

Human Capacity Building in Manufacturing Sector: A Factor to Industrial Growth in Nigeria

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Abstract—Human ability is a major source of constraint to manufacturing industries in Nigeria. This paper therefore, discusses the importance of human influences on manufacturing and consequently to industrialization and National development. In this paper, the development of manufacturing was anchored on two main factors; Infrastructural Capacity Development (ICD) and Human Capacity Development (HCD). However, a wider view was given to the HCD and the various contemporary human capacity issues militating against manufacturing in Nigeria. It went further to discuss various ways of acquiring and upgrading workers' skills and finally, suggestions were made on how to tackle the onerous human capacity issues in manufacturing.

Keywords—Manufacturing, Human, Capacity, Development, Innovation.

I. INTRODUCTION

CAPACITY is the ability of individuals, institutions and societies to perform functions, solve problems, and set and achieve objectives in a sustainable manner. Capacity Development (CD) is, therefore, the process through which the abilities to do so are obtained, strengthened, adapted and maintained over time [1]

Organisation for Economic Co-operation and Development, OECD, uses a slightly different definition: Capacity is the ability of people, organisations and society as a whole to manage their affairs successfully. Human Capacity Building is the “process of equipping individuals with the understanding, skills, and access to information, knowledge, and training that enables them to perform effectively” in an informed society [2].

Berg (1993) elaborates on this definition to highlight three main activities [3]:

- Organization strengthening: the process of institutional development
- Procedural improvements: general functional changes or system reforms
- Skill enhancement: general education, and professional deepening in crosscutting skills

For socio-economic development of any country, a strong Industrial base is desirable. The natural resources need to be

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developed and utilized both as input to industrial production and as direct products for the social wellbeing of the citizenry. Since Nigeria's Independence in 1960, industrialization has been recognized as one of the critical factors to the economic transformation of the country. To achieve the desired result, Government had, for the past two and half decades, focused on her industrial policy mainly on the promotion and establishment of large-scale industries (LSIs) in pursuance of import substitution process. The promotion of Small and Medium Industries (SMIs), on the other hand, received relatively low direct Government investment, and was left to the initiatives of the private entrepreneur [4]

In Nigeria today, industries, particularly small and medium-sized manufacturing industries (SMIs), operate under various harsh conditions and constraints, which stand on the way to the achievement of organisational goals. There are, for example, high cost and shortage of raw materials, inadequate fund, inability to recruit competent staff etc. Ad hoc studies conducted during 1989 indicated that, on the average, there was little rise in productivity [5]. In Oshoba's study (1989) on food and basic metal industries, only 30 per cent of respondents indicated they had rising productivity [6]. About 11 per cent recorded no growth, while more than half, 57%, recorded declining productivity levels. In the same vein, the Manufacturers Association of Nigeria (MAN) confirmed that the general trend in productivity in industry was negative in 1989. Indications are that the situation has worsened since then [7].

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 [8]. Manufacturability of a country is a measure of industrialisation of that country. In other words, Manufacturability of a country is directly proportional to the development of a given country. Manufacturing is the support that drives every other sector of the economy. It is therefore, a cornerstone of a healthy economy [9]

Nigeria under development today is as a result of her inability to develop manufacturing sector to meet global standard. This negative development is anchored on:

- i. Manufacturing Infrastructural Development and
- ii. Human Capacity Development in Manufacturing

These two critical factors must be developed simultaneously and consciously if the desired goal is to be achieved. Take a closer look at the developed countries of the world today, virtually everything can be manufactured. Again focus your attention on the under developed ones, it seems that nothing is

possible. The separator here is the level of manufacture of these two categories.

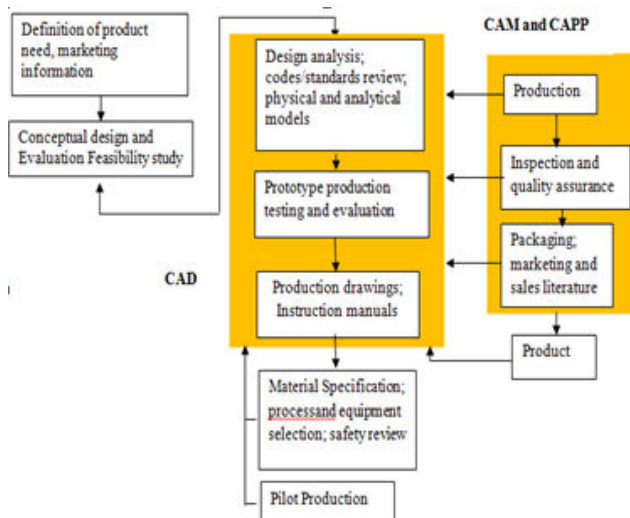


Fig. 1 A Model of Modern Manufacturing

What is manufacturing? Manufacturing is derived from Latin words 'Manu Factus' meaning 'made by hand'. Manufacturing has been defined as 'a Well-organized method of converting raw material to end product' [10]. The most challenging of manufacturing is the global competition that involve in it. This has made the dynamism in manufacturing unpredictable; posing more and more challenges to developing nation like Nigeria. For a product to meet acceptable standards and compete globally, a good manufacturing system must be put in place. Due to global influences, modern manufacturing systems take the steps shown in Fig. 1.

II. REQUIREMENTS OF A GOOD MANUFACTURING SYSTEM

- Product should meet design requirement
- Economical Process
- Quality should be built into the system
- Should be flexible and responsive to new technology
- High productivity: Best utilization of man, material, machine, capital and available resources.

III. MANUFACTURING SYSTEM IN NIGERIA

Mineral resources are important to national economy and are yardstick to predict the economic growth of a country. This is because Mineral consumption is an indicator of industrial development of a particular area. Minerals are directly or indirectly basic raw materials for strategic industries. Most agricultural produce that are sold in formal markets requires post-harvest processing operations. The market for processing machines therefore is of significant economic importance and offers great opportunities for local companies which specialize in the fabrication of agro-allied machinery (both "pre" and "post" harvest machines); and their existence and operations are pivotal to the overall success of the country to become an industrialized nation [11].

The country's economy dwindles because of her inability to manufacture caused by over dependence on petroleum. Nature has so blessed Nigeria that every region has one or more natural endowment either agricultural based or mineral based. These endowments remain economically useless (with exception of few) unless economic values are added to them. The addition of economic values to these nature-given items is through manufacturing. Capacity constraints in manufacturing, due to poor state of core manufacturing infrastructure and human capacity issues are the critical factors threatening the economic take-off and its sustainability in Nigeria [9]. Manufacturing capacity in Nigeria is highly inadequate. This has rendered the endowments useless or taken away from us cheaply by foreigners, and this has contributed reasonably to the various issues we have in Nigeria today. These issues include:

- i. Unemployment
- ii. Substandard and fake products
- iii. Pollution
- iv. Poor health system
- v. Insecurity
- vi. Poor standard of education, etc

IV. IMPORTANCE OF HUMAN CAPACITY DEVELOPMENT IN MANUFACTURING

It is the human effort or its cumulative knowledge that further promotes technological innovation to enable organization and nation to cope with change. The explosion of knowledge that is taking place today is the innovation of the human resource in the past. Since the present condition is not static, it is dangerous for an organisation or a nation to rely on the present achievement, hence, the need to innovate whether they are succeeding or failing. Organisation and nations should not wait for technology limit before innovation; there is always need to innovate because human resources require constant nurturing and training to enable them recognise or capture the limit and attack, rather than to allow change to overwhelm them. The "attacker" constantly analyses the present, and tries to peeps into the future, to enable him understand and determine environmental threat and limitation and then launch attack. Defending the present condition may provide false security that cannot stand the test of time. Defender may be deceived by security of economic performance that may make it difficult for him to reposition himself or to move along with the changing conditions. Managers in this situation may find it "too late" to respond and maybe doomed by doing "too little" [12].

Human resource performance is intimately linked to technological change and technological innovation. Technological change could be effectively managed through human resource joint approach. Individuals can innovate and achieve great technological breakthrough but the complexities of modern technology requires effective combination of different innovations based on different aspects of technology. Hence human resources need to work as an individual and as a team and combine their innovation for production of new technologies, goods and services. Individual innovation is

meaningful and workable when combined with that of others. The collective innovation is also impossible without individual innovation, hence the two are separate, but could only work in the production process when they are combined and effectively managed to produce result, [13], [14].

When a manufacturer fails to innovate, it means that he/she has planned to fail; certainly the manufacturer will be out of market with time. This has crippled many manufacturing firms in Nigeria. Joseph Schumpeter in two of his famous books; *The Theory of Economic Development and Capitalism, Socialism, and Democracy*, claims that innovation represents the driving force of economic development [15]. Though, some investors in the manufacturing sector in Nigeria had made attempts to innovate their operations through purchase of new machines and equipment for the purpose of increasing their efficiency and competitiveness and to make more profit, the study of Ilori et al, (2002) revealed that [16]:

- i. The adoptions of new technologies in the recent years have improved the performance and Profitability of Nigerian Manufacturing Industry.
- ii. Workers performances have also increased due to the use of new technology, but workers skills have not improved sufficiently to cope with new technology.
- iii. Technological change has also not significantly improved the performance and working condition of some workers.
- iv. Management have also not substantially benefited from investment in technology.

V. CONTEMPORARY HUMAN CAPACITY DEVELOPMENT ISSUES IN MANUFACTURING

A. Inadequate Training Personnel

There is a strong disagreement of some analysts belief that, there is adequate man power in science and technology in Nigeria. For instance, Chikwendu (1991) in his work 'The Structure of Nigerian Industries and the Utilization of Scientific and Technological Manpower' stated that it would be erroneous to maintain that there is a shortage of scientific and technological manpower in Nigeria when many graduates in science, engineering and technical education are unemployed [17]. This assertion was based on quantity and not on quality. It is not out of place if it is stated that, the employer employs skill; just that the skill is in the entity called human. It is the skill that is of utmost importance to the employer and is as good as nothing if the skill he is looking for is not in the entity.

For population to be a positive factor in economic growth, the contribution of labour force in economic growth has to be high—both in terms of number and its quality. The quality in turn depends on the levels of education and training. Nigeria education system has not been able to bridge the gap between the employer and the employee. The study of Ebhota (2011) revealed that there are miss-matches between the skills required by the employers and the skills obtained by the employees (Nigerian graduates) during training [18]. It is

obvious that human capacity developmental training needed for modern manufacturing is gross inadequate in the country.

B. Technological Innovation and Acquisition

The major key necessary to win the market from other competitors is acquisition of better knowledge of manufacturing. Companies acquire new developed technologies to be effective in the market and gain a competitive advantage. Technology acquisition is an important process for companies that engaged in technological innovations due to its impact on the performance and overall contribution to the goals of the company [19]. Reluctance of manufacturers to implement technology innovations and techniques or the narrow scope of such implementations results in a reduced level of competitiveness of the products according to [20]. In this context, there should be all times conscious search for technological skill (good enough to guaranty their relevant) for the workers so that they can measure up with global manufacturing trends.

C. Brain Drain

The term brain drain designates the international transfer of resources in the form of human capital and mainly applies to the migration of relatively highly educated individuals from developing to developed countries. Oshuntokun 1998 as cited by Nancy [21] has conceptualised brain drain to mean the massive movement of highly skilled and experienced manpower away from public service as a result of harsh economic conditions in Nigeria. Africa is the source of some of the most fearful concerns about the brain drain. Africa lost 60,000 professionals between 1985 and 1990 (Aredo and Zelalem, 1998 as cited by Ruth, 2007 [22]). In addition, this study found that Africa had already lost one third of its human capital and was continuing to lose its skilled personnel at an increasing rate. According to a recent United Nations Educational, Scientific, and Cultural Organization (UNESCO) report, there are currently over 300,000 highly qualified Africans in the diaspora, 30,000 of whom have PhDs [22].

The Toronto Globe and Mail (November 2, 2005) went so far as to write an article about the African brain drain entitled "The new slave trade: A poor country's best workers" in which it said that rich countries could "suck all of the human capital out of the poor countries, leaving them forever destitute" [23]. One of the most obvious incentives for a skilled professional to emigrate is to increase their salaries [24]. With this kind of brain drain issues, one cannot but agree to an opinion credited to a deputy executive secretary of the Economic Commission for Africa (ECA) that "unless African governments ensure that brains remain in the continent, in 25 years' time, Africa will be empty of brains." [Quoted in *ibid.*]. For Emeagwali, it appears that "Africa is operating one third of its universities to satisfy the manpower needs of Western nations." [Quoted in *ibid.*] [25].

To understand the scale and impact of skilled labour migration from developing countries, it is necessary first to understand the factors driving it. These can be usefully categorised as 'push' and 'pull' factors. Pull factors are those

factors that attract skilled labour from developing countries and relate in the main to conditions in countries that receive skilled migrants [26].

Pull factors include:

- Higher wages.
- Job opportunities.
- Relatively good working conditions.
- Freedom from political instability or oppression.

The use of selective immigration policies designed to attract high skilled workers, while deterring others seen as less economically beneficial to receiving countries. In the case of academics, these are augmented by access to research funding and facilities and the potential to collaborate with other researchers.

Push Factors include:

- Lack of life chances.
- Low living standards.
- Political and social instability or repression.
- Lack of opportunities to utilise skills.
- Natural disasters and environmental or ecological deterioration.

D. Inadequate Research Programs and Incentives

It has been said that no nation can develop beyond the level of her education. In other words, education is the livewire of any serious nation which aspires to attain the highest level of development [27]. Education and training are necessary prerequisites for creating a favourable R&D environment. The generation of human resource for R&D in science and technology is mainly the responsibility of Universities. They produce graduates with research degrees such as PhDs and provide opportunities for post-doctoral R&D. In Nigeria, the neglect of higher education over the years led to the collapse of all aspects of this important level of education and made it difficult for universities to provide the human resource capacity required for research.

Most Universities and Research Institutes carrying out research in science and engineering do not have strong incentives or the facilities to conduct further development or apply research results to practical development. In Nigeria, one might not be too wrong to say that the policy of the successive government in the country is that the goose that lays the developmental golden egg must be killed so that it does not turn around to criticize the misappropriation and looting of its resources or how else does one explain the continuous neglect of the education sector whereby students, who are the nation's assets and bridge to the future, are made to bear the brunt of our government's insensitivity while the lecturers and other workers, who train the future wealth of the country, are made to wallow in abject poverty [27].

A recent survey of some faculties of science and engineering by the African Network of Scientific and Technological Institutions [28], revealed weaknesses in both the quality and quantity of staff. The survey, conducted among 20 institutions spread across all the geo-political regions of sub-Saharan Africa (excluding South Africa), revealed that:

- i. On average, across the region and across disciplines only 70% of the required staff is at post.
- ii. Most of the staff at post are young and inexperienced.
- iii. On average, the percentage of staff with PhD in science and engineering faculties in the institutions surveyed was just above 50%.

This survey indicates an overall weakness of staff to undertake research since most of them do not have long experience of unsupervised research. The small size of the staff and the weakness of their background confirm that staff in the universities in the region spend more time teaching and less time on research. In effect the human resource capacity for research in science and Technology in higher education institutions is minimal [28].

E. Poor Working Conditions

The neglect of staff welfare is manifested in many ways, including:

- i. Poor remuneration for staff. The rapid devaluation of national currency without a matching rate of increase in salaries
- ii. Increase in petroleum products and public utilities like water, electricity tariff, telecommunication etc., without increase in workers' salaries
- iii. Inadequate staff training Non or inadequate job insurance
- iv. Inefficient pension scheme

VI. HUMAN CAPACITY DEVELOPMENT NECESSARY FOR MODERN MANUFACTURING

A. Advanced Manufacturing Technology (AMT)

When one talks about the manufacturing sector, one notes that even in relatively more labour-intensive sectors like garment manufacturing, electronic, etc., the use of computer-based techniques is becoming increasingly frequent. There is a positive correlation between global competitiveness index and the index of higher education and training. The potential for achieving high and sustained growth of a country depends critically on investment which, in turn, is influenced by its competitive strength. Competitiveness of a country can be enhanced by improving the level of efficiency of her institutions and the productive capacity of her human resource [29].

Nigeria is routinely misled by insidious economic strategists. An emphasis on boosting Nigeria's comparative advantage due to its local resources has only led to a redundant addiction to the nation's oil exports. With easy petro-dollars rolling in, successive governments continue to pay lip service to manufacturing technology acquisitions and implement lack luster techno-policies that have neither direction nor bite. Consequently, the results of these indiscretions continue to plague the manufacturing sector with an overwhelming intensity that manifests in serious macro-economic distortions. Therefore, the focus of NASENI in the last few years has been on AMT. This is a paradigm shift from conventional manufacturing technology, for global

competitiveness of industrial products, hence rapid industrial development. The ultimate purpose of AMT is to create wealth in Nigeria.

AMT is a modern method of production incorporating highly automated and sophisticated computerized design and operational systems. AMT aims at manufacturing high quality products at low cost within the shortest delivery time. Manufacturing around the world is changing rapidly. The processes, equipment and systems used to design and produce everything from automobiles to computer chips are undergoing dramatic changes in response to new customer needs, competitive challenges and emerging technologies.

Highly skilled and well trained personnel at various stages of production are needed and the demand will keep on growing based on the growth of the sector. There is a need for establishing centre of Excellence in Colleges of Technology, and Universities. Skilled personnel from Colleges can be employed as technicians, trained personnel in. Training of trainers is also for better manpower development. Participation/attendance at International conference/workshop should be encouraged [30].

1) AMT and National Development (Vision 2020) Correlation

AMT programme of NASENI should be taken by the federal government of Nigeria as one of the National agenda and should be stepped up and expanded to meet the yearning and expectations of the country. In fact, without missing words 'this is the surest step capable of catapulting Nigeria to the level as proposed by vision 2020. This can be pursued through acquisition of existing AMT technologies, operation and maintenance skills (i.e. 3-in-1package). This will be followed by domestication of the technologies acquired by indigenous capacity building in AMT machinery design, fabrication, operations and maintenance.

2) AMT and Skill Upgrade

In order to benefit from AMT and technological innovation investment, improvement of workers skill should be considered in the following areas:

- i. Mechatronics
- ii. Automation and material handling
- iii. Advanced manufacturing technologies CNC
- iv. Electronics
- v. Hydraulic and pneumatic systems

These skills upgrade can majorly be done through the following [31]-[33]

- Training,
- Apprenticeship and
- Seminars,
- Workshop,
- Formal Education,
- Research etc.

VII. OTHER COMPONENTS NECESSARY FOR HIGH MANUFACTURING PRODUCTIVITY

A. Employer and Employee Relation

To truly have an effective human capacity development in manufacturing, apart from upgrading workers formal skills to meet present challenges in manufacturing and to increase productivity and profitability in the industry, the following issues should be inclusive:

- i. Working conditions should be improved and salaries and allowances enhanced and paid promptly.
- ii. Workers union should ensure that the effects of technological change on their members' jobs are considered.
- iii. Technologies in the manufacturing industry should be monitored and they should anticipate rather than to react to technological change, i.e. being an attacker instead of a defender. They should be proactive and organize training and retraining for areas they are likely to be affected by technological change.
- iv. Technology change should be complemented with good employment relations practice to enable employers and employees benefit from technological change and to protect the interest of all the stakeholders.

B. Maintaining Market Relevant

To avoid market displacement, several ways could be used to acquire this innovation. Below is a list of the different approaches to technological innovation and acquisition.

- Sponsoring university research
- Industry–university research consortia
- Supporting employees' graduate education
- Community colleges
- External R&D centers Consultants
- In-house technology development
- Licensing agreements
- Vendors/suppliers
- Technical meetings
- Technical journals
- Participation in trade shows
- Purchasing of existing technology

VIII. PROSPECTS OF AMT AND WELL-DEVELOPED HUMAN CAPACITY IN A GROWING ECONOMY

When above approaches are applied, it will lead to the following productive impacts:

- Productivity increase
- Maintenance costs will reduce
- Service performance improvement
- Domestic sales increase
- International sales increase
- Production costs reduction
- Product quality improvement
- Product development cycle shortens
- Number of new products increase
- Labour–management relations will improved Accuracy of the information flows increase

- Responsiveness to production schedule changes increase

IX. CONCLUSION

Nigeria is a country rich of Oil, Minerals deposits and Agriculture; the country's economy cannot be strong and vibrant without growth in its manufacturing sector. The key determinants of her economic growth must be developed consciously and simultaneously to give room for technological and industrial rebirth. Massive manufacture infrastructure development and human capacity development in manufacturing should be embarked upon by Nigeria government. For adequate HCD for present and future manufacturing requirements, the capacity building should be tilted to AMT

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