

EMERGING TECHNOLOGY COMPETENCIES NEEDED BY MOTOR VEHICLE MECHANICS IN BRAKING AND SUSPENSION SYSTEMS MAINTENANCE FOR ESTABLISHING AUTOMOBILE ENTERPRISES

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Abstract: *The study was designed to determine the emerging technology competencies needed by motor vehicle mechanics in braking and suspension systems for establishing automobile enterprises. Two research questions and two null hypotheses guided the study. A descriptive research design was used for the study. The study was carried out in FCT, Abuja Nigeria. A total of 854 respondents comprising of 810 motor vehicle mechanic master craft men drawn through the use of a proportional stratified random sampling technique and 44 automobile industrial technicians was used as a total population for the study. Braking and Suspension Systems Emerging Technology Competencies Questionnaire (BSETCQ) developed by the researcher and validated by three experts was used for the data collected for the study. The reliability coefficient of the instrument was 0.85 through Cronbach Alpha statistics. Statistical Package for Social Science (SPSS Version 23) was used for the data analysis. Mean and standard deviation were the statistical instrument for answering research questions while z-test statistics was used to analyze the null hypotheses formulated for the study at 0.05 level of significant. The findings of the study revealed among others that all the identified emerging technology competencies in the study were highly needed by motor vehicle mechanics in braking and suspension systems for establishing automobile enterprises. Based on the findings it was recommended that: The National Automotive Design and Development Council (NADDCC) charged with the responsibility of organizing training and refresher programmes for motor vehicle mechanics should in collaboration with the Federal Ministry of Labour and Productivity incorporate the identified emerging technology competencies needed by motor vehicle mechanics in their training programmes as this will expose them to new innovations in modern automobiles and thus boost their performances in the area of undertaking the repairs and maintenance of modern vehicle in their enterprises. Since most motor vehicle mechanics are products or graduates technical colleges in Nigeria, National Board for Technical Education (NBTE) should integrate the all emerging technology competencies needed by motor vehicle mechanics identified in the study into curriculum of motor vehicle mechanics work programme as this measure will go a long way to encourage and strengthened the students' interest towards establishing automobile enterprises upon graduation.*

Keywords: *Motor Vehicle Mechanic, Emerging Technology, Competency, Automobile Enterprise*

Introduction

Automobile enterprise in the context of this study refer to a designated place or room where workbenches, mechanical tool boxes and other basic vehicle maintenance and repair tools and standard equipment are used for vehicle maintenance by motor vehicle mechanics. However, in the words of Olaitan and Ikeh (2015) automobile enterprise refer to independent vehicle maintenance mechanic workshops or garages set up by motor vehicle mechanics master craftsmen under private ownership for the purpose of self-employment and employing others. Although automobile master craftsmen in terms of maintenance and repairs of modern vehicle in the automobile industries. However notwithstanding, other businesses opportunities available in an automobile enterprise include: car dealership, spare parts distribution and jobbers. In other words, activities such as Auto body repair and spraying and painting, Auto electrical work, Auto body mechanic work and Auto body building (panel beating) are also available in automobile enterprise for maintenance and repairs. Although the major activities in automobile enterprises lied in the hand of motor vehicle mechanics. Motor vehicle mechanic is one of the mechanical engineering trades which involve the acquisition of scientific knowledge in design, selection of materials,

construction, operation and maintenance of motor vehicles. Motor vehicle mechanic work trade at the technical college level consists of three components/subjects grouping as: Service Station Mechanic Work, Engine Maintenance and Refurbishing and Auto Electricity. Welbur (1999) described motor vehicle mechanic as a person who, for compensation, engages in the diagnosis or repair of faulty motor vehicles components or system. This means that motor vehicle mechanics are responsible for the service and repair of motor vehicles including undertaking work on engine, transmission, differential, steering, suspension and brakes in their business enterprises which can be operated as automobile enterprises. There is also urgent need for motor vehicle mechanics to be generally equipped with emerging technology competencies that are necessary for the maintenance and repairs of modern vehicles, this is because conventional technology competencies already possessed by them cannot take care of emerging technologies on modern vehicles.

Technology competencies can be described as the technical expertise applied in the development and manipulation of devices, machines and techniques for manufacturing and productive processes. Osinem (2008) pointed out that, technology competencies are types of expertise requiring a good understanding and proficiency in a specific activity, particularly one involving methods, procedures or technique and processes. Emerging technology competencies in motor vehicle mechanics however, refer to new set of competencies needed by motor vehicle mechanic for the maintenance and repairs of modern vehicles according to the manufacturers' specifications. According to Nna (2001) today's modern vehicles contain more embedded electronic components and controls that require a higher degree of sophistication for testing and servicing, as well as special On-Board Diagnostic (OBD) tools and test instruments. Although, Parts of these modern vehicle system and subsystem affected with emerging technologies according to Abubakar, Yahaya and Tijani (2015) includes: Braking and suspension systems. The braking system allows the vehicle to be brought to a stop safely. To slow down or completely stop a vehicle one needs braking system. Faramarz and Salman, (2009) shown that, brakes absorb the kinetic energy and dissipate or store it in some other form (usually heat or electricity). The types of braking system include mechanical, hydraulic, pneumatic and others. Most modern brake systems according to Giri (2013) include some form of brake assist (power brakes) and anti-lock braking system (ABS) to prevent skids or tyre burst due excessive friction during an emergency braking situation and traction control system (TCS) to prevent the drive wheels from wheel-spinning during starting off or acceleration on a wet or icy surface. Drivers are to note that the rolling, pitching, galloping as well as the oscillation action of the vehicle entirely is counteracted by means of suspension system.

Suspension system on the other hand enables vehicle to absorb the bumps and variation in road surface, keeping the vehicle stable. It provides the vehicle a smooth ride in an uneven terrain. The main components of the suspension system as indicated by Konrad (2015) are the springs and the shock absorbers. It could be dependent or independent suspension (or independent front suspension or fully independent suspension system). A suspension system also helps to improve the fuel efficiency by maintaining continuous contact of the wheels with the road and thereby preventing rolling slip (Julian, 2015). The various types of suspension system use in modern vehicles in the words of Konrad (2015) includes telescopic fluid filled suspension, leaf spring suspension, torsion spring suspension, hydro-elastic suspension and electro actuated suspension. The electronic damping control (EDC) have electronically controlled suspension systems using air, nitrogen gas and hydraulic oil as suspension agent.; hence there is need for motor vehicle mechanic to be competent enough to fully undertake the maintenance and repair of all aspect of modern automotive. Maintenance is a repair activity carried out on vehicles or other machineries to keep them unaltered, and if altered, to restore them to their original state (Okah-Avae 1995; Akinola & Ogedengbe, 2005). Narayan (2004) also stated that maintenance involves taking specific approved steps and precautions to care for a piece of equipment, machinery or facility and ensure it attains its maximum shelf-life. In the context of this study, maintenance is the adherence to the manufacturer's schedule for vehicle upkeep plus the repair of systems or faults that have led to excess emissions. This also means that effective maintenance prolonged the life span of all categories of motor vehicles. The foregoing clearly revealed that modern automobiles are blend of 20th century and 21st century technology.

The designs of modern vehicles have advanced to a very sophisticated level. Unlike the old mechanical operated vehicle systems, the modern vehicles are being operated and controlled by computerized electrical sensors. Indeed, almost every other function within the engine is controlled by an on-board computer. Hence; in spite of all emerging technologies on modern vehicles, the business of motor vehicle mechanics in the automobile enterprises should be to undertake the maintenance and repairs of both conventional vehicles and modern vehicles equipped with integrated electronic systems and computers. However, it has been observed that most motor vehicle mechanics who generally enjoyed constant flow of customers for effective maintenance and repairs of conventional vehicles are now faced with the challenges of how to either troubleshoot or fully undertake the maintenance and repairs of modern vehicles presently equipped and controlled primarily by computers and electronics components in their enterprises. Aruku (2007) stipulated that, with sophistication in modern vehicles due to advancement in technology, the artisans as well as the motor vehicle master craftsmen are finding it difficult to handle repairs of faults in motor vehicle generally and the new vehicles specifically. Michika (2019) pointed out that, MVM cannot compete favourably in the global workforce due to lack of appropriate skills in testing, diagnosing, servicing and complete repair faults on a modern vehicle according to manufacturer's specification. This situation has made most automobile enterprises established by motor vehicle mechanics a dumping ground for these modern vehicles that seems to have either developed minor or major mechanical and electronic problems. Though the forgoing might not be unconnected with the fact that these motor vehicle mechanics do not have technical knowhow to undertake the maintenance and repairs of modern vehicles, but seems to be faced with the lack of emerging technology competencies needed to fully undertake the maintenance and repairs of the braking and suspension systems in their enterprises. This study is therefore design to determine the emerging technology competencies needed by motor vehicle mechanics in braking and suspension systems maintenance for establishing automobile enterprises.

Aim and objectives

The aim of this study is to determine the emerging technology competencies needed by motor vehicle mechanics in braking and suspension systems for establishing automobile enterprises. Specifically, the objectives of the study are:

1. Identify the emerging technology competencies needed by motor vehicle mechanics in brakingsystem maintenance for the establishment of automobile enterprises.
2. Find out the emerging technology competencies needed by motor vehicle mechanics in suspension system maintenance for the establishment of automobile enterprises.

Research questions

1. What are emerging technology competencies needed by motor vehicle mechanics in brakingsystem maintenance for the establishment of automobile enterprises?
2. What are the emerging technology competencies needed by motor vehicle mechanics in suspensionsystem maintenance for the establishment of automobile enterprises?

Hypotheses

- H₀₁:** There is no significant difference in the mean responses of motor vehicle mechanic master craftsmen and automobile industrial technicians as regards the emerging technology competencies needed by motor vehicle mechanics in braking system maintenance for the establishment of automobile enterprises.
- H₀₂:** There is no significant difference in the mean responses of motor vehicle mechanic master craftsmen and automobile industrial technicians as regards the emerging technology competencies needed by motor vehicle mechanics in suspensionsystem maintenance for the establishment of automobile enterprises.

Methodology

A descriptive research design was employed for the study. The study was carried out in FCT, Abuja Nigeria. A total of 854 respondents comprising of 810 motor vehicle mechanic master craft men drawn from a total number of motor vehicle mechanic master craft men that was 8,100 through the use of a proportional stratified random sampling technique and 44 automobile industrial technicians was used as a total population for the study. A structured questionnaire titled: Braking and Suspension Systems Emerging Technology Competencies Questionnaire (BSETCQ) developed by the researchers and validated by three experts was used for the data collected for the study. The questionnaire items were assigned four points rating scale of: highly needed (4), needed (3), moderately needed (2), and notneeded (1) The reliability coefficient of the instrument was 0.85 through Cronbach Alpha statistics: Statistical Package for Social Science (SPSS Version 23) was used for the data analysis. 854 copies of questionnaire were distributed to respondents; 779 copies were duly filled by the respondents and returned representing 91.2%. Mean and standard deviation were the statistical tools for answering research questions while z-test statistics was used to analyze the null hypotheses formulated for the study at .05 level of significant. Therefore, decisions for research questions were based on the resulting mean scores interpreted relative to the concept of real lower and upper limits of numbers; accordingly, the decisions on the null hypotheses formulated for the study were based on comparing the significant value with ($P < .05$) level of significant; that is where the significant value is less than ($P < .05$) it was rejected, while equal or greater than ($P < .05$) level of significant the hypothesis was upheld.

Results

Table 1: Mean and Standard Deviation of Opinion of Respondents on the Emerging Technology Competencies Needed by Motor Vehicle Mechanics in Braking System Maintenance for the Establishment of Automobile Enterprises

S/N	Item	N	Mean	SD	Decision
1	Checking the lines of the Anti-lock Braking System (ABS) for leakages and functionality	854	3.66	0.33	Highly Needed
2	Identifying the causes of ABS delay for rectification	854	3.65	0.89	Highly Needed
3	Checking the service manual for the voltage and resistance values on various pins and sensors	854	3.65	0.97	Highly Needed
4	Consulting the service manual for a chart of specific values of components	854	3.66	0.07	Highly Needed
5	Identifying the causes of ABS delay for rectification.	854	3.77	0.26	Highly Needed
6	Ability to test drive in order to check the wheel speed sensor after replacement.	854	3.52	0.25	Highly Needed
7	Ability to undertake visual inspection of the wiring and mechanical components.	854	3.59	0.28	Highly Needed
8	Ability to recognize a faulty antilock braking system warning light.	854	3.10	0.05	Needed
9	Using oscilloscope to verify the voltage and signal supply to ignition system.	854	3.64	0.27	Highly Needed
10	Competency in carrying out test repaired braking system for functionality.	854	3.55	0.34	Highly Needed
11	Competency in carrying out all preventive maintenance in braking system.	854	3.58	0.18	Highly Needed

S/N	Item	N	Mean	SD	Decision
12	Carrying out all form of mechanical test on braking system.	854	3.56	0.29	Needed
13	Identifying materials needed for servicing ABS.	854	3.56	0.40	Needed
14	Topping up the brake fluid reservoir according to manufacturer's specification.	854	3.18	0.24	Needed
15	Checking master cylinder, braking lines and hoses.	854	3.10	0.19	Needed
16	Undertaking speed sensor signal testing.	854	3.50	0.16	Highly Needed
17	Checking power lines to the wheel speed sensor.	854	3.53	0.39	Highly Needed
18	Servicing the wheel speed sensor.	854	3.54	0.22	Highly Needed
19	Replacing electrical wiring to the wheel speed sensor.	854	3.50	0.25	Highly Needed
20	Inspecting wheel speed sensors pulsers for damaged teeth.	854	3.66	0.21	Highly Needed
21	Removing and replacing wheel speed sensors.	854	3.50	0.23	Highly Needed
22	Performing visual inspection of wheel speed sensor and cables.	854	3.26	0.81	Needed
Grand Mean/SD			3.51	0.33	Highly Needed

Note that: N = Number of Respondents, SD = Standard Deviation

Table 1 shows that the respondents agreed with all the items with grand mean of 3.51 as emerging technology competencies needed by motor vehicle mechanics in braking system maintenance for the establishment of automobile enterprises.

Table 2: Mean and Standard Deviation of Opinion of Respondents on the Emerging Technology Competencies Needed by Motor Vehicle Mechanics in Suspension System Maintenance for the Establishment of Automobile Enterprises

S/N	Item	N	Mean	SD	Decision
1	Maintain and repair Active Suspension system	854	3.62	0.28	Highly Needed
2	Maintain and repair air suspension system	854	3.35	0.09	Highly Needed
3	Check and inspect telescopic shock absorbers	854	3.64	0.09	Highly Needed
4	Inspect suspension for squeaking noises due to bushing and other connections failing	854	3.53	0.20	Highly Needed
5	Inspect shock absorbers or struts for over bumps	854	3.29	0.18	Needed
6	Inspect leaf springs and fix or replace as needed	854	3.23	0.20	Highly Needed
7	Check struts bearings and replace if necessary	854	3.77	0.89	Highly Needed
8	Check and inspect Stability Control System	854	3.51	0.25	Highly Needed
9	Check out for leaks on the air suspension system	854	3.74	0.87	Highly Needed
10	Service the air compressor for replenishing the air	854	3.62	0.90	Highly Needed
11	Detect active suspension system actuator faults	854	3.69	0.31	Highly Needed
12	Inspect damage spring and/or replace	854	3.07	0.01	Needed
Grant Mean			3.51	0.32	Highly Needed

Note that: N = Number of Respondents, SD = Standard Deviation

Table 2 shows that the respondents agreed with all the items with grand mean of 3.51 as emerging technology competencies needed by motor vehicle mechanics in suspension system maintenance for the establishment of automobile enterprises.

Table 3: z- test of Difference Between the Mean Scores of Motor Vehicle Mechanic Master Craftsmen and Automobile Industrial Technicians on the Emerging Technology Competencies Needed by Motor Vehicle Mechanics in Braking System Maintenance for the Establishment of Automobile Enterprises

Motor Vehicle Mechanics	N	Mean	S.D	df	Z	P - value
Motor Vehicle Mechanic Master Craftsmen	810	2.54	0.77	852	-0.524	0.600
Automobile Industrial Technicians	44	2.61	0.65			

Table 3 revealed that there is no significant difference ($P < 0.05$) in the mean score of the respondents. $Z (582) = -0.524$, $p = 0.600$. Therefore, the null hypothesis was accepted indicating that there was no significant difference between the mean responses of motor vehicle mechanic and automobile industrial technicians on the emerging technology competencies needed by motor vehicle mechanics in braking system maintenance for the establishment of automobile enterprises.

Table 4: z- test of Difference Between the Mean Scores of Motor Vehicle Mechanic Master Craftsmen and Automobile Industrial Technicians on the Emerging Technology Competencies Needed by Motor Vehicle Mechanics in Suspension System Maintenance for the Establishment of Automobile Enterprises

Motor Vehicle Mechanics	N	Mean	S.D	df	Z	P - value
Motor vehicle mechanic master craftsmen	810	2.78	0.83	852	-.257	.797
Automobile industrial technicians	44	2.81	0.76			

Table 4 revealed that there is no significant difference ($P < 0.05$) in the mean score of the respondents. $Z (582) = -0.257$, $p = 0.797$. Therefore, the null hypothesis was accepted indicating that there was no significant difference between the mean responses of motor vehicle mechanic and automobile industrial technicians on the emerging technology competencies needed by motor vehicle mechanics in suspension system maintenance for the establishment of automobile enterprises.

Findings and discussion

The findings in Table 1 relating to research question 1 showed that respondents agreed with all the items on the emerging technology competencies needed by motor vehicle mechanics in braking system maintenance for the establishment of automobile enterprises. The findings revealed that motor vehicle mechanics needs the ability to properly maintain anti-lock braking system (ABS). This is in agreement with Vaishak (2010) who pointed out that ABS which work with sensors located on each wheel are monitored by a computer called a controller, which opens a valve to release on the brake, thus allowing wheel to keep moving after lock. The findings also in line with the opinion of Bosch (2004) that, 76 percent of all new vehicles were equipped with ABS and it has become standard equipment for passenger cars in the European Union (EU), United States of America (USA) and Japan.

The finding also revealed that motor vehicle mechanics also needs the ability to carry out preventive maintenance on the anti-lock brake system modulator. This finding conform to the findings of Li (2010) which asserted that, the ABS control computer is incorporated into the ABS modulator and, with the aid of sensor inputs, provides the controlling actions that are designed to allow safe braking in emergency stops. Furthermore, the findings revealed that competency in the use of scan tools and sensor testers is also needed by motor vehicle mechanics. This finding is in agreement with assertion of Erjavec (2010) who pointed out that, ABS scan tools and testers can often be used to monitor and/or trigger input and output signals in the ABS. This will allow technicians to confirm the presence of a suspected problem with an input, switch, or output solenoid in the system.

The findings in Table 2 relating to research question 2 revealed that respondents agreed with all the items emerging technology competencies needed by motor vehicle mechanics in suspension system maintenance for the establishment of automobile enterprises. The findings revealed that motor vehicle mechanics needs the ability to detect and maintain active suspension system actuator. This finding is in consonant with the findings of Cengage learning (2014) which pointed out that, modern system uses advanced electronics and computer systems to make real-time changes to steering and suspension systems to provide increase handling and safety. This finding was further supported by the work of Fischer and Isemann (2004) who maintained that active suspension usually used passive parts such as extra springs, and dampers in parallel or in series with their actuators, to enhance the suspension system performance and insure system reliability even when the actuators are having faults or not working. As a result, the mechatronic integration of actuators, they involved sensors and electronic units, enable process suspension system identification and fault detection and diagnosis for the whole system. The finding also revealed that, mechanics needs the ability to maintain telescopic shock absorbers. This is in consonant with Lukaz & Rufai (2017) asserted that the finding further revealed that motor vehicle mechanics highly needs the ability to repair and maintain stability control systems.

Conclusion

This study identified the emerging technology competencies needed by motor vehicle mechanics in braking and suspension systems for establishing automobile enterprises. The findings of the study serve as the basis for making the following conclusion: That all the emerging technology competencies on braking and suspension systems are highly needed by motor vehicle mechanics for the establishment of automobile enterprises. Accordingly, if the findings of this study are effectively utilized a batch of highly skilled motor vehicle mechanic craftsmen in the area of undertaking the maintenance and repairs of modern automotive will be produced.

Recommendation

1. The National Automotive Design and Development Council (NADDC) charged with the responsibility of organizing training and refresher programmes for motor vehicle mechanics should in collaboration with the Federal Ministry of Labour and Productivity incorporate the identified emerging technology competencies needed by motor vehicle mechanics in their training programmes as this will expose them to new innovations in modern automobiles and thus boost their performances in the area of undertaking the repairs and maintenance of modern vehicle in their enterprises.
2. Nigerian Automobile Technicians Association (NATA) as motor vehicle mechanics professional body should organize Regular seminars, workshops and conferences for their members in the areas of new technologies in modern vehicles as this will equip them with needed competencies for maintaining such vehicles.
3. National Directorate of Employment (NDE) as one of the government agency charge with the responsibility of training motor vehicle mechanics should organize from time to time regular seminars and conferences for motor mechanics master craftsmen in the study area and indeed mechanics in any other parts of Nigeria on the need to acquire the emerging technology competencies identified in the study as this will enhance their performances in their enterprises.

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Industrial Technology Education: A Panacea for Productivity and Sustainable Development In Nigeria

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Abstract

The technology development and the advancement of any nation in term of productivity and sustainable development, is a product of the application of practical skills as well as basic scientific knowledge. As the quest for industrialization cannot be attained without technology education playing a vital role, the paper examine industrial technology education as a tool for productivity and sustainable development in Nigeria. The paper will discus the concept of technology education, concept of productivity, concept of sustainable development, Role of industrial technology education in sustainable development, recommendation and conclusion.

Introduction

The level of development of any nation is measured by the abilities which provide people with such basic needs like food, shelter, health, clothing, minimum education, sufficient communication, transportation system e.t.c. As technology is the primary index of power today, technology education must be recognize as the foundation of socio-economic transportation of a nation. Technology education has long be pointed out as a tool for National development and growth as well as the foundation to a healthy economic of any nation. Many developed nations such as U.S, British, Japan, Australla etc have developed through Investing and pursuing technology educations programmes in their institutions. Convergence of I.T and communication technology brings about greater potential and possibilities is using technologies as a powerful medium of delivery. Instructions and communication. The National policy on Education support government way of

achieving those aspect of her National objectives of a "United strong and self reliant nation" and "a great and dynamic economy" using education as a tool. Industrial technology education provides the knowledge which would lead the country towards productivity and sustainable development (self sufficiency). Industrial technology has been defined as a field of study designed to prepare technical and/or management oriented professional for employment in business, Industrial, Educations and government (NAIT, 2004). The attainment of an industrialized nation varies from trades and profession which among other includes, Air conditioning, Automotive service, Aircraft maintenance, Construction and maintenance trades, carpentry, electricity, fabric maintenance service, Industrial atomic energy, maritime occupations metal working, metallurgy, electric power and generating plant, textile production and fabrications, leather working, wood working to mention but few. Fourty Seven years of sovereignty as a nation, leaves one in doubt of our capabilities in transforming Nigeria into an industrialized nation. Therefore to attain a sustainable development and productivity in the country, the role of industrial technology education is crucial in our educational system.

Concept of Industrial Technology Education

Industrial Technology Education could mean the systematic study of technique for making and doing things. Miller (2003) describe Technology as the application of scientific knowledge or principles to practical task for developing and producing goods and services for mankind. Education on the other hand could be defined as a process of polishing the heart, head and the hand of the individual to enable him/her to live a worthy self-reliance life. Going by the concept of technology and education therefore. Industrial technology education can be describe as a systematic way of exposing individual to the practical task for developing and producing good and service to meets the needs and wants of man. It is the field of study designed to prepared technical and or management oriented professional for employment in business, education and government.

Technology refers to all that it takes for man to set in motion the natural forces of his entire body in order to make natural materials available informs useful to influence and control nature to aid his survival as a social being and all his attempts to solve essential but specific materials and spiritual problem in his life.

The National policy on Education revised (2004) define technology Education as "That aspect of education which leads to acquisitions of practical and applied skills as well as scientific knowledge" The aim of technology education includes the following.

1. To provide trained manpower in applied science, technology and commerce particularly at the sub professional grades.
2. To provide the technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development
3. To provide people who can apply scientific knowledge to the improvement and solutions of environmental problems for the use and convenience of man
4. To give training and impart the necessary skill leading to the production of craftsman, technicians and other skilled personal who will be enterprising and self-reliant and
5. To enable our young men and women to have an intelligent understanding of the increasing complexity of technology

Concept of Productivity

The concept of productivity, generally defined as the relation between output and input, has been available for over two centuries in the economic system. It is argued that productivity is one of the basic variable governing economic production activities, perhaps the most important one. Infact productivity is frequently discussed by managers but rarely defined, often misunderstood and confused with similar terms and seldom measured in an

appropriate way, leading to productivity being disregarded or even to that contra productive decision are taken.

According to Koss and Levis, remarkably many managers who every day make decisions about improving plant efficiency do not know how to answer the simple question "what do we really mean by productivity?". Nevertheless if we do not fully understand what productivity is, how can we decide what productivity measure to use?, how can we interpret them correctly?, how can we know what action to take to improve productivity?. Evidently, the confusion surrounding the subject makes it necessary to further investigate and emphasize the basic meaning of productivity. Hence an improper definition of productivity will often result in that action as being misdirected.

Despite the confusion on the subject several characteristics features that represent the concept of productivity have been identified. Generally speaking, productivity is in industrial engineering defined as the relation of output (i.e. produced goods) to input (i.e. consumed resources) in the manufacturing transformation process. Productivity is therefore on the one hand. Closely connected to the use and availability of resources. This means in short that productivity is reduced if a company's resources are not properly used or if there is lack of them. On the other hand, productivity is strongly linked to the creation of value. Thus, high productivity is achieved when activities and resources in the manufacturing transformation process add value to the produced products.

Concept of Sustainable Development

Sustainable development as widely used, is the development that meets the needs of the present situation without compromising the ability of future generations to meet their own needs. Sustainable development as conceived by the layman, relates to those infrastructure, policies and behaviours that are conceptualized, instituted and maintained over a period of time. These infrastructure are considered essential to the vitality, general welfare and continued existence of the people and environment such as housing, government,

retail stores and markets, agriculture, air, water, roads and highways, recreation, schools and universities, technology, mineral resources (renewable and non renewable), transportation, industries and product distribution. This means to ensure better quality of life for everyone now and for generation to come. The entire idea of sustainable development should therefore be considered as a non-negative trend in a measured output and technology where economic growth and environmental protection are inextricably linked and quality of present and future life rests on meeting human needs without destroying the environment on which life depends consequently satisfying human aspirations and needs is the major objective of development.

Considering the idea of sustainable development, Stephan (2000) quoted Lale (1991) to have accepted that sustainable development consists of two main components 1st the care for the natural environment and reversing the current destructive pattern of the society that threaten all forms of life on our extremely fragile planet, economic value of bio-diversity, and social relationship between humans and our natural environment. 2nd the concept that relates to sustaining culture because of the linear relationship between it and sustaining ecology. These component and attributes of sustainable development goes down well considering what are its objectives, goals and aspirations. The goals and aspiration of sustainable development according to Bryant (2003) explain that, it is meant to achieve four (4) objectives at the same time in U.K and the world at Large.

1. Social progress which recognize the need of every one
2. Effective protection of the environment
3. Prudent use of natural resources and
4. Maintenance of high and stable ~~of~~ economic growth and development

Need for Industrial Technology Education

Industrial technology education is education to earn a living in an occupation in which success is dependent largely upon technical information and

understanding of the laws of science and principles of technology as applied to modern design, production, distribution and service.

Nigeria is a country rich in natural resources. Some of these natural resources are not utilized because of lack of technical manpower. Technology education is greatly needed in conserving and developing the nations resources. Most of Nigerian youth are under-developed and under utilized as a result of lack of technical training. The highest possible welfare for Nigeria citizens is achieved only when each individual produces to the unit of his capacity. Therefore an organized and carefully planned programme of industrial technology education is essential if the above objectives are to be realized in Nigeria.

Roles of Industrial Technology Education for Productivity and Sustainable Development in Nigeria

The rapid industrialization of any nation is tied to acquisition of science and technological knowledge. The National policy on education states that "the preparatory aspect of pre-vocational training offered to student is for the purposes of enabling individuals to have an intelligent understanding of the increasing complexity of technology. At the most fundamental level of teaching someone the systematic way of exposing individual to the practical task for developing and producing goods and service to meet the needs and want of man or its developmental role of training scientist, technologist, engineer and teacher education, fuel the engine of any nation progress. As education is a tool for livelihood and self sufficiency, Industrial Technology Education have become the driving force of change in the modern world of galvanizing resources for productivity and sustainable development in Nigeria.

Through the application of science and technology, the resource of the nature have been transformed into goods and services for better quality of life, the advancement in science and technology has assured man of comfortable living, improved his thinking process and very importantly conserved his energy for other activities. A country like Japan which has very little natural resources but,

depend on importation of raw materials from other countries has through efficient application of science and technology education transformed these materials into goods and service and now dominate the world market with her products. Japan has successfully established a self-sustained economy through effective use of science and technology education without much of natural resources (Okunday, 1995)

The developing countries of the world like Nigeria failed to attain solid economic growth because of over dependence on the industrialized world. This is a result of their inability to adequately use science and technology education to exploit their natural resources. They have abundant natural resources but lack the relevant scientific and technological knowledge to transform them into goods and services. Through science and technology, life expectancy increased through better health care services, improved transport and communication, industrial productivity increase as a result of efficient machines etc. (Lamorde 1988)

With the advent of Information and Communication Technologies (ICTs) access to knowledge has become a potent force for transforming social, economic and the internet may well become as transformative as the industrial revolutions.

Conclusion/Recommendation

Since it is believed that the rapid industrialization of any Nation for productivity and sustainable development is tied to acquisition of science and technology education and since 70% of the gainfully employed persons are engaged in work requiring manual skills and technical knowledge, Industrial technology education must be recognized as the foundation for socio-economic transformation of a nation.

However, for sustainable development and productivity of any nation the government of that nation must:

- Lunch necessary campaign that will direct the nation focus on acquisition of science and technology education which will propel the country into economic recovery through industrial growth.

- Government should learn lesson from that of Japan that rose from the devastation of the second world war and through effective acquisition of science and technology education which have now-taken over the world markets and consequently build a strong and vibrant national economy.
- Salaries, wages, condition of service and incentive must be improve to attract and retain technologist, engineer and technician.
- People with strong political will should be given the mandate of implementing industrial technology education policies.

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