/tonnes (IISI, 2004).

TABLE 8.1
Crude Steel Production - Top 30 Steelmakers in the World 2005

Ranking	Company	Country	2004	2003	Growth rate 04/03
1	Arcelor	Luxembourg	46.9	42.76	9.68
2	LNM Holdings	Netherlands Antilles	42.84	31.13	37.62
3	Nippon Steel	Japan	31.41	31.76	-1.1
4	JFE Steel	Japan	31.13	29.78	4.53
5	Posco	South Korea	31.05	29.71	4.51
6	Shanhai Baosteel	China	21.41	19.87	7.75
7	US Steel	USA	20.83	17.92	16.24
8	Corus Group	UK	19.94	18.87	5.67
9	Nucor	USA	17.91	15.82	13.21
10	Thyssen Krupp	Germany	17.58	17.02	3.29
11	Riva Group	Italy	16.7	15.66	6.64
12	International Steel Group	USA	16.11	10.61	51.84
13	Gerdau Group	Brazil	13.4	12.3	8.94
14	Severstal	Russia	12.8	9.89	29.42
15	China steel	Taiwan	12.53	10.1	24.06
16	Sumitomo Metal Ind.	Japan	12.33	13.29	-7.22
17	Evraz Holding	Russia	12.23	12.07	1.33
18	Sail	India	12.14	12.39	-2.02
19	Anshan	China	11.93	10.18	17.19
20	Magnitogorsk	Russia	11.28	11.47	-1.66
21	Wuhan	China	9.31	8.43	10.44
22	Novolipetsk	Russia	9.1	8.9	2.25
23	Usimas Group	Brazil	8.95	8.73	2.52
24	Imidro	Iran	8.7	7.9	10.13
25	Salzgitter	Germany	8.69	8.56	0.47
26	Shougang	China	8.48	8.17	3.79
27	Maanshan	China	8.03	6.06	32.51
28	INI Steel	South Korea	7.92	7.24	9.39
29	Kobe Steel	Japan	7.67	7.25	5.79
30	Tangshan	China	7.66	6.08	25.99

Source: Metal Bulletin and Nippon Steel Corporation, Basic Facts About Nippon Steel, 2005

The Annual worldwide steel consumption vacillated between 700-800 million tonnes for approximately 20 years until 2000 when consumption began to climb higher. In fiscal 2004, the one-billion tonne mark was reached after the sudden high demand from East Asia and China in particular (Nippon Steel Corporation, 2005b:10). See table above for the positions and volume of crude steel produced by the top 30 steelmakers in the world.

Global consolidation is currently ongoing in the steel industry amongst the major players, and it is possible that the position of the individual companies indicated in the table above will vary from time to time. The boom from Chinese consumption has encouraged a succession of mergers. For instance, Arcelor, a European multinational made of top companies from France, Spain and Luxembourg formed in 2001 was toppled from its leading position early in 2005 by Mittal. Mittal is now the world No.1 steel company. It is a London-based steel empire 88 per cent owned by Lakshmi Mittal and his family. They had earlier bought America's International Steel Group, itself a recent agglomeration of distressed family names, like Bethlehem steel and LTV. Mittal has also concluded the purchase of Ukraine's Kryvorizhstal, taking its annual production to over 65 m/tonnes - well over Arcelor's output of about 47 m/tonnes. Japanese steel companies of Nippon Steel and JFE Steel are in the third and fourth positions with steel outputs of 33 m/tonnes and 32 m/tonnes respectively (The Economist, 2005). Sumitomo Metal Industries and Kobe Steel are also among the top 30 producers with production outputs of about 12.33m/tonnes and 7.67m/tonnes respectively for 2004 (Nippon Steel Corporation, 2005a:59). Generally, Japan's steel exports stopped being a major problem for European and American producers when it began in the 1960s to utilize and add value to most of its steel products in the automobile and shipping industries. Today, the competitive advantages of Japanese steel producers lie in their ability to produce special and value-added products in a cost-efficient manner.

There is no doubt whatsoever that Japan is a key player in the global steel trade, especially when it comes to the supply of specialized products to important sectors of the global economy. This is also an indicator of Japan's advanced level of industrialization. If we take a look at the statistics for Japan's steel exports against the background of the industry's ability to supply the domestic market, the importance and viability of this industry become very obvious. In 2004, Japanese steel exports totaled 35.30 million tonnes. This was a 2.6 per cent increase over the previous year. Export volume, which exceeded the 30 million tonne mark for the fourth consecutive year, was the third-highest level on record, after the 36.32 million tonnes registered in 2002. By major destinations, the exports went to China, South Korea, Thailand and Taiwan. These four accounted for 65 per cent of all steel products Japan exported in 2004. On the other hand, they also accounted for more than 90 per cent of all ordinary steel products imported by Japan in 2004. By type of product, ordinary steel products accounted for 73.5 per cent of all Japanese steel exports in the same year. Special steel represented 15.2 per cent, ingots and semis 8.8 per cent, secondary

TABLE 8.2
Japan Steel Exports and Imports 2000 - 2004

(Million tonnes)

Year	2000	2001	2002	2003	2004
Exports					
Iron and Steel	29.16	30.48	36.32	34.41	35.3
Ordinary Steel	22.39	22.13	25.76	25.12	25.94
Imports					
Iron and Steel	7.75	6.08	5.26	5.95	7.05
Ordinary Steel	4.66	3.63	2.84	2.85	3.46

Source: Adapted from "Customs Clearance Statistics", Ministry of Finance, Japan.

products 1.7 per cent and pig iron 0.1 per cent. Exports of ordinary steel products rose 3.3 per cent to 25.94 million tonnes, topping the 20 million tonne mark for the fifth consecutive year (The Japan Iron and Steel Federation, 2005). See table below for a summary of Japan's steel exports and imports from 2000 to 2004.

In all, Japan in 2004 exported 35.3 million tonnes of steel worth US $25 billion. In 2003, it exported 34.4 million tonnes worth US $19.2 billion. In terms of imports, it imported a total of 7.05 million tonnes of iron and steel products worth US $5.9 million in the same year, while it imported 5.95 million tonnes worth US $3.5 million in 2003. In terms of details, Japan exported 35.91 million tonnes of pig iron worth US $11.42 million in 2004 (JPY110.21 = US1$). It also exported 3.1 million tonnes of semi-finished products worth US $9.6 million. Ordinary steel products exported in 2004 included rails, steel sheet piling, sections, bars, wire rod, heavy plate, medium plate, hot-rolled sheet, hot-rolled wide strip, hot-rolled narrow strip, cold-rolled wide strip, cold-rolled narrow strip, electrical sheet and strip, ton plate, tin-free steel, galvanized sheet and other metallic-coated sheet, all worth about US $966.1 million. This trend showed signs of continuing in 2005, infact in September 2005 Japan exported 452,259 metric tonnes semi-finished products worth US $186.4 million. A cursory glance at the Japan's steel trade statistics for 2004 show that ferroalloy; semi-finished products; ordinary steel in particular, heavy plate, hot-rolled narrow strip, cold-rolled narrow strip, galvanized sheet and welded pipes and tubes constitute the major sources of foreign exchange for this industry. Special steel products consisting of stainless steel and other speciality steel also contributed to foreign exchange earnings. Secondary steel products including steel wire also brought in a handsome figure of US $2.4 billion. In this particular year, Japan on the whole exported products worth US $6.3 billion. All said, the iron and steel industry of Japan has not only contributed to the country's industrialization, especially through its various linkages but has continued to be a major foreign exchange earner for the country.

However, the discussion on the growth of the Japan Iron and steel industry and its importance for the country's industrialization cannot be exhausted, without generally mentioning the role played by science and technology and the educational system. According to the Survey of Research and Development, R&D expenditures increased by more than 10 per cent year-on-year in fiscal 1989 and 1990. This declined during the adjustment period, but picked up again in fiscal 1995 with expenditures growing by 3 - 4 per cent. In 2002, Japan spent 16.7 trillion yen on R&D which was 0.9 per cent over the previous fiscal year. The expenditure total in fiscal 2002 was equivalent to 3.35 per cent of GDP. Japan leads among the major industrialized countries in the ratio of research expenditures, including the humanities and social sciences, to Gross Domestic Product.

On the value of technology trade, which comprises the import and export of technology such as patents and other knowledge with other countries by the private sector and others, Japan received 1.39 trillion yen from exports in fiscal 2002, of which 69.6 per cent accounted for the exports to parent companies or subsidiaries with more than 50 percent equity interest, up 11.2 per cent compared to the previous fiscal year. Japan also paid 541.7 billion yen for imports, of which 16.9 per cent accounted for the imports from parent companies or subsidiaries. Japan exported its technology to the United States (45.7 % of exports); Canada, China, and the U.K were the other major recipients. On the other hand, it equally imported technology from the United States (67.5 %), and many European countries like France, the Netherlands and the U.K (Statistical Research and Training Institute, 2004:87).

It is therefore clear that Japan is a leading technology producer, as well as consumer. No wonder she has continued to improve upon her technological achievements, which have manifested positively in the industrial sector. Suffice it to say, however, that Japan's technological growth could not have been possible without a good educational system anchored on technical subjects, and an infrastructure that makes it possible to translate scientific findings to useful purposes in the manufacturing sector. A practice, which ensures that technically competent persons are encouraged and remunerated incrementally without salary ceilings in the private sector makes it possible not only to retain such persons, but also to get the best out of them.

8.2 Impact on the Japanese Economy

The iron and steel industry has not only been a leading industry, but also a major contributor to the growth of the Japanese economy especially beginning from the 1950s. From the Second World War up to the end of the 1960s demand from the civil engineering and construction sectors accounted for about 50 per cent of the total demand, however, with the increase from automotive and industrial machinery in the following years, the share of the civil engineering and construction sectors decreased (Toda, 1981:25). As the Japanese economy underwent rapid growth, shipbuilding, automotive and machinery industries expanded greatly as important steel consuming sectors. Not surprisingly, steel demand in Japan diversified to have characteristic structural pattern with much weight in flat rolled steel and heavy structurals. With the support of the Japanese government which very early recognized the importance of this industry to the growth of the Japanese economy through the provision of government loans offered at favourable rates, modernization and expansion of the domestic industry was achieved. By the 1970s iron and steel became the leading exports from Japan, accounting for over US $2.8 billion or 14.7 per cent of total exports. This export share peaked in 1974 at 19 per cent (CIA World Factbook, 1994). All these while, the imports of iron and steel remained very minimal, mainly due to the strength of the domestic industry and the various import barriers. However, the rapid and successful growth of this industry generated high demands of raw materials, of which Japan lacked such as iron ore and concentrates and coking coal. Nonetheless, the industry was able to borrow and generate the required funds to continue importing and stockpiling raw materials in order to ensure continuous supply to the highly demanding domestic market, which in a way was fueling the growth of the Japanese economy.

This demand for iron and steel products by the Japanese economy is still very much the case in the 21st century. As earlier mentioned, in 2005 the steel industry had a production value of 13 trillion yen, with 4.5 trillion yen of added value, the same as that of the automobile industry, earning profits through the sale of high-tensile steel that other countries could hardly produce (Japan Economic Foundation, 2005). In terms of the linkage of the iron and steel industry to the manufacturing sector, Japan is still the foremost car producer in the world. Japan produces around 10 million vehicles every year of high quality, which gives it a competitive edge. It is also the highest producer of industrial machinery, metal molds and robots for manufacturing. It is important to point out at this juncture, that the success of the Japanese manufacturing sector and economy generally could also be attributed to the existence of home-grown high management. In Japanese manufacturing industry, TQM (total quality management) occurs as a matter of routine, with small groups in the companies playing important roles in producing world-class products. Often, Japanese workers do not follow the provided manual strictly, but pool their ideas together, sometimes through industry-wide consultation and experimentation in order to overcome production problems permanently. This is a practice that is not common with many western corporations that often tend to depend strictly on the provided manual.

In general, the impact of the iron and steel industry on the growth of the Japanese economy and the continued impressive performance of the manufacturing sector in Japan cannot be over emphasized, it is only left for us to glean lessons from the experiences of Japan in this industry for the benefit of the developing countries that still require the input of this industry for their industrial development. Nigeria, is a good example of such a country, and having comprehensively examined the state of its iron and steel industry and economy earlier on, it would be proper to see what lessons could be articulated for its benefit.

8.3 Lessons from Japan's Experience

In a way, the history of the development of the iron and steel industry in Japan is also the history of the growth of industrialization in the country. The historical process of the growth of this industry is a history of the various difficult experiences and efforts made to establish and improve its facilities and expand internationally. In otherwords, the growth of an industry like the iron and steel industry may take awhile. Sometimes, it involves the transplantation of technology from another part of the world, as in this case, which involved the transplantation of western technology (Lida, 1980:6). However, the major lesson from the Japanese experience is that the political will, especially by the government has to be there initially and augmented with systematic planning for the proper development of the industry. This should further be justified by an effective demand for iron and steel products by the domestic economy. Indeed, in 1951, when the Japanese iron and steel industry launched a round of modernization programmes, the Korean War, which had broken out the year before strongly stimulated Japanese demand for steel in construction, shipbuilding and the manufacture of electrical products and automobiles (Lida, 1980:64). As pointed out elsewhere, the post- war steel industry was one of the major targets of the industrial policies implemented by the Japanese government. The priority production system implemented at the initiative of the Economic Stabilization Board from 1946 facilitated the industrial reconstruction of Japan by giving priority to promoting the production of steel and coal, thereby creating a snowballing effect on overall industrial recovery. Consequently, throughout the 1950s and 1960s, the industry achieved a high rate of increase in productivity and a continual decline in unit production costs, with prices of steel products declining whilst exports increased (Komiya, 1988:302).

Another lesson to be learnt from the Japanese experience is the necessity for international cooperation by industries, especially when a particular industry lacks the relevant raw materials. The steel industry in Japan because of its inherent disadvantages in obtaining the relevant raw materials like iron ore and coking coal, of which it had to import large quantities, made the industry to maintain harmonious corporation with other countries. Invariably, it became a major player in regional and international bodies concerned with the production and sale of iron and steel products.

During the period of rapid growth in the 1960s through the 1970s, the Japanese steel industry accumulated various operational as well as construction technologies of integrated steel mills, exemplified by the construction of highly efficient mills at minimal cost. The industry later established itself as an engineering industry utilizing these technologies and now exporting their expertise overseas. Today, Japanese assistance is in high demand for the construction of integrated steel mills by both developed and developing countries including the management control technology.

Therefore making one's experience and technology available to another through some bilateral arrangement should not be discountenanced as this holds mutual benefits both for the giver and receiver. For the giver, the benefits may not only be restricted to this industry, but also to its related affiliates in the recipient country. However, while the profit motive is very important in building corporation arrangements, it is not often that a win-win situation presents itself for the technologically advanced counterpart. Sometimes, it may be necessary to take some risks, after all business itself is all about risks.

A general lesson from the Japanese experience is that industrialization was strongly promoted by the government. Infact, it hired thousands of experts to establish modern industries, created new industries and opened technical institutes and universities. Government-owned businesses were then sold to private entrepreneurs (zaibatsu). In general, there were two related forms of industrial organization in Japan. Usually, family-centered holding companies act to organize and integrate many different firms. Often, large banks operate to supply capital and in other cases, complex systems of manufacturers and suppliers serve as the main forms of organization. Zaibatsu refers to such enterprise systems prior to 1945, while *Keiretsu* refers to such systems after 1945 (Lairson and Skidmore, 1997). The point to note however, was that by 1900 Japan was already the most industrialized land in Asia (Bentley and Ziegler, 2003).

In sum, it is important to note the following points on why the Japanese iron and steel industry was able to survive even after the near devastating impact of the pacific War. The first is that the Japanese already had more than a century of experience and achievements in modern iron-making since the late Edo period, and had made progress in independent development of the technology involved. Secondly, they responded sensibly to postwar changes in the international economic environment and made correct choices concerning the importation of appropriate technology. Thirdly, cessation of demand from the military-industrial complex as a result of Japan's defeat in World War 11 shifted the emphasis of the industry to providing products for civil uses thereby raising the peoples standard of living; and fourthly, in the process of restructuring to promote the growth of heavy and chemical industries, industrial machinery manufacturing which was stalled during the war, succeeded in establishing itself as an important industry in the economy. According to Lida (1980:61), remarkable progress was achieved generally in the development of steel-related technology leading to the formation of an industrial-technological environment in which "iron necessitated another supply of iron" and "one innovation led to another". These are important lessons from the Japanese experience.

Further, in recent times significant efforts have been made by the industry to conserve energy and natural resources, hence there are in existence stricter energy control practices, improved operation techniques and active implementation of energy saving technologies. For instance, the percentage of blast furnaces operated without oil injection has fast diminished. This development arose because of the impact of the global oil crisis of 1973 on the Japanese economy, which was triggered by the Yom Kippur war, and forced Japanese companies to re-think the philosophy underlying their technologies. In general, it was realized that there should be some synergy between things (nature, use of natural resources) and the activities of humans for sustainability of the environment. The lesson from the experience of rapid industrialization in Japan is the necessity to encourage technological ideas that could co-exist with nature in such a way that the future existence of the human race is not jeopardized.

In terms of market development, the thrust of the efforts being made at present indicate the direction that the iron and steel industry of Japan is taking. The Japan Iron and Steel Federation has carried out a wide range of market development activities focused on the following – the development and diffusion of application technologies centering on highly functional high performance steels, research on technology conducive to social capital improvement, the recognition and penetration of Japanese-made functional steels in Southeast Asia and China and the verification of environmental superiority (JISF, 2005).

It suffices to conclude that the Japan steel industry had over the decades accumulated immense experience for the successful running of steel plants. The Japanese are masters in every aspect of construction and operation of integrated steel plants, a mastery garnered during the course of the rapid expansion of the industry in the past. They have therefore mastered the technologies of steelmaking and not only produces good steel optimally, but also with value-added.

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9. Extending Cooperation to Nigeria

At this juncture, it is time to examine what one may consider the external cooperation architecture available for Japan in its economic relations with other countries of the world. This exercise will serve as a basis for the subsequent exploration of cooperation with Nigeria in the iron and steel industry. However, in doing this we know that international relations do not just begin in a vacuum, but is usually associated with a history of political and economic relations that may have endured for some years. To this extent, the state of political and economic relations between Japan and Nigeria is also presented as a background for exploring further economic cooperation between the two countries in the iron and steel industry.

It has been the case, up to recent times that there was limited preoccupation with Africa in general in Japan. It did appear that Africa was a long way from the daily concerns of the average Japanese. However, for Japanese leaders and policy makers, Africa including Nigeria should be of strategic interest considering the interconnectedness in relations among nations, but more especially in terms of the intricacies of the global political economy. It was therefore rather alarming when in fiscal year 2001 a decision was taken by the Japanese government of Prime Minister Yoshiro Mori to cut Overseas Development Aid (ODA) by three per cent (Adem, 2001). ODA is considered an important pillar of Japan's international contribution. This was alarming because over the decades, Japan had increasingly played a leading role in assisting the developing countries with initiative and independence of thought and action. This was only mildly modulated by geopolitical and ideological calculations during the cold war period. With the cold war over, Japan was expected to even further improve on its independence in foreign relations, and especially in economic relations. The initiative to hold the Tokyo International Conference on African Development (TICAD I), first in 1993, then (TICAD II) in 1998 and (TICAD III) in 2003 represented an indication of the fact that Japan had very early made a philosophical shift in the perception of its role in the global arena. During the ten years of the TICAD process, the Japanese government provided educational opportunities to about 2.6 million children in Africa by constructing schools and providing health care and medical services to over 240 million people through vaccinations. It also supplied safe water to about 3 million people through bilateral official development assistance worth about 12 billion US dollars in total (JICA Annual Report, 2004:71). However, a point which needs to be quickly made is that Japan's ODA to the developing countries whether in South-East Asia or in Africa should not be seen as purely charity. According to Prime Minister Mori during his visit to South Africa in 2001:

> our optimism that people can overcome any difficulty through development of the human potential and cooperation between people underpins our stance towards cooperation; that stance is based not on acts of charity, but on always viewing

others at the same eye level and acting as fellow human beings (Mori, 2001).

This of course, does not mean that the asymmetric nature of interdependence between two unequals is not there, only that there is in the present era a wide scope for more meaningful cooperation. Indeed, Japan needs Africa's raw materials and possibly markets, while Africa requires Japan's market, economic aid and investment. Today, South Africa, Kenya and Nigeria represent Japan's major trading partners in Africa, and are also, the major recipients of Japanese aid and investment. The point therefore, is that it is not totally inconceivable to argue along the lines of rational cooperation between Japan and Nigeria with respect to assistance in a particular industry. This cooperation has a background, is mutually beneficial and as we will see later, is politically useful.

9.1 Overview of Japan's Development Cooperation Architecture

This segment begins with the following statement, which is the mission statement of the Japan International Cooperation Agency (JICA):

> We, as a bridge between the people of Japan and developing countries, will advance international cooperation through the sharing of knowledge and experience and will work to build a more peaceful and prosperous world.

There is indeed, no better way to summarize the fact that international cooperation is not only possible but a rational act than the way JICA, a Japanese government agency captured the overall thrust of its existence above. This attitude gives some hope to the masses of people in the developing world that indeed, it is possible for the industrialized countries to assist their counterparts in the South.

Apart for JICA, which was founded in October 2003 as an independent administrative institution, other institutions which form part and parcel of the ODA architecture in Japan and that implement technical projects include the Japan Foundation (JF), the Japan External Trade Organization (JETRO), the Association for Overseas Technical Scholarship (AOTS), and the Japan Overseas Development Corporation (JODC). However, JICA and JETRO are the two major institutions used by Japan in its development cooperation arrangements. Others, like the Japan Foundation was founded in 1972 as a special public institution to enhance understanding between Japan and other nations and to promote international friendship. It became an independent administrative institution in October 2003, and receives part of its project budget from the Ministry of Foreign Affairs' budget. The Foundation implements projects for both developed and developing countries. Of these, the ODA budget is primarily used for budgets involving personal exchanges with developing countries, dissemination of Japanese language education, and presentation of Japanese culture (JICA, 2004).

9.2 Japan External Trade Organization (JETRO)

The Japan External Trade Organization (JETRO) on the other hand, was founded as a special public institution in 1958 to implement Japan's trade promotion projects comprehensively. JETRO basically focuses on the trade angle. It seeks for foreign companies that wish to invest in Japan and facilitates this. It also, assists Japanese companies that wish to invest abroad with information, market research and advice (Shikama, 2005). Since the late 1960s, it has worked mainly toward encouraging imports from developing countries. It often brings officials responsible for trade policy and executives of private companies (that export to Japan) in developing countries to Japan, had given its support to the promotion of economic reform, had encouraged developing countries to export to Japan and sent its own experts to developing countries to help in the dissemination of technology appropriate to those countries. JETRO merged with the Institute of Developing Economies (IDE) in July 1998, became an independent administrative institution in October 2003, and is now also engaged in basic and comprehensive studies and research on economic and other conditions in developing countries (JICA Annual Report, 2004).

However, for our purposes in this study, it is JICA and the Japan Bank for International Cooperation (JBIC) that are more relevant and institutionally placed to engage in economic relations relating to technical and financial cooperation and to the improvement of infrastructure and other projects necessary for development in partner countries. Indeed, JIBC is more institutionally suited and empowered to facilitate collaboration with other partner institutions like JICA in effecting international cooperation.

9.3 Japan International Cooperation Agency (JICA)

JICA is an independent administrative institution established under the New Japan International Cooperation Agency Law (Law No.136 of 2002) for the purpose of contributing to economic and social development in developing regions as well as the promotion of international cooperation. As at October I, 2003 it had a capital of 84.37 billion yen, and a budget of 166.7 billion yen for the fiscal year 2004. JICA encourages a field-based approach in its activities based on the observation that developing countries have a variety of problems depending on their respective political systems, and industrial growth. Hence, Japan's assistance is extended with consideration to the specificity of each developing country. Secondly, a concept of human security as a framework is canvassed to be incorporated into JICA's programmes. Human security is here understood, as a concept that serves to protect vital freedoms from critical and pervasive threats. JICA therefore, supports an approach that is based on the protection and empowerment of people. Protection refers to the norms, processes, and institutions that shield people through establishing the rule of law, accountable and transparent institutions, and democratic governance structures. Empowerment emphasizes people as actors and participants in attaining better lives. Thirdly, JICA aims to implement its programmes and projects in an effective and efficient manner, through a result-based management pattern.

Before JICA became an independent administrative institution in 2003, it was for nearly thirty years a special public institution of the government. Today, it has 56 overseas offices with expanded functions. Generally, JICA provides cooperation in the form of policy advice and human resources development for the transition to market economy countries. It also upgrades basic infrastructure taking into consideration the stage of development in the particular country. It was in 2003 at TICAD III that Japan announced that it would contribute to African development based on the three pillars of human-centered development, poverty reduction through economic development, and the consolidation of peace. In providing cooperation JICA seeks to promote intra-regional cooperation (like the NEPAD), among African countries with regional bases and also South-South cooperation utilizing the experience of development in Asia. For instance, Japan has concluded Partnership Programmes that determine the comprehensive framework of South-South cooperation with 11 developing countries that have a positive attitude to this policy. Though South-East Asia encompassing 10 ASEAN countries and Timor-Leste is a very important region for Japan in terms of politics, economics and culture, and the share of aid to this region has been greatest, Africa is increasingly becoming important, especially with respect to cooperation in the procurement of raw materials.

Since 2003, JICA has focused on the priority issues confirmed in TICAD III (The Third Tokyo International Conference on African Development) such as social development, including health care and education and the consolidation of peace. In terms of modus operandi, it strives to promote the strengthening of the support systems in Africa through the creation of a new Regional Department IV beginning April 2004. It also strives to strengthen local systems through the delegation of authority to overseas offices and increase in personnel in overseas offices. There are currently 18 JICA offices (thirteen overseas offices, two JICA/JOCV offices and three JOCV offices) in Africa (JICA Annual Report, 2004). To promote field-based cooperation promptly, JICA transfers responsibility and authority to overseas offices and improves the system that allows a proper response to the needs of the developing countries through prompt decision making. In terms of specifics, JICA operates through investment in social infrastructure like roads, bridges, hospitals, schools etc. and the dispatch of experts and volunteers to the recipient countries. Often, contracts are drawn up involving the Japanese government and the developing countries' governments (Shikama, 2005). This makes for proper monitoring and shared responsibility. A major feature of Japan's development cooperation is that JICA provides long-term, low interest loans to Japanese enterprises for projects which do not qualify for loans from the Overseas Economic Cooperation Fund or the Export-Import Bank of Japan. It also conducts surveys and provides guidance as necessary to Japanese businessmen and the government. These services, referred to as Development Cooperation, support Japanese private enterprises who intend to invest and contribute to the economic progress of the developing countries. Generally, JICA's activities include funding projects when loans are not readily available, construction of public utilities, financing development projects specially commissioned by the governments of the developing countries under international agreement, surveys and technical consultancy for identified projects. Besides these and providing loans, JICA dispatches experts to solve technical difficulties in developing countries and equally invites staff for training in Japan.

9.4 Japan Bank for International Cooperation

In principle, the Japan Bank for International Cooperation has a statutory mandate to undertake lending and other operations for the promotion of Japanese exports, imports and economic activities overseas; for the stability of international financial order; and for economic and social development as well as economic stability in the developing economies. The JBIC operates under the principle that it does not necessarily compete with private financial institutions (JBIC, 2005a). It is an official financial institution of the Japanese government. In terms of funding, JBIC finances its activities by drawing on various sources including borrowings from the Fiscal Investment and Loan Program (FILP), government-guaranteed bond issues, and government contributions to its capital and government grants. Indeed, JBIC recently began to issue FILP Agency Bonds without a government guarantee in the domestic capital market since the 2001 fiscal year in Japan. In terms of operations, JBIC's operations consist of the International Financial Operations (IFOs) and the Overseas Economic Cooperation Operations (OECOs). By the provisions of the Japan Bank for International Cooperation Law (JBIC Law), these operations are financially independent and undertaken on separate accounts. In terms of structure of operations, International Financial Operations which contribute to Japanese exports, imports and economic activities overseas issue export loans, import loans, overseas investment loans, untied loans and equity participation in overseas projects of Japanese corporations. It also extends guarantees for loans by private-sector financial institutions and public bonds issued by governments of developing countries, as well as supports studies required to implement the above. Overseas Economic Cooperation Operations support self-reliant development efforts in developing countries, through financial assistance including ODA loans. The goal here is to provide concessionary long-term, low-interest funds necessary for the self-help efforts of developing countries, including social infrastructure development and economic stabilization. Other modes of assistance include Private-Sector Investment Finance and execution of studies required to implement the above. In recent times, ODA loans accounted for 40 per cent of Japan's official development assistance, thereby making Overseas Economic Cooperation Operations of JBIC the cornerstone of Japanese ODA policy (JBIC, 2005b).

In brief, JBIC supported projects usually go through the standard project cycle and ODA loan procedures which include project preparation, loan request, examination/appraisal and ex-ante project evaluation, exchange of notes and loan agreement, implementation, project completion/ex-post evaluation and follow-up monitoring. Special assistance could be given for project formation, for procurement management, project implementation and project sustainability. At the beginning, a developing country usually draws up medium- and long term development plans and carries out project identification for targets and strategies in these plans, together with the cooperation of JIBC; the government of the developing country then files a loan application to the Japanese government accompanied by documents in the project identification and preparatory stages. The JBIC subsequently examines the loan application documents submitted by the government of the developing country and may send a mission to the country to study economic, social, technical and environmental aspects of the project and based on the results of the appraisal conducted by JBIC, the Japanese Government makes a decision over loan provision as well as amount, terms, and conditions. The diplomatic document - Exchange of Notes (E/N) may then be signed, followed by a loan agreement between JBIC and the borrower. After implementation, JBIC conducts ex-post evaluation for the completed project and lessons learned are then fed back into the identification and preparation stage of future projects (JIBC, 2005b). This in short, is the standard project cycle of ODA loans in Japan.

9.5 Overview of Japan's Official Development Assistance (ODA)

Generally, the funds and technology that governments provide to developing countries are referred to as Official Development Assistance (ODA). ODA can be divided into four categories, namely bilateral grants, bilateral loans, technology cooperation and contributions to international organizations. Bilateral grants include technical cooperation that transfers technology to developing countries, and grant aid that provides funds to developing countries with no obligation for repayment. Most developing countries usually prefer grant aid. Technical cooperation transfers Japanese technology, skills and knowledge to developing countries in order to develop the human resources that will play a leading role in socio-economic development. It also supports the development and improvement of technology appropriate to the circumstances of a particular country while contributing to raising its level of technology and establishing new organizations and institutions. Grant aid basically involves the provision of funds for the construction of buildings like schools and hospitals, the procurement of materials and equipment for education, training and medical care and for reconstruction after disasters occur. On the other hand, bilateral loans are loans that provide the funds needed for development under long-term, low interest conditions. They can be classified firstly, into ODA loans under which funds needed for development are provided directly to the government or a government agency in a developing country; and secondly, as private-sector financing and investment under which funds are provided to Japanese companies or local companies operating in developing countries. ODA loans are generally known as “yen loans”. Yen loans previously focused on project loans for economic and social infrastructure, however, in recent times, the proportion of commodity loans targeted at improving international balance of payments and loans for intellectual support, such as for education, has increased (JICA Annual Report:2004:32).

Experience has shown that economic cooperation is a very wide concept in Japan ODA. However, the philosophy is that ODA is only just a support that augments the domestic development budgets of developing countries. ODA could indeed, be between governments once the diplomatic procedures have been followed. Usually, as we shall see later, certain guarantees are required from the recipient governments. The trend has been for Grant Financial Aid to be given by the Foreign Ministry, technical assistance by JICA and the Ministries and loans by the JIBC. JBIC could give low-interest, long term loans of only 1-2 per cent with a repayment period of 30 to 40 years (Tanimoto, 2005).

In terms of achievements, the total value of Japan’s ODA in 2003 was US $8,911.07 million, excluding aid to Central and Eastern Europe, graduate nations, and contributions to the European Bank for Reconstruction and Development (EBRD). This made Japan the world’s second largest donor, and represented 13.0 per cent of the total value of ODA, which was US$68,483.00 million provided by 22 Development Assistance Committee (DAC) member states. Japan’s ODA accounted for 0.20 per cent of its Gross National Income (GNI), placing it in the 19th position among DAC countries (JICA Annual Report, 2004:36). For Africa, JICA in fiscal 2003 provided technical cooperation worth 19.8 million yen. If grant aid (based on Exchange of Notes) is added, Japan extended support of more than 57.8 billion yen and has thus, attained the position of a major donor country for Africa. Nigeria in particular received cultural grant aid from Japan (cumulative total fiscal 1975-2004) worth 234.7 million yen. However, in response to changes in the domestic and overseas ODA environment, Japan as we saw embarked on the reform of its ODA by revising its Official Development Assistance Charter in 2003. 2004 marked fifty years of Japan’s Official Development Assistance (Statistical Research and Training Institute, 2004:131). In addition to ODA, there are also private sector companies’ direct investment and export credit, and non-profit organizations that offer grants and voluntary support to local NGOs. This is in addition to participating volunteer citizen groups, which all form part of Japan’s international cooperation.

As severally observed, the fundamental philosophy behind Japan's ODA is to "donate fishing rods, rather than fish", so that recipients could manage their daily lives themselves (Hatakeyama, 2005:2). Since this is the philosophy, a better case scenario could be made for an argument that seeks Japanese assistance in the development of the iron and steel industry in Nigeria for instance, an industry considered critical for industrialization and the eradication of mass poverty. Japan's ODA has been used to development economic infrastructure such as electricity generation, and port facilities which are indispensable for private sector participation, including foreign direct investments. This could also be extended to the iron and steel industry, in the Nigerian case.

It is heartening that Prime Minister Koizumi Junichiro of Japan decided to double the amount of ODA to Africa within the next three years, whilst the G8 leaders committed themselves to doubling the amount of ODA to Africa within the next five years from US $25 billion in 2004 (Hatakeyama, 2005:2). This notwithstanding, the thinking here is that it is time ODA donor countries like Japan begin to extend their assistance, not just to the traditional areas of cooperation, but to targeted industries necessary for the sustainable creation of employment, and reduction of poverty like the iron and steel industry.

9.6 Political and Economic Relations

Politically, relations between Nigeria and Japan could be said to be very cordial. In the eyes of the ordinary Nigerian, Japan is seen as generally positively disposed to issues affecting Africans and the developing world. Relations between Nigeria and Japan have over the years, also involved economic cooperation and cultural exchanges. These have been sustained by the mutuality of interests and the friendship of the peoples of Japan and Nigeria. Whilst there were about 2000 Japanese working in Nigeria in the1970s, the number gradually decreased over the years during the period of military rule to only a few hundreds. Nonetheless, it has been a relationship characterized by mutual respect, frankness and trust between the leaders of both countries, a relationship strengthened by the resolve to make the world a better place for all economically and culturally. The strong political ties between both countries are easily evident when one considers the frequency of visits between the various leaders and officials of both countries. Whereas Prime Minister Yoshiro Mori visited Nigeria in January 2001, President Olusegun Obasanjo within the first two years of his election visited Japan three times – April 1999, July 2000, and May 2001. Indeed, President Obasanjo was one of the first foreign leaders to visit Japan after Junichiro Koizumi assumed leadership in Japan (Obasanjo, 2001). President Obasanjo also paid another visit to Japan in October 2004 during the G8 Meeting held at Okinawa. Prior to Obasanjo's visits, H.E Yakubu Gowon, former Nigerian Head of State (1966-1975) had been invited to Japan and attended the Ceremony of the Enthronement of His Majesty the Emperor in November 1990 (MOFA, 2005). On the other hand, the government and people of Japan played a very significant role in the turbulent days preceding Nigeria's transition to democracy in 1999. This says a lot about the state of relations between both countries. It was therefore not surprising that Japan resumed its development assistance to Nigeria in vital areas like water supply, healthcare delivery, education and rural electrification.

It suffices to note, that Japan and Nigeria have a lot in common that revolves around their deep attachment to their rich cultural heritage, and also the fact that they share similar views on major international issues like the peaceful resolution of conflicts and respect for the rule of law. Just like Japan, and in line with the principles of democratization sweeping around the globe, Nigeria has not only called for the reforms of the United Nations System, in particular to make the Security Council more representative, it also believes that by all objective criteria Japan deserves a place in an enlarged Security Council. Indeed, apart from government-to-government relations between both countries, the people-to-people relations, is even more buoyant with many Nigerian intellectuals, businessmen and associated groups visiting Japan and vice-versa.

Economically, just as some other African countries, Nigeria had been a trading partner of Japan even while she was under British colonial rule. Today, Japan is a major trading partner, often offering alternatives to western goods, thinking and economics. Nigeria exported goods worth about 22.276 million yen to Japan in 1999, and imported goods worth about 28.556 million yen which included automobiles and steel products. The table below shows in summary, the state of trade relations between Japan and Nigeria from 1968 to 2002. It is quite clear that the balance of trade had been in Japan`s advantage for many years until 2002 when Nigeria had a favourable balance of trade of US$488,527,549. In 2000, the volume of trade between both countries was a little over $500 million with Nigeria having a trade deficit of about US$72,313 million (Ampiah, 2005: 564). Japan`s main export items to Nigeria include automobiles, industrial machinery, electrical machines, telecommunication equipment, steel and galvanized metals. On the other hand, Nigeria exports crude oil, gas products, cocoa, oil seeds, hides and skin and other leather products (Ampiah, 2005:565). The increase in volume of trade between both countries is a good sign of the improved economic relations between both countries. In terms of direct investment from Japan, the cumulative total fiscal between 1951 and 1998 was 48.005 million yen (MOFA, 2005).

Against the background of what many have referred to as the African condition, which is a condition predominantly characterized by poverty, conflicts and lack of technological depth, Nigeria recognizes the need for external assistance from Japan, even while acknowledging the role bad governance had played in generating this condition. This assistance is justified in a way considering that the root causes of Africa's poverty could also be traced to the impact of global economic disequilibrium manifested in globalization, the external debt burden, lack of access to capital and declining overseas development assistance

TABLE 9.0: Trade between Japan and Nigeria 1968-2002

US$ million

Year	Exports to Nigeria	Imports from Nigeria	Trade balance with Japan
1968	14.5	13	-1.4
1969	28.6	12.9	-15.7
1970	62.8	12.8	-50
1971	95.9	27.1	-68.8
1972	125.9	79.9	-46
1973	141.1	189	47.8
1974	284.6	448.8	164.1
1975	585.3	178.5	-306.7
1976	537.7	108.7	-465
1977	1,009.50	20.2	-946.2
1978	954.4	47.5	-946.9
1979	806.8	42.4	-764.4
1980	1,526.60	117.9	-1,408.70
1983	567.5	6.7	-560.7
1984	445.5	7	-438.5
1985	342	5.8	-336.1
1986	194.7	5.1	-189.5
1987	345.9	5.2	-340.7
1988	293.1	5.3	-261.4
1989	266.1	4.7	-261.4
1996	309.7	165.6	-144
1997	213.6	198.8	-15
1998	229.2	84.2	-145
1999	246	206.8	-40
2000	289.3	217.0	-72.3
2001	444.0	276.8	-167.1
2002	259.5	748.0	488.5

Sources: Kweku Ampiah, Nigeria's Fledgling Friendship with Japan: The Beginning of a "Special partnership". Figures for 1968-1999, from Japan Tariff Association. Figures from 2000-2002, from JETRO.

(Obasanjo, 2001). It is therefore, in order to attract meaningful cooperation that President Olusegun Obasanjo of Nigeria instituted several measures aimed at creating an enabling environment for local and foreign investments. Appropriate legal framework for the protection of foreign investment and the repatriation of legitimate profit has been put in place by the government. A new regime of accountability and transparency in conformity with internationally acceptable codes of business ethics, and in which corruption has zero tolerance has also been put in place and implemented to enable a more productive business environment. There are concurrently ongoing, programmes of economic reforms, political reforms, civil service reforms and banking reforms. Therefore, the rather insecure business and social environments that existed before in the country had gradually, but steadily changed. All these were aimed at making Nigeria a better business partner and a destination for FDI.

Nigeria's programme of privatization aimed at substantially disengaging government from direct participation in business has gone far with giant strides made in the privatization of telecommunications, power generation and distribution, petroleum, gas, fertilizer production, machine tool fabrication, steel and aluminum, mining and solid mineral extraction, sugar, cement production, finance and banking, hotels and tourism. The Nigerian government at this critical but opportune period in its history has therefore severally invited the Japanese investor community as friends to take advantage of the openings and avail themselves of the immense opportunities available for profitable investment. The icing on the cake also happens to be that Nigeria is positioned as the next major market of destination, a market influencing the whole of the West African region.

In conclusion, the Japanese government has been gradually increasing its activities and presence in Nigeria since the successful handover of the reigns of government to elected officials. For instance, Japan on the 19th of September 2003, rescheduled Nigeria's $3.587 billion debt owed her on repayment terms that were more favourable than those signed between Nigeria and other Paris Club members (Office of Public Communications, 2003). Also, the Damask Rural Electrification Project in Borno state of Nigeria executed through Japanese Grant-In-Aid Programme was inaugurated December 6, 2004 after its completion (Office of Public Communications, 2004a). In attendance, were President Obasanjo and the Japanese Ambassador to Nigeria, Akio Tanaka. Infact, the Japanese government donated a total sum of N625 million to the Federal Government of Nigeria in 2005, under the Japan Non-Project Grant Aid (JNGA), and revealed plans through its Ambassador to totally write off Nigeria's official debt owed her of about US $4 billion (Office of Public Communications, 2005; The Guardian, 2005). As a matter of fact, in March 2006 Japan officially cancelled a $2.1 billion (Y244 billion) debt owed her by Nigeria (Aderinokun, 2006). This was in line with the general agreement by the Paris Club of creditors in June 2005 to cancel $18 billion out of Nigeria's estimated public debt stock of about $36.2 billion. The cancellation of this debt will enable Nigeria resume normal business, trade and investment relations with Japan, which had hitherto been hindered by a backlog of debt service arrears. It should also lead to the restoration of export credit cover by the Export Credit Agencies like the JBIC and METI for Nigerian imports from Japan. As at 2005, the total assistance package to Nigeria from Japan was to the tune of US $6.87 billion (Obayuwana and Okwe, 2005), mainly in the areas of health, primary education and rural development. This was in a way, recognition of the economic and political reform efforts being made by the Obasanjo administration, and a statement to the fact that Japan was earnestly restarting its cooperation with Nigeria.

In summary, whilst Nigeria is calling on Japan for closer economic relations and cooperation in the iron and steel industry and in the development of the use of solar energy, Japan recognizes Nigeria's leadership role in Africa and the strides made in the country's reform agenda. Japan sees Nigeria as central to Africa's development, and a possible model for the rest of Africa (Office of Public Communications, 2004b). The point to be made at this juncture is that Japan and Nigeria need to further strengthen the scope and content of their economic relations beyond what exists presently. This relationship has to be extended for mutually beneficial cooperation in strategic industries like the iron and steel industry. It is mainly on the basis of the shared experiences of both countries, and the necessity to get something out of this collective experience that Nigeria should be compelled to look towards Japan with a view to building functional and collaborative cooperation in areas of mutual advantage to both countries. This will no doubt, contribute significantly to the attainment of sustainable economic growth in Nigeria.

9.7 Cooperation in the Iron and Steel Industry

This very important segment begins with an observation made by a Japanese scholar in 1981 while discussing the Japanese steel industry with respect to the internationalization of the industry:

> As in the past, there will be requests for cooperation from other countries which have increased in recent years. It would be necessary for the industry to see this inevitable course of history and to respond when the cooperation is considered effective to the economic progress of the country concerned (Toda, 1981:49).

Therefore, the importance of exploratory studies of this nature had implicitly been predicted decades ago, and should not appear impracticable. However, it is assumed that for the Japanese government to be able to extend cooperation to Nigeria in the iron and steel industry that certain institutions would have to be involved, including banks in association with the Japanese private sector, especially steelmakers. The Nigerian government had already laid the foundation for attracting Foreign Direct Investment into this industry through its various liberalization policies and allowance for concessionary agreements. This is probably why international companies like Mittals of India took advantage of the incentives to enter into concessionary arrangements with the Nigerian government on Delta Steel Company and the Ajaokuta Steel Company, including the Itakpe Iron Ore Company in the bargain as a source for raw materials. My belief is that there are still opportunities for investment in the steel sector in the country, especially in the rolling mills at Jos, Katsina and

Oshogbo and the machine tools industry. In addition, investing in this industry in Nigeria has great potentials for energizing the West African market. Moreso, as the New Partnership for Economic Development (NEPAD) is focused on developing regional infrastructure and projects that have wide impact.

A general observation however, which has often been made is that Japanese companies find it extremely difficult to commit funds to investments in countries that appeared unstable. However, while they stalled and remained cautious about investing abroad, other companies from China, India, South Korea and Taiwan move in to harness the opportunities that have been made available by the transiting economies of Africa, Eastern Europe and Asia. For instance, Chinese and Indian companies are investing substantially in many sectors in Nigeria apart from the oil and gas industry. No wonder, China was able to achieve a record growth rate of 9.65 per cent during the period 1980-1993 (Ngom, 2005), and triumphantly declared a growth rate of over 16 per cent for the year 2005 even surpassing their own expectations, while Japanese companies remained rather cautious. Take for example, POSCO, a South Korean steelmaker which signed a $12 billion deal with the Indian state of Orissa to build a mill and an iron-ore mine in 2005. This was India's largest single foreign direct investment. This deal expanded POSCO's ability to feed demand in China, and possibly America, where steel imports surged by 23 per cent in the first four months of 2005, compared with the same period in 2004 (The Economist, 2005). Also, Tata Group of India recently chose Bangladesh as the beneficiary of its largest foreign direct investment. The Mumbai-based car to steel and software conglomerate proposed investments of $2.5 - $3 billion in fertilizer, steel and power plants in the neighbouring state with which it had often had difficult relations. Tata's proposals were for a 2.4 million tonne capacity steel plant, a 1 million tonne urea unit and a 1,000MW coal-fired power plant. The fertilizer and steel units will use local gas, while the power plant will run on abundant, but still untapped coal for which Tata hopes to receive mining rights ((Khozem) Marchant, 2005). In otherwords, some investment risks could still be undertaken, when weighed against the overall objective of a state or company.

For Nigeria, the Federal Government of Nigeria and the Peoples Republic of China in October 2005 signed a contract agreement for the construction of 598 Water Schemes for 19 states in the country including the Federal Capital Territory (FCT) at a cost of 40.27 million Chinese Yen or N695 million (Taiwo, 2005). In addition, the Chinese are also discussing with the Nigerian authorities on the rehabilitation and reconstruction of the ailing Nigerian Railway Corporation (NRC). Under a subsisting understanding, the Nigerian government is to provide N130 billion ($1 billion), while the balance of N260 billion ($2 billlion) will be realized for this project as "grant loan from China" (Ebosele, 2005). Trade ties between Nigeria and China has been on the increase since 1971 and the trade volume exceeded $3 billion in 2004 alone, while Nigerian exports to China has increased sharply to about five times what it was in 2003. As at the end of September 2005, more than 100 Chinese enterprises had invested in Nigeria, with a total contractual investment of over $1 billion. Chinese companies have also taken an active part in project contracting in Nigeria. This is clearly a good evidence of South-South economic cooperation. It has often been the case that the Chinese have dared to conquer in investing abroad and in international cooperation inspite of perceived unfavourable political climate, while many Japanese companies have been rather too cautious. There is a need for Japanese companies to become more proactive with respect to investing abroad.

In general, Japanese investments in Africa are currently, not encouraging. In 1994 for example, there were only 35 projects and the total investment made by Japan was only US $346 million, almost all in South Africa. This was a significant decline from the position Japan had until the 1980s, when it had manufacturing ventures in Kenya, Nigeria and South Africa and mining ventures in countries with rich natural resources like Niger, Zaire and Nigeria. In general, Japanese business opinion identify a range of reasons for not investing more actively in the African continent including political instability, difficulties in raising capital, poor quality of labour, economic instability, difficulties in collecting information, poor transportation and communications infrastructure, government inefficiencies and corruption (Basu and Miroslinik, 2000: 66). Suffice it to say, that today many of these constraining factors have been re-dressed by the various governments in Africa. In Nigeria, for example, the government has radically improved civil governance since 1999, also improving the quality of labour, improving the transportation and communication networks and addressing corruption in the public and private sectors. However, it is important to observe that as opposed to the usual argument of political instability as a major reason for not investing abroad, studies indicate that the greater a country's natural resources, rather than the level of stability of its economy and political system, the more likely the country is to receive FDI in the future (UNCTAD, 2004). It is therefore not surprising that in Africa, South Africa and Nigeria are the only countries on the list of the top five destinations for FDI in the continent. Others include the North African countries of Egypt, Morocco and Algeria. In the global economy in existence today, there are some minimal risks which a forward-looking company has to take to benefit from the liberalization of the economies of the developing world. These countries are basically what they are called - developing countries, which goes with certain political and economic risks. But where a country like Nigeria is seen to be making stringent efforts to improve the political and business climates, then there is nothing preventing foreign investment from coming into its economy. Japanese investors are therefore called upon to invest in the growing Nigerian economy, and in particular, in the iron and steel industry.

There are ways through which the Japanese government and people could cooperate with Nigeria in the development of its iron and steel industry. The first is through attracting investments into the industry. This is because the iron and steel industry is a capital intensive industry that requires funds for its continuous operation. It is not as if no Japanese company had ever been involved in the Nigerian steel industry, only that there has been little or no impact. Kobe steel of Japan served as technical partner during the construction of the Katsina Steel Rolling Mill, and recently bided for concessions for the Delta Steel Company, though it was not successful. The expectation here is that with the assistance of the Japanese government, it may be possible for JBIC, to fund particular aspects of the revitalization of the rolling mills in Nigeria, or the Machine tools industry.

Secondly, the Japanese government could assist Nigeria move its steel industry forward through the training and retraining of experts in the industry. These should include engineers, technologists, technicians and welders. This could also be done through the use of ODA facilities. The last mass training of personnel in this industry was done over three decades ago, and most of those trained have retired, gone to the private sector, or require re-training. Quite relevant for this training to succeed is recognition of the need for a shift from just technology transfer to technology partnership, with more attention directed to education in order to build up human capacity in not only the adoption and mastery of technology, but also capacity in innovation and technology development. The modality for this sort of cooperation with the viable steel concerns could be worked out through some agreement. Indeed, it is possible for both countries to cooperate through the means of facilitating feasibility studies for investments and capacity building through the dispatch of experts to steel industries and related businesses as advisors.

Thirdly, cooperation could also be extended through encouraging Japanese steel producers to export semi-finished, special steel products and rolling technology to Nigeria. Since Nigeria has some advantage at the rolling stage of steel production with three rolling mills already on the ground, it will be to her advantage to utilize the mills while also, improving on rolling technology. In return, Japanese producers could procure relevant raw materials like iron ore, coal and rare materials from Nigeria. In addition, agreements could also be reached on the supply of modern equipment and the training component to Nigeria if requested. Technology management could also be extended to Nigeria, with special emphasis on policy, determination of plant size and introduction of new technology. Ideally, the expectation is that like any technology policy, the management cooperation should enhance the development of indigenous capability in this industry, and the efficient absorption and adaptation of the imported technology appropriate for the country and its resources.

Fourthly, since it may be difficult for private steel producers like for instance, Nippon Steel to cooperate with a “government”, as the management have a responsibility to share-holders and cannot take undue risks, the onus lies with the Nigerian government to offer a win-win cooperation arrangement in order to attract Japanese steel producers. As noted earlier on, one way the Nigerian government could do this is to encourage Japanese automakers to build plants in Nigeria. Once this is done, it is possible that Japanese steel producers will invest in the Nigerian steel industry so as to be able to supply the automobile makers with the relevant products cost-effectively. For many Japanese steel producers now, the most important market remains the domestic market, which consumes a large percentage of high-value-added steel products. Indeed, for Nippon Steel, over 70 per cent of its products are shipped within Japan; and to the BRICs countries of Brazil, Russia, India and China.

Finally, cooperation between Nigerian companies and their Japanese partners is possible if the Nigerian companies were to focus more on the down-stream sector of the steel industry. In otherwords, these companies as an option could import semi-finished products like blooms and billets for the rolling mills in Nigeria, producing such products as wire rods and bars, sections and shapes. However, since Nigeria has abundance of natural gas, it could also seek cooperation in the upper-stream by seeking technology in direct-reduction of iron ore and coal. While it is good that Mittal has taken over the management of the Delta Steel Company at Aladja, the expectation is that it should be able to turn the fortunes of the Company around by producing those products relevant for the Nigerian market. Nigeria has more need of ordinary steel for the construction industry, bridges and railways and industrial machines than the high-value products. Perhaps, Mittal Steel is better placed to ensure the delivery of ordinary steel for the Nigerian market for now. Indeed, as pointed out before, Global Infrastructure (Nigeria) Limited, managers of the Ajaokuta Steel Company is now able to supply some rolled products to the Nigerian market and also export to nearby countries, with further possibilities of extending the market to Senegal, Benin and Togo (Ezigbo, 2006). Indeed, Ajaokuta could with time establish itself as the market leader in West Africa.

While it is recognized that the institutional means of expediting a government-to-government cooperation in this industry is not clearly defined as such, the expectation is that somehow the Japanese government will find a way of using existing institutions like JICA and the Japan Bank for International Cooperation (JBIC) to channel funding and assistance towards the Nigerian iron and steel industry and facilitate the entry of Japanese private capital into the industry depending on the request. As we will see later on, this has been done in some countries by the JBIC, which could actually seek for technical support from JICA in the execution of identified projects. In 2002 for example, JBIC signed a loan agreement totaling US $14 million with Borcelik Celik Sanayii Ticaret AS, a steel mill in the Republic of Turkey. This is a private steel mill and the second largest producer of steel sheets in Turkey. JBIC provided a direct loan (buyer's credit) to finance the Japanese export of a complete set of reverse cold milling facilities to the mill. The Japanese exporter was Itochu Corporation and the domestic manufacturer Mitsubishi-Hitachi Metals Machinery (JBIC, 2002). Also in 2003, JBIC signed loan agreements totaling US $39 million with Companhia Siderurgica de Tubarao (CST), which operates steel mills in the Federated Republic of Brazil. JBIC provided direct loans (buyer's credits) to CST, which is located in the Espirito Santo State, to financially support exports from Japan, including exporting the complete equipment for a steam power plant and an LD gas recovery system to CST (JBIC, 2003). Buyer's credit is a form of trade credit extended to a foreign importer or financial institution to finance the imports of Japanese equipment or technology.

As against this practice, ODA loans are provided based on the Exchange of Notes between the Japanese Government and recipient countries. For Japan, ODA loans operations have predominantly focused on the Asian region, though it has also extended assistance to other regions of the world. A case is now being made in this study for an expansion of JBIC assistance to the Africa region for very good reasons, the most important being the increasing interdependent nature of the global economy and Japan's need for access to natural resources like oil, gas and iron ore to power its key industries in a more cost-effective manner. In accessing these resources, what comes into play, is a mix of politics and economics, anchored on cultural and economic diplomacy. Already, Japan has done very well on its cultural diplomacy beginning from the 1960s, and will do well to build upon this by enhancing its economic goals through political sagacity. An economic move towards Africa and its abundant natural resources, where it already has immense goodwill will be in its own interest. JBIC's Memorandum of Understanding with the United Nations Development Programme (UNDP) towards achieving the Millennium Development Goals (MDGs) is a step in the right direction and can only increase Japan's goodwill in the developing world.

For now, most of Japan's economic cooperation activities appear centered in the North African states of Egypt, Algeria and Tunisia. JBIC provided an ODA loan totaling ¥5.73 billion for the Borg El Arab International Airport Modernization Project located around 40 kilometers southwest of Alexandria. It also signed a framework agreement with Sonatrach, an Algerian state-owned hydrocarbon company on buyer's credit in July 2004. Under this loan agreement, JBIC will be able to extend buyer's credit expeditiously to Sonatrach once Japanese firms obtain machinery and equipment orders from it (JBIC, 2005a:55). Whilst JBIC already has representative offices in Cairo, Egypt which is in North Africa and Nairobi, Kenya in East Africa, it is suggested that there is a need for such an office in Lagos or Abuja to oversee what will undoubtedly be significant economic cooperation arrangements between Nigeria and Japan in the very near future.

In the case of cooperation with Nigeria in the iron and steel industry, though many of the steel projects in the country are old or have had long gestation periods, it is fairly common knowledge that steel development is usually not only an expensive process, but often subject to time overlap. Inspite of these, governments still pay attention to this industry and support it as a result of its importance for the industrialization of any country. For instance, the construction cost of the Pohang Iron and Steel Plant in Korea, with blast furnace in the range of 8.50 million tonnes yearly production was estimated at US$3.6 billion (using input prices substantially lower than those in the world market), while the length of the construction period was ten years (IDE, 1982:221). The experience from Asia with respect to the development of this industry showed that in many cases, even after the steel factories commenced operations, the government continued to render support for a certain period of time through providing long term low-interest credit for working capital, discounts of public service fees (railway transport fees, water charge, harbour charge, electric charge etc.), reduction or exemption of corporate tax (income tax), subsidies for industrial research or technical training, and various export promotion policies (IDE,1982:220). As severally insinuated all through this study, for Nigeria, the development of this industry will ensure the supply of iron and steel products for use in the construction of basic infrastructure like harbors, roads, railway, electric power plants, and factories on the one hand, as well as for use as raw materials in other industries like the shipbuilding industry, transportation machinery, agricultural machinery, industrial machinery, and electric machinery. Indeed, the importance of this industry and the necessity to extend cooperation to it by Japanese business cannot be overemphasized for a country upon which the international community looks upon to uplift Africa from its economic doldrums and poverty. The presence of abundant oil and gas resources, iron ore and coal deposits and the expected mechanization of the country's agriculture and re-building of aging infrastructure, especially the railways make Nigeria an attractive destination for economic and technical cooperation in the iron and steel industry.

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10. Conclusion

This study began with the assertion that the iron and steel industry is crucial for the industrialization and development of any economy. We have now seen that this is true to a large extent judging from the development and growth of the Japanese steel industry from about 1857 to the present. The Japanese economy could not have been able to finance and support the comparatively high standard of infrastructure development and standard of living in the Japanese society had it not been for the initial investments in the development of the iron and steel industry. However, it is generally important to note that while improvement in infrastructure provides the environment for economic activity, it is only an input to development not development itself, which occurs only when the people engage actively in productive economic ventures. This was the case with Japan, seen as a late industrializing country, but which amazed the world with the speed of its industrialization borne out of the ingenuity of its people who were ready to learn and apply the knowledge and technologies of the West for its industrial growth. As we have seen, to be able to do this, the iron and steel industry was identified as critical and subsequently given all the necessary support to develop and eventually compete internationally. On the other hand, for the developing countries of the world like Nigeria, it is increasingly obvious to those of critical reasoning that the poor development and application of technology for societal uses, of which iron and steel technology is basic, is one of the major hindrances to industrialization and development. In this study, exploring the potentials and possibilities for cooperation between Japan and Nigeria in the iron and steel was therefore, one way of concretely suggesting how Nigeria's industrialization and the industrialization of the West African sub-region could be speeded up. Permit me the leisure of this exploration, but as it were, it was an exploration based on historical facts as well economic and political realities and permutations.

For Nigeria and indeed, several countries of the developing world, there are many lessons that could be learned from the Japanese experience in the development of its iron and steel industry as follows:

- Human resource anchored on devotion and determination is the key to technology acquisition, mastery and innovation.
- Certain minimum level of indigenous skills and knowledge is necessary for the development of scientific and technological goods.
- State intervention and support is critical at particular periods in the development of the iron and steel industry, especially the provision of initial capital, industry infrastructure and mechanisms to ensure viable domestic demand of products.
- As is natural, there will be periods of failures and successes in the development of the appropriate technology; the point is to remain focused.
- The private sector must be made part and parcel of the growth of this industry.

Technology choices, plant size, raw materials sources, markets and management style are all important factors to ensure successful operations.

- Internationalization of the industry requires government support and some specialization in the supply of certain products.
- International cooperation, partnerships and mergers are all necessary for more efficient operations.

However, it is enough to observe that since Nigeria is generally speaking still at the early stages of industrialization, the development of indigenous capacity in this industry including the raw materials component is critical in any cooperation arrangement. Here, education is essential for technology acquisition, development and innovation. As recognized from the Second Tokyo International Conference on African Development (TICAD-II), high literacy rates and skills were key underpinnings of Asia's development successes. The onus therefore, lies with the Nigerian government to design an educational system in which, there is not only a turnover of qualified individuals but also one in which, there is a relationship between the products from this system and the human capital base needed for the economy and the iron and industry in particular. The teaching of technical subjects and the training and re-training of the teachers themselves should be taken very seriously if the country is to achieve the necessary technological capacity for sustainable industrialization. Nigerian policy planners should take an inventory of the human resources available to the iron and steel industry, in order to identity its strengths and shortages and suggest training programmes necessary to reinvigorate the industry. There is also an urgent need to strategically promote industrial and corporate linkages, especially as this relates to research and development activities. The various research institutes in the country need to be more closely allied to the Small and Medium Scale Enterprises (SMEs), while the government should tilt the manufacturing industry more towards the capital goods' market as a way of encouraging productive activities.

The rationalization of the iron and steel investments in Nigeria by the government is a policy option that could not be delayed any more. Apart from revitalizing those investments that could produce steel in a cost-effective manner like the Delta Steel Company, the option of recapitalizing and revitalizing the rolling mills to operate with imported semi-products from Japan and elsewhere is a real alternate to erecting new plants which is usually expensive to do. Rather than erecting new plants, a careful study of the requirements of the Nigerian economy, and the market demand for iron and steel products would help determine the capacity and types of steel required from the domestic producers and what needs to be imported from outside for energizing Nigeria's industrialization. Indeed, this exercise could also be carried out for the West African sub-region since it will serve as a catchment area for steel products from Nigeria. The implications of a vibrant Nigerian iron and steel industry for the Nigerian and West African markets cannot be over-emphasized. For one, it will not only contribute to employment generation, but invariably impact positively on poverty reduction in the sub-region.

The international political economy of iron and steel is now visibly manifesting in the globalization of the industry, with many of the key players jostling for lucrative mergers and access to raw materials sources. In recent times, Mittal Steel and Arcelor have been proactive in seeking to expand their business activities. There are two possible effects of this on Africa and the South countries – the first is that countries seeking to modernize or expand their steel industries will benefit from the competition for acquisitions at the global level as the major players scheme to outbid each other. Mittal's recent incursion into the Nigerian steel industry with its investment in Ajaokuta and Delta Steel Companies is a case in point. Infact, steelmakers in Algeria and South Africa which together produce over 60 per cent of steel in Africa are now under the Mittal Steel Group. Africa's total crude steel production is presently in the range of about 17 million tonnes, with South Africa producing 9.5m/tonnes and Egypt 4.8m/tonnes per annum, while Algeria and Libya produce about 1m/tonne each. Nigeria, which hitherto could not be mentioned at all in this league, has recently improved on its production of iron and steel, though still insignificant compared to the leading producers in Africa. The second impact of this is that with the attention of the major players riveted on seeking sources of raw materials and lucrative markets, South countries who do not posses any of these may actually loose out completely in the ongoing globalization as more and more resources get committed to those areas of strategic interest. Fortunately, Nigeria has rather benefited from this global agglomeration of steel companies and sources of raw materials, especially since it included the Nigerian iron Ore Mining Company (NIOMCO) in the investment package.

For the moment, it appears that Japanese steel producers are oblivious to the developments in the steel industry in Nigeria, except for the export of limited amounts of high-grade steel to the country. This maybe because the world-wide demand for steel is presently high, especially in China and East Asia where it has comparative advantage. But were the Chinese economy and its amazingly rapid industrial growth to take a nosedive, demands for inputs and exports of steel products to China would be affected in the same magnitude. Indeed, there is a fear that with the increasing capacity of Chinese steel producers, enhanced also through mergers, exports from China to other markets could jeopardize the existing markets for Japanese steel exports. It is therefore imperative that Japanese producers diversify their markets and partnerships away from China and East Asia to other potential sources of raw materials and markets in preparation for downturns in their traditional markets.

As noted, Nigeria and Japan have very cordial political and economic relations, and there is indeed, no reason why Japanese companies should not feel safe to invest in the Nigerian economy, and in particular in the iron and steel industry. Infact, relations between both countries is increasing in all fields, and strategically also, in respect to global politics.

This relationship should be translated into economic partnerships that would benefit both countries. Since, Nigeria is at the historical juncture of implementing economic, social and political reforms, akin to a revolution that would benefit its people and re-position the country amongst the comity of nations, Japan will do well to be associated with this through also participating in the ongoing privatization of the iron and steel industry in the country. Japan's benign cultural and political diplomacy, evident in the goodwill it has cultivated in Africa and elsewhere, should be augmented with the exportation of its economic experience and resources. If it decides to do this in Nigeria, through mutually beneficial cooperation in the iron and steel industry, it would ultimately have touched the lives of millions of people in the sub-region of West Africa and beyond.

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