

# Scientific Models that Initiate the Journey to Industrialization and Sustainable Development in Nigeria

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**Abstract** This paper studied the lessons from history on how some of the developed countries in the world began their journey to industrialization. It identifies the various steps to industrialization which includes learning (man power training and education), employment in quantity and quality. Increase productivity through group work and mechanization processes (industrialization). It also examines the relevant policies that can aid industrialization; this brings the government into the picture as it is the role of government to bring about these policies. The policy lead to programmes, projects and activities. The journey to industrialization starts with desire to achieve industrialization, driven by the gains that come with it. Developing the factors that initiate sustainable industrialization, the industrial core which includes the internal and external core and a check put in place to measure the sustainable economic development. In conclusion, we observe that the greatest challenge facing the industrialization in developing nations is limited knowledge and inability of the people to create new innovations. However, the first step to fight this scourge is acquiring knowledge especially in the area of science and technology and using this knowledge for technological innovations that will in turn better the society.

**Keywords** Industrialization, Technological Learning, Manpower and Sustainable Development

## 1. Introduction

The importance of history is to enable one make decisive judgements and draw conclusions today based on yesterday's events. It may be said that history is to the human race, as memory is to each man. It sheds the light of the past upon the present, thus helping one to understand oneself, by making one acquainted with other people's history.

History is indeed, "a bridge connecting the past with the present and pointing the road to the future". Many people and societies operate without any sense of history. Consequently, most men have been thinking and doing things as if the world began today. The lack of regards and consultation of history has led to man's low sense of history, which makes man to continue to repeat his mistakes and suffer avoidable pains (Ogbimi, 2010).

### 1.1. Lessons from History on Industrialization

History shows that Britain and France spent 2000 years before achieving modern industrialization (Carrington and Jackson, 1954). But the positive changes which characterized the later stages of their evolutionary development voyage are

worthy of note. Most pre-industrial European economies had standards of living not much above subsistence (as it is the case in Nigeria, today) among majority of the population. For example, in medieval Europe, as much as 80% of the labour force was employed in subsistence agriculture (Wikipedia, 2012). Poverty increased, population increased and crime escalated; during the reign of Henry VIII, it was estimated that as many as 72,000 people were executed for criminal offences (Randa, 1997).

In the eighteenth and nineteenth centuries, the United Kingdom experienced a massive increase in agricultural productivity due to the mechanization of agricultural processes known as the British Agricultural Revolution. This enabled an unprecedented population growth, freeing a significant percentage of the workforce from farming and helping to drive the Industrial Revolution. Demand for more machinery and steel works were increasing, job opportunities also began to increase (Collette, 2011). The overwhelming efficiency of mechanized farming made the increased population not mainly dedicated to agriculture but involved in various industrial works. This improved productivity in various sectors and the process of production was divided into simple tasks, each one of them being gradually mechanized in order to boost productivity and thus increase income. The application of new technologies enabled the industrialization process to continue to evolve. A ship-building yard and engineering works were established

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in 1938 and the corset iron company started a steelworks in 1939 and the ability of the economy to absorb labour increased (Pickard, 1982). France, Germany, Sweden and other European nations had similar experiences.

Singapore also faced the same experience. The most feasible solution to Singapore's unemployment and low economic development was to embark on a bold and comprehensive program of industrialization. Labor-intensive industries were a prime target. However, industrialization was a relatively new experience to Singapore. Singapore had no industrial tradition; self-employment had historically been active in trading and commercial activities. The majority of its working population was in trade, processing and service activities (Goh, 1963).

Besides being an investment promotion agency and working with other relevant government agencies, the Economic Development Board (EDB) of Singapore invested in necessary manpower development, skills and technologies. In 1971, the EDB established an Overseas Training Program for Singapore workforce training in industrialized countries and subsequently, technology and design training institutions in Singapore and other foreign countries. Additionally, the EDB administers the Skills Development Fund to encourage the right kind of manpower training and promotes the opportunity for the trained to apply the acquired knowledge.

The development of a highly educated and flexible workforce is very important, and Singapore has been cultivating its human capital by building a wide pool of skilled knowledge workers. The result of all these developments is rapid economic growth and full employment.

Singapore's industrial base was restructured and emphasis was on expanding R&D and high technology industries (Yuen, 1992). Product diversification is a crucial factor in enhancing sustained export performance and growth. Two engines of economic growth: manufacturing and services, have been identified in Singapore's industrial restructuring process.

This was also the case with America. American colonies gained independence in 1783 just as profound changes in industrial production and coordination were beginning to shift production from artisans to factories. The American Industrial Revolution (1820-1870) was of great importance to the economic development of the United States. The Industrial Revolution itself refers to a change from hand and home production to machine and factory.

The people living in the Pacific Northwest built wooden houses, used nets and weirs to catch fish, and practiced food preservation although substantial agriculture was not developed (Cowan, 1997). Throughout the colonies, people lived primarily on small farms and were self-sufficient. In the few small cities and among the larger plantations of south Carolina and Virginia, some necessities and virtually all luxuries were imported in return for tobacco, rice, and indigo exports (Edwin, 1988).

American industrialization was facilitated by a unique confluence of geographical, social, and economic factors.

The real impetus for America entering the Industrial Revolution was the passage of the Embargo Act of 1807 and the War of 1812. Americans were upset over an incident with the *Chesapeake* whereby the British opened fire when they were not allowed to search the ship. They also seized four men and hung one for desertion. This resulted in much public outrage and the passage of the Embargo Act which stopped the export of American goods and effectively ended the import of goods from other nations. Eventually, America went to war with Great Britain in 1812. The war made it apparent that America needed a better transportation system and more economic independence. Therefore, manufacturing began to expand and employment began to boom (Kelly, 2012). This resulted in an increase in productivity and increased ability of the nation to absorb labour.

Small local industries emerged as the colonies grew, such as sawmills and gristmills, standard of living were generally high (Greene and Pole, 2004). However, the populations of these peoples were small and their rate of technological change was very low (Cowan, 1997). By then, even the American children worked in large numbers in mines, glass factories, textiles, agriculture, canneries, home industries, and as newsboys, messengers, bootblacks, and peddlers.

Industrialization is characterized with rapid economic growth (usually export-oriented) where the growth of manufacturing concerns and factories can draw many thousands of labourers. Also, having large national corporations operating in several continents is a character of industrialized nations. Various steps to industrialization were noted in the study of the historical facts of industrialized nations;

1. Learning; Manpower training and education
2. Employment in quantity and quality
3. Increase productivity through group work
4. Mechanizing production processes (Industrialization)

Rapidly growing economies demand employment of all categories, while stagnating economies experience mass unemployment; Unemployment, as such is a critical symptom of stagnation (the disease). Hence, promoting sustainable economic growth, competence-building (Learning) and rapid industrialization is the solution to mass unemployment and poverty in any society.

The Miracle on the Han River is a term used to refer to South Korea's postwar export – fueled economic growth, including rapid industrialization, technological achievement, education boom, large rise in living standards, rapid urbanization, skyscraper boom, modernization, successful hosting of the 1988 summer Olympics and co-existing of the 2002 FIFA world cup. This growth was accompanied by a democratization and globalization that transformed the country from the destruction of the Korean War to a wealthy and developed country with a globally influential economy and prominent multinational conglomerates such as Samsung, LG and Hyundai-Kia (Hyun-kyung, 2009).

The paper employed scientific conceptual modelling methods to suggest appropriate ways to promote sustainable economic development and growth.

## 1.2. Sustainable Industrialization and Development

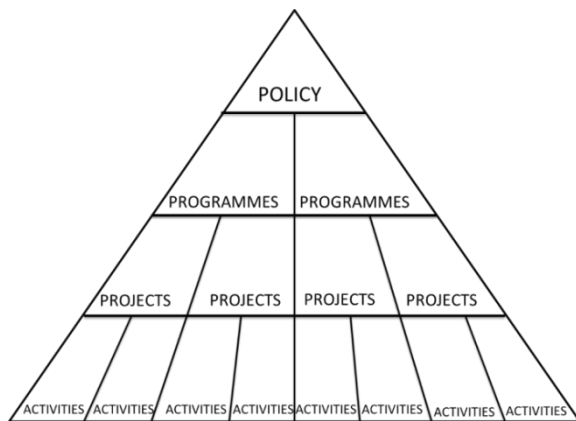
Sustainable Economic Growth, Industrialization and Development (SEGID) are achieved through learning. The value of the learning-man appreciates in a compound fashion with learning intensity and time (Ogbimi, 2005). This in turn creates relatively permanent changes in knowledge, skills and other behaviours (Klausmeier, 1985).

Learning includes both education and training. Ehiemetalor (1988) suggests that a distinction between education and training is very important to successful manpower planning. The emphasis in education is on the acquisition of theoretical knowledge and the development of basic mental capabilities and general knowledge that is broad. The essence of education is in developing trained minds (Nduka, 1997).

Coombs (1973) however, defines training as a scheme designed to generate expertise or skills needed to perform a particular job or series of jobs. Nigeria's planning has always lacked growth elements. That explains why Nigeria has been announcing growth without development (GWD) since 1999. That is probably why Nigeria is a failing nation, the Nigerian policy for curbing mass unemployment has not been effective. That may be responsible for rising unemployment rate and currently it has risen over 30% and the youth unemployment is over 50%. This may be due to the lack of knowledge on proper policy formulation.

## 1.3. Science and Technology Policy

Policy is a guide to thinking and action (Ogbimi and Adjebeng-Asem, 1994); policy guides every thought processes and activities undertaken in a society.



**Figure 1.** Policy Pyramid. *Source: Field Survey, 2013*

Technology policy is “systematically stimulating technical progress, i.e. enhancing the skills, knowledge and procedures applied in the production of goods and services (Ahrens, 1999). The consensus that emerged out of this phase was that developing countries need some degree of “technological capability” if they were to be successful in choosing, adapting, and making incremental improvements in technology. It was also emphasized that (often irreversible) investments are needed in building such technological capability, and that policy actions have an important role to

play in the process (Chang and Cheema, 1999).

Figure 1, represents the policy pyramid. The policy pyramid further defines and explains the methodology and flow of policies through to the activities stage. The policy pyramid makes it clear that every activity in the economy should be connected to the policies guiding that economy. Therefore every project and programme being implemented in the economy should be geared towards actualizing a policy statement.

## 2. Models for Industrialization

Discussing the journey to industrialization requires an emphasis on the desire to achieve industrialization. This models represented in this book would have no effect if there is an absence of desire. The nation must realize that attaining industrialization transforms the economy from a dependent state to an independent state, even further more to an interdependent state.

Real growth and development cannot take place over night; the price must be paid over an extended period of time to reap the benefits of these models.

Below are models that offer more insight on the concept of industrialization, models that guide developing nations on the path to industrialization and models that transform individuals to become active creators, learned and productive.

### 2.1. Factors that Initiate Sustainable Industrialization

However, it was observed that a nation which hopes to manufacture many products must develop the people to manufacture them. These people developed are referred to the nation's workforce or manpower. Developing nations, African nations in particular, need to set up a framework for training university graduates in a curriculum-based scheme for 3 – 4 years, so as to acquire the skills for modernizing their traditional activities and for studying, servicing, maintaining, and duplicating, and eventually improving upon the things they import today.

Nigeria and other African nations need to give opportunities to the science and engineering graduates to input the theories they acquire in universities into their artisan-agriculture; artisan/craft activities

Productivity increases as the developed manpower are employed into productive activities, this in turn creates more room for employment, and as they continually involve themselves in productive activities, inventions/innovations sprout out and these inventions/innovations form the basis for new knowledge.

### 2.2. The Industrial Core

The industrial core consists of simple parameters that must not be overlooked. This model explains the components that make up the industrial core. The industrial core is made up of two layers: the INTERNAL CORE and the EXTERNAL CORE as shown in Figure 2.

The internal core consists of the primary industry, secondary industry and tertiary industries. The primary industry is also known as the extractive industry because it deals with the extensive extraction of natural resources without provision for their renewal. The primary industry is key and fundamental for the effective existence of both the secondary and tertiary industry.

The secondary industry is also known as the manufacturing industry because it deals with the process of converting raw materials, components or parts using machinery, into finished goods that meet a customer's expectation or specifications.

The tertiary industry is also known as the service industry because it serves other industries. This basically refers to the intangible products that are important to the primary and secondary industries.

The external core however constitutes the decisive environment. The percentage utilization of libraries, educational centres, information technology centres, scientific research findings, cultural uniqueness of the citizens and the integration of all these in government policies, go a long way to determine the kind of industries, the level of industrialization and the growth prospects

available. The primary industry must be fully developed to a point to allow for efficient and effective growth of both the secondary and tertiary industry.

### 2.3. Three True Measures of Sustainable Economic Development

From history we can deduce that there are three-true measures of sustainable economic development: The level of technological knowledge, the level of industrialization and the level of national productivity. These three-true measures are intertwined.

An increase in the level of technological knowledge through learning spurs increased national productivity through employment (application of technical knowledge), more industries would be erected to absorb the knowledge and increase productivity to meet up with higher demands and exportation. The cycle continues, the economy is experiencing sustainable growth, development and industrialization sets in. industrialization is the extensive organization of an economy for the purpose of manufacturing (Sheffrin, 2003). This initiates a period of social and economic change that transforms a human group from an agrarian society into an industrial one.

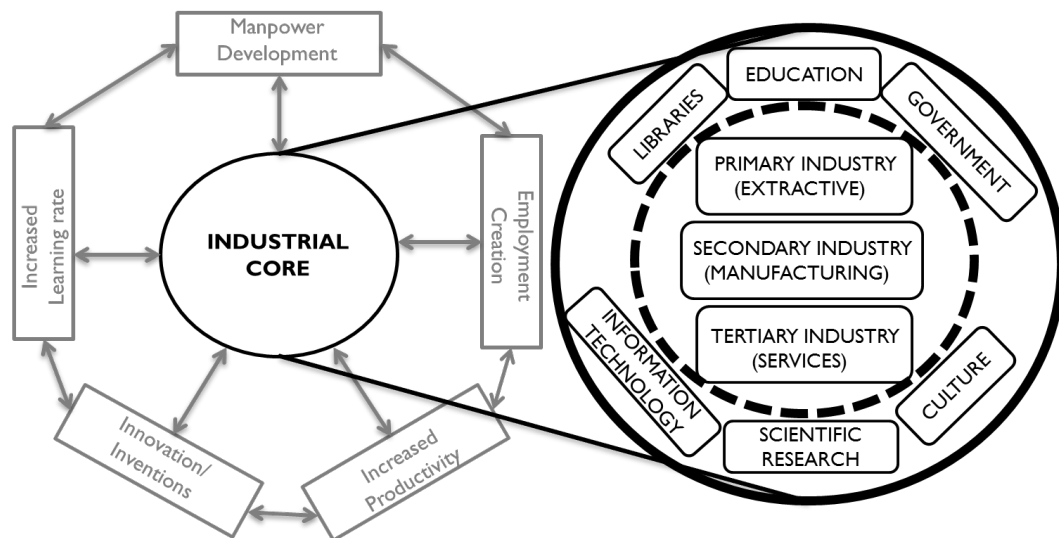


Figure 2. Components of the Industrial core. Source: Field Survey, 2012

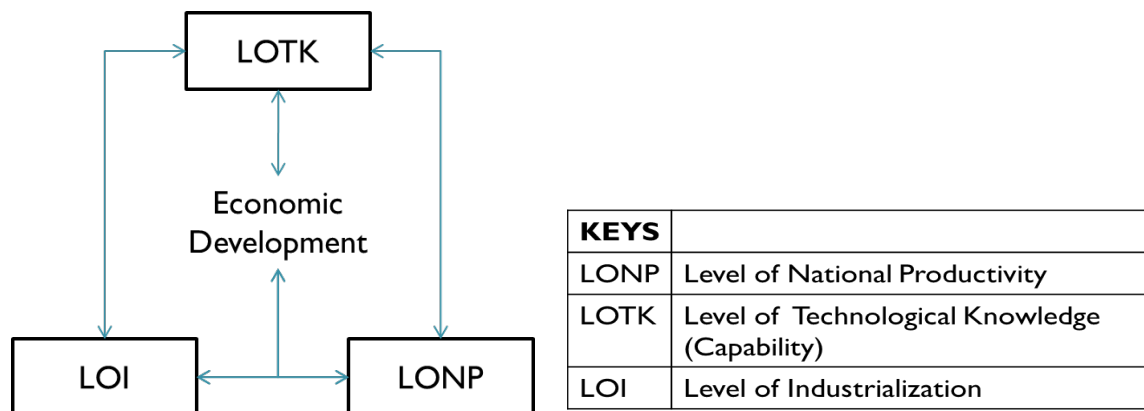


Figure 3. The Three True measures of Economic Development. Source: Field Survey, 2012

## 2.4. Development Flow Chart

Looking at the accounts of developed countries on how they became industrialized. We can identify various stages that promoted and sustain their industrialization process. The stages are; Preparation, Learning, Productivity and Networking of scientific ideas.

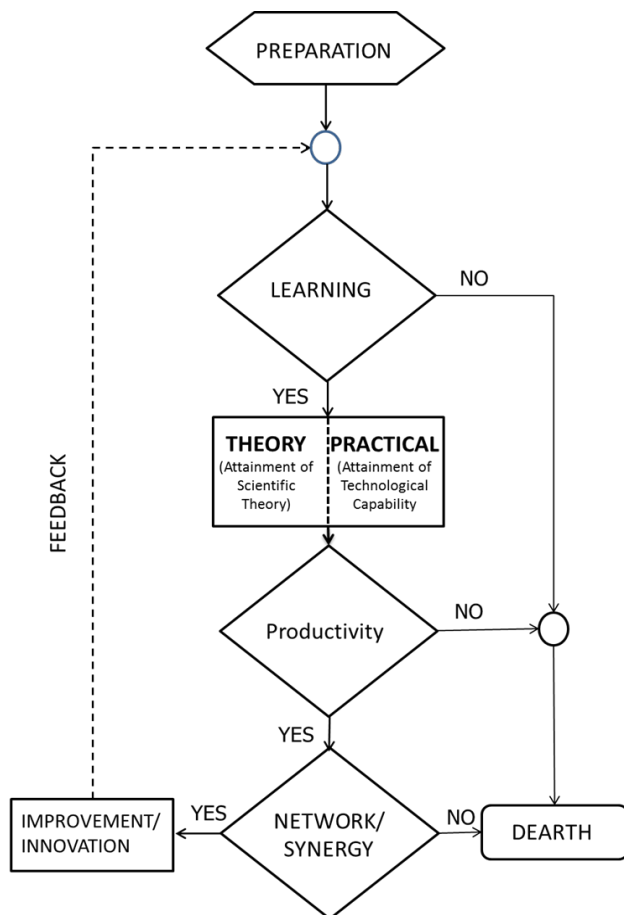


Figure 4. Development Flowchart. Source: Field Survey, 2012

The flow chart stresses the importance of Preparation; although, the industrialization process of the United Kingdom lacked preparation. Industrialization began out of curiosity and this curiosity driven industrialization lasted for a long time before actualization. History shows that Britain and France spent 2000 years before achieving modern industrialization (Carrington and Jackson, 1954), but studying other countries like America, Singapore and the Newly Industrialized Countries (NIC) we see the element of planning and preparation and industrialization was achieved in less than 50 years. The developed countries had to prepare for development hence the decision for industrialization.

The Development Flow Chart systematically integrates all these stages to present a simple and clear representation of the process which would attain sustainable development and industrialization.

If a nation or an individual intends to develop based on the Development Flow Chart also known as “YOUNG’s MODEL” they must first prepare themselves for development. The nation or individual needs to learn how to

get that which is desired. They have to understand the theories surrounding it and how to practically carry it out. The first attempt may not be that good; they can consult or meet colleagues for the purpose of improvement. Any man or nation that follows this path is on the right path towards development. If not, it is dearth.

## 3. Conclusions

In most of these developing countries, the system of colonialism and the process of colonization carried with it the dehumanizing element of fostering dependency and robbing individuals of the essential aspect of creative development. This debilitating system also provides its subjects with basic training for service but not for productivity.

In essence, they were taught how to grow sugarcane, but not how to make sugar; they were taught how to grow cotton but not how to make cloth. They were taught how to sell but not how to produce what they sell. They were taught commerce and not the science of productivity.

As technologies become more complex, the role of science and technology education in the creation of new innovations becomes ever more important because technological breakthroughs depend on the understanding of technology. The greatest challenge facing the industrial process in developing nations is the limited knowledge and ability of its people to create new innovations. Failure to continuously strengthen our knowledge base will result in a declining ability to provide for the wants and needs of our people. When increased productivity is viewed as a generator of wealth, the importance of innovation is clear. Employment in many industries will bloom as productivity increases, and indirect employment can be expected to follow suit.

In developing countries, moves towards industrialization are scarce and hesitant. This is mainly due to the copy and paste policy syndrome from industrialized nations by developing nations, without knowledge that industrialization change has no general policy prescriptions and therefore industrial policies should be tailored to the capabilities of the particular country with the more selective policies requiring the highest levels of capabilities.

Certain challenges can be identified, but these two; limited knowledge and knowledge acquisition processes, and the poor policy formulation process are the root cause of all our problems. These two challenges are associated with our thinking process and it’s been proven that our actions are fruits of thoughts. These challenges which when tackled would ensure a smooth journey to industrialization for developing nations.

## 4. Recommendations

In order to attain the industrial state a nation must possess certain qualities. These qualities include; economic activities

spurred by increased manpower in manufacturing and industry; increased economic output spurred by large productivity in manufacturing and industry; national organization spurred by a stable system that works and sincerely transparent politics; mechanization spurred by the use of machines in enhancing production process; and technology spurred by increased registered patents and industrial designs.

These activities lead to increased employment opportunities, increased wage and salary per employee, increased standard of living both human welfare and quality of life, and the value and standard of goods increase.

Until this stage is attained, developing countries may be classified as non-industrialized nation. Just as Bob Moawad said, “the best day of your life is the one on which you decide your life is your own. This is the day your life really begins.”

Nigeria should embark on a massive reorientation program to enlighten the citizens on their self-worth and the importance of their confidence in developing the skills, intelligence and sophistication necessary to attain the nation’s goals. This would act as a reinforcement for industrial revolution.

Nigeria should setup policies that promote sustainable development and enforce all activities, projects and programmes employed in the economy should portray or actualize the set policy.

Nigeria should ensure an adequate learning system that promotes education (Scientific Theory) and training (Practical Knowledge) for productivity.

Nigeria should resuscitate failing industries and promote the emergence of new industries in all sectors of the economy in order to enhance productivity, curb mass unemployment and become an industrialized nation.

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