IMPACT OF TECHNOLOGICAL ADVANCEMENT ON THE JOB PERFORMANCE AND SATISFACTION OF AUTOMOBILE ROADSIDE MECHANICS IN MINNA METROPOLIS.

BY

UJEVBE, OKE BENJAMIN

2008/2/31483BT

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

OCTOBER, 2012

IMPACT OF TECHNOLOGICAL ADVANCEMENT ON THE JOB PERFORMANCE AND SATISFACTION OF AUTOMOBILE ROADSIDE MECHANICS IN MINNA METROPOLIS

BY

UJEVBE, OKE BENJAMIN

2008/2/31483BT

A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION, SCHOOL OF SCIENCE AND SCIENCE EDUCATION FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR AWARD OF BACHELOR OF TECHNOLOGY (B.TECH) IN INDUSTRIAL AND TECHNOLOGY EDUCATION.

OCTOBER, 2012

CERTIFICATION

I Ujevbe,Oke Benjamin with matriculation number 2008/2/31483BT, an undergraduate of the Department of Industrial and Technology Education certify that the work embodied in this project is original and has not been submitted in part or full for any Diploma or Degree of this or any other university.

....

Name **Sign-date**

APPROVAL PAGE

This project has been read and approved as meeting the requirement for the award of B.Tech degree in Industrial and Technology Education, school of Science Education, Federal University of Technology Minna.

.....	.....
Supervisor	**Sign-date**
.....	.....
Head of Department	**Sign-date**
.....	.....
External Supervisor	**Sign-date**

DEDICATION

With profound joy and gratitude in my heart, I dedicate this project to God Almighty for His Unshakable and Unbreakable Faithfulness.His Divine and constant guidance in my life has made this project a reality today. Thank God.

ACKNOWLEDGEMENT

I am sincerely indebted to the Almighty God for His unshakable and unbreakable faithfulness, His divine and constant guidance in my life, as it has deemed Him fit to see me through the successful completion of my studies in the university.

My appreciation also goes to my Head of Department Dr. Ohize, Emmanuel .J for his fatherly counsels.I profoundly acknowledgemy indefatigable project Supervisor, Mal. Abdul, Bello Kagara for his immense support towards the successful completion of this project. Thanks also to Mal.Abdullahi,Abdulkadri for spending time going through my project. To Mr. James, F. Maigida, for the priceless knowledge you shared with me.

My gratitude also goes to the project co-ordinator, Mr. T. M. Saba,Dr.UamrYakubu, Dr.R. O.Okori, Mal. G. A.Usman, Mal. Abdulkareem,Mr. Emmanuel Raymond,Mr.IstifanusKalart, Mal. M. Idris, Mal.MohammedBala, Mal. Dauda Ibrahim,and other departmental staff.My deep appreciation goes to Prof. G.D.Momoh and Prof. K.A. Salami, who were like guidians and fathers to me all through my stay on campus.

I am indebted to my family members for their financial, material and spiritual support throughout my stay here on campus: my lovely parents Pastor and Mrs UjevbeOke Fredrick, my late elder sister Mrs. Gripka Williams Precious, my brotherUjevbeOtuke Victor. Also, to my disciples/mentors: Rev. P. J. A.Olaya and family, Barrister Efetie Friday and family, Uncle Bode Badaki, Dr.Grikpa Williams.Unforgettable friends:OgugwoUchechukwu, IhezieAmarachi, NuhuAbdulmalik, OluwatosinBankole, AlhassanMunirat, Omame Isaiah, Fancies Abutu, Nissi Anna, AkeemJimoh, KekereSanni and others, God bless you richly.

And lastly, to the members of my family while here on campus; Fellowship of Christian Students (His Dwelling Place), God bless you all.

ABSTRACT

The study is designed to determine Impact of recent technology on the job performance and satisfaction of Automobile Roadside Mechanics in Minna town. Three research questions and two null hypotheses were formulated to guide the study. A forty five (45) items questionnairewas develop and used to collect data from the respondents, consisting of 50 Automobile Roadside Mechanics and 20 Vehicle Owners randomly selected from five major locations in Minna. Data collected was analyzed using frequency count, mean, standard deviation and t-test statistics. The null hypotheses were tested at 0.05 level of significance and 68 degree of freedom. Furthermore, the findings revealed that Automobile Roadside Mechanics can actually update their performance skills by having a standard periodic training and retraining programmes onmodern troubleshooting devices for automobile diagnosis and repairs. Based on the findings, its recommended that Automobile Roadside Mechanics should be taught the basic principles guiding the operations of the Electronic Control Unit (ECU) to upgrade their performance skills; Automobile Roadside Mechanics should develop personal interest for computerized diagnostic equipments to enhance satisfaction; the Federal Ministry of Works and Transportation in collaboration with the National Automotive Council (NAC) should provide necessary and relevant facilities that would be used for impacting into Automobile Roadside Mechanics the practical applications of computerized diagnostic equipments to enable them adequately cope with the prevailing recent technology in modern vehicles.

TABLE OF CONTENTS

CHAPTER II

REVIEW OF RELATED LITERATURE

CHAPTER III

RESEARCH METHODOLODY

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMEDATIONS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Background of study

Generally speaking, technological advancement has made huge impact on our society today by improving work output, easing stress, lessen time taken to perform a task or tasks, provide better and faster procedures that maybe employed in the production and service line among others. TheAutomobile industry have revolutionalized the way people travel, making it easier, faster and more comfortable for people to commute from one place to another.Technological advancement came along with the emergence of sophisticated and computerized diagnostic equipment in the Automobile industry which now imposes greatthreats to Automobile Roadside Mechanics and their profession. Thereby rendering them obsolete and redundant in their job performance owing to their inability to effectively use of computerized diagnostic equipment for such simple and more or less complex repair jobs. These goes further to cripple job satisfaction on the part of both the Automobile Roadside Mechanic and vehicle ownerWilliam and Donald (2007).As technology dictates the cadence of all things automobile, engineering, sciences, social sciences, arts and crafts and other facet of life, even so, it dictated the march of automotive repairs, and approaches to repairs and maintenance. Miami (2009) stated that there have been tremendous positive changes in modern Automobile industry.

According to Wikipedia (2012), the innovations in Automobile industry are more rapid in three areas; electronics, composite materials and non-fissile fuel forms of propulsion (hydrogen fuel). Most modern vehicles are Electronic Unit (ECU) enabled. ECU-enabled vehicles refer to vehicles that have ECU incorporated as a major part of the electrical system. The ECU is a computerized micro system that is programmed to

centrally(oxygen sensors) to control the actuators, (fuel injectors) to get the desired performance in a modern vehicle,Coombes and Rogers, (2006).Hillier et al explained further that the complexity of electronically controlled vehicle systems easily posse confusion to someAutomobile Roadside Mechanics. Automobile Roadside Mechanics or Auto-craftsmen refer to ECU as brain box. Amitabh (2009) defined technological advancement as the modification of equipments or theexistence of new equipments, devices, product processes or services in vogue which are far better, more reliable and efficient compared to those versions (versions of OBD introduced in the early 1980s that would simply illuminate a Malfunction Indication Light, or MIL, if a possible problem was detected-but would not provide any information as to the nature of the problem) thatexcised before them. Technological advancement is simply the new equipments, substances, methods, processes or procedures and ideas to solve problems or perform specific functions in better ways than before. The ECU monitors virtually every component that can affect the emission performance of the vehicle to ensure that the vehicle remains as clean as possible over its entire life.It also assists Auto-Mechanics in troubleshooting faults in computerized engine. The system also store important information about the detected malfunction so that technicians can accurately identify and resolve the problems using their skills and basic knowledge of On-Board Diagnostic (OBD) techniques.

Job performance is a commonly used, yet poorly defined concept in industrial and organizational psychology, the branch of psychology which deals with the workplace and Human Recourse Management (HRM). Job performance commonly refers a situation in which a person performs a given job either well or not using the necessary and relevant updated performance skills Bono and Judge (2003). Despite the confusion over how it should be exactly defined, performance is an extremely important criterion that relates to organizational outcomes and success.

William and Donald (2007) opined that the increase use of electronic components, equipment and electronic devices in the Automobile industry is threatening the job performance of Automobile Roadside Mechanics. Brown and Peterson (1994) noted that the job performance andsatisfaction of an Automobile Roadside Mechanic depends on the effort, skill and techniques applied carrying out a given job. (Bono and Judge, 2003) noted that the job performance and satisfaction of an Automobile Roadside Mechanic depends on the relevance of the work skill they possess. How well a job is carried out and the feelings of satisfaction or dissatisfaction after the job is carried out by a Automobile Roadside Mechanic is greatly determined by the proficiency and knowledge possessed by the Automobile Roadside Mechanic. Furthermore, Cranny, Smith and Stone (1992) added that for Automobile Roadside Mechanics to lack the require skills and knowledge needed to perform adequate and accurate diagnosis, repairs, and maintenance of modern vehicles, the job performance and satisfaction of the Automobile Roadside Mechanics will be greatly impinge and counterproductive to the Automobile Roadside Mechanics. Job performance culminates at satisfaction or dissatisfaction. A job properly performed provides great deal of satisfaction to both parties; theAutomobile Roadside Mechanic and the vehicle owner.

Job satisfaction as described by Michael (2004)explains how content an individual is with the job at hand. The happier people are within their jobs, the more satisfied they are said to be. Logic would dictate that the most satisfied (“happy”) workers should be the best performers and vice versa.Smith and Stone (1992) definedJob satisfaction as the feelings people have about their jobs. It has been specifically defined as a pleasurable (or unpleasant) emotional state resulting from the appraisal of one’s job, especially a job well done, an affective reaction to one’s job, an internal state of mind, an attitude towards one’s job; it could be associated with a personal feeling of achievement, either quantitative or qualitative Weiss (2002). The feelings of an Automobile Roadside Mechanic will only culminate at a

satisfaction when the vehicle he or she employs the service of diagnostic tools tocarry out repair work. Job satisfaction takes into account feelings, beliefs, and behaviors of workers with respect to the job at hand.

The feelings of satisfaction on a job also tell on vehicle owners whether the faults have been resolved by the Automobile Roadside Mechanic or otherwise. Vehicle owner can attest to the fact that they usually feel a great sense of relieve, satisfaction and happiness whenever their vehiclefaults are resolved. On the other hand, they may feel a great deal of burden, dissatisfactionand sadness whenever their vehicle faults still noticed even after repairs.

Durham (1997) mentioned that the satisfaction may be obtained by performing certain jobs with the use of certain tools and equipments in this context; by Automobile Roadside Mechanics. This however discourages the interest on recent technologies and challenges the job satisfaction of Automobile Roadside Mechanics as a good number of them lack the requirements for diagnosing, repair and maintaining modern vehicles with the aid modern automobile diagnostic equipments.

An Automobile Roadside Mechanic is someone whose occupation is repairing and maintaining automobiles. They provide service assistance to motorists whose vehicles have suffered a mechanical failure that is significant enough to leave them stranded at their present locationWikipedia (2012). The task of auto mechanic involves inspection, maintenance and repair of cars and light trucksKirpal (2006). He further stated that automobile roadside mechanics performs routine services on vehicles and light trucks to keep them running well such as testing, inspection and lubrication of engines and component parts of the vehicle. They often follow a checklist to be sure they examine potential trouble spots. Belts, hoses, plugs brake and fuel systems are items mechanics may install or repair

accessories, such as heaters and windshield wipers. Automobile mechanics are also known as service technician (or car mechanic in British English and Motor Mechanic in Australian English) defined by Wikipedia (2012) is a mechanic with variety of Automobile makes or either in a specific area or in a specific make of Automobile. It also stated that modern vehicles are complex integrated products with more than 3000 parts that all need to work in harmony. Recent technology in the Automobile industry encompasses the use of more advanced electronics, computers and wireless communication system to assist drivers and enhance safety (Salami, 2007). These recent technologies replace mechanical systems that power, steering systems, break the vehicle and others. The International Trade Commission (ITC) (2002) revealed that Automakers have developed alternative such as hybrid vehicles, robot vehicles and fuelled cell cars. Hybrid vehicles combine two or more sources of power, which able to operate using rechargeable batteries and gasoline. It is obvious that using a hybrid vehicle will switch between gasoline and electric power will achieve fuel economy.

The term Automobile Roadside Mechanics as described by Ogwu and Oraunu (2006) is a vocational training acquired through the informal apprenticeship progamme. He further stated the vocation training is the term given to basic skill training, where the basic scientific knowledge inherent in the skills is not emphasized. Therefore, the term Automobile Roadside Mechanics refers to an aspect of informal vocational education where the skills are acquired through the apprenticeship system of training which occur in the formal sector. The National Board for Technical Education (NBTE, 2002) described auto professionals as auto mechanics who have acquired Auto Mechanic skills through a formal system of training. Auto professionals comprises; Automobile technicians, auto technologist, auto engineers and formal sector master Auto Mechanic who usually renders maintenance services at relatively higher prices than Automobile Roadside Mechanics or craftsmen.

Ogwo and Oranu (2006) distinguished between Automobile Roadside Mechanics and automobile professionals by stating that, the Automobile Mechanics as a vocational training is characterized by non-existing of a written curriculum, entry requirements and certification. The master craftsman decides out of the experiences what the apprentice should learn, and the skill acquisition is usually by observation and imitation of the master craftsman. The apprenticeship system involves the use of less sophisticated tools and equipments. They usually produce semi-skilled craftsmen in Automobile Mechanics.

Okoro (1993) stated that the apprenticeship training programmes are inadequate because they are lacking the theoretical content. He pointed out that the apprentice is told what to do but not why they have to in the way specified. He further stated that their creativity and innovate are not developed. They are therefore unable to cope with the new situations different from their previous experiences. It appears as if the inadequate skills passed by Automobile Roadside Mechanics reduce the tendency for them to properly diagnose, repair and maintain modern vehicles. Thus the impact of recent technology poses challenges to the job performance and satisfaction of Automobile Roadside Mechanics.

Statement of the problem

The continuous use of sophisticated electronic equipments and devices has changed the work skills and competence requirements of Automobile Roadside Mechanics. This shift has made many Automobile Roadside Mechanics redundant and thus gave room to question job performance or satisfaction among auto-technicians and car owners.

In addition, the ignorance of some Automobile Roadside Mechanics in several occasions while working on most modern vehicles, remove vital electronic components or wrongly position them, which further worsen the vehicle fault and greatly affect the reliability vehicle owners have on Automobile Roadside Mechanics and also impinge their

job performance and satisfaction. The lack of specialized skills to diagnose, repair or maintain modern cars obviously breeds fear, uncertainty, and challenges the job performance and satisfaction of Automobile Roadside Mechanics. These necessitate the researcher to study the impact of technological advancement on the job performance and satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

Purpose of the study

The purpose of the study is to assess the impact of technological advancement on the job performance and satisfaction of Automobile Roadside Mechanics in Minna Metropolis. The study:

1. Identified how technological advancement in automobileaffects the job performance of Automobile Roadside Mechanics in Minna Metropolis.
2. Assessed what affectjob satisfaction ofAutomobile Roadside Mechanics inMinna Metropolis.
3. Determined ways of improving job satisfaction ofAutomobile Roadside Mechanics in Minna Metropolis.

Significance of the study

The findings of the study are of enormous benefit to Automobile Roadside Mechanics, Vehicle Owners, Transportation and Fleet Operators, Automobile Technology Teachers and Automobile Technology Students in Polytechnics, individuals and the society at large.

Automobile Roadside Mechanics will benefit greatly from this study as it has revealed areas of strengths and weaknesses in their capabilities handling faults in modern vehicles. This study further more will assist Automobile Roadside Mechanics by exposing them to opportunities to acquire skills, knowledge and appreciation and interest to repair modern vehicle faults thereby enabling effectiveness and proficiency in their job

performance and consequently satisfaction handling these vehicles.

The worth of the findings of this study will also benefit Vehicle Owners as they will beexposed to basic problems envisaged in modern vehicles, hence making them informed customers. More so, the issue of fear and dissatisfaction will be eliminated in Vehicle Owners when going to Automobile Roadside Mechanics, for repair and thus regain confidence in the job of Automobile Roadside Mechanics.

This study will also assist Transportation and Fleet Operators in making adequate of the strengths and weaknesses of the Automobile Roadside Mechanics for organizing training and retraining opportunities for their Technicians or workers.

This study will provide relevant information enough to benefit Automobile Technology Teachers as the findings of the study points out specific subject areas that need to be improved upon in their teaching in order to produce adept and knowledgeable; not "half baked but fully baked" breed of competent graduates into the world of work. Importantly also, Automobile Technology Students in Polytechnics will subsequently receive immerse benefits as more improved training will be as a vital aspect of their practical works.

The findings of the study are also of enormous benefit to both individual and society as it enlightens them with respect to the identified strengths and weaknesses of Automobile Roadside Mechanics in their capabilities handling faults in modern vehicles.

Scope of the study

This study covered the impact of technological advancementon the job performance and satisfaction of Automobile Roadside Mechanics in Minna Metropolis. The effect of advancement on the job performance of Automobile Roadside Mechanics was also covered. However, the effect of advancement on the job performance and satisfaction of Automobile Mechanics of established automobile companies was not covered owing to the actuality that

they are trained Mechanics, better still, mecha-tronics, who possess the skills and technicalities in the use of most advanced technologies for the repair and maintenance of modern cars.

Research questions

The following questions were formulated to guide this study:

1. To identify how technological advancement in automobile affects the job performance of Automobile Roadside Mechanics in Minna Metropolis.
2. To assess what affect job satisfaction of Automobile Roadside Mechanics in Minna Metropolis.
3. To determine ways of improving job satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

Hypotheses

The following null hypotheses were formulated and were tested at 0.05 level of significance:

1. Ho_1: There will be no significant difference in the mean responses of Automobile Roadside Mechanics and Vehicle Owners on how technological advancement in automobile affects the job performance of Automobile Roadside Mechanics in Minna Metropolis.
2. Ho_2: There is no significant difference in the mean responses of Roadside Automobile Mechanics and Vehicle Owners on what affect job satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

CHAPTER II

REVIEW OF RELATED LITERATURE

Literature related to this study is reviewed under the following sub-headings

1. History of the Automobile
2. The Job of Auto Mechanics
3. Automobile Technology And Innovation
4. Concept of Job Performance
5. Concept of Job Satisfaction
6. Apprenticeship System of Training Automobile Roadside Mechanics
7. New Approach for Automobile Diagnosis and Repairs
8. Summary of Related Literature

History of Automobile

The automobile has been around for more than 100 years. According to Wikipedia (2012), the history of the automobile begins as early as 1769, with the creation of steam powered automobiles capable of human transport. In 1806 the first cars powered by internal combustion engines running on fuel appeared, which led to the introduction in 1885 of the ubiquitous gasoline or petrol fuel internal combustion engine and later diesel fuelled engine in 1892. The automobile, motor car or car can be described as a wheeled motor vehicle which carried its own engine and is used for transporting or moving people and goods on the land. cars powered by electricity briefly appeared at the turn of the 20th century but quickly appeared from commonality until the turn of the 21st century, when interest in low and emissions transportation was reignited.

Furthermore, in the 21st century, innovations, new or recent technology on flying cars (or road-able aircraft; an aircraft that can also travel along roads) were innovated. Though,

many researchers like Glenn Curtiss in (1910), who designed the first flying car, Henry Ford in (1926), Waldo Waterman who associated with Curtiss in (1937) to actually design the first car that really flew, have been experimenting ways to develop better and more efficient cars that could fly.

The first automobiles were basically horse-drawn buggies and carriages powered by gasoline and diesel fuelled engines instead of horses. They were called gas buggies and horseless carriages. The early engines had one cylinder that could produce only one or two horse power. A horse power is roughly the power of one horse. In 1885 and 1886, Karl Benz built the modern automobile in Germany. It had three wheels, one in the front and two in the rear. In 1886, a German, Gottlieb Daimler built a four wheels gas buggy (Wikipedia, 2012). Two brothers, Charles and Frank Duryea built the first automobile in United Stated in 1893. By 1895, Henry Ford, Ransom olds and other were building cars in the United State; the early cars were crude company to today's cars. William and Donald (2007) reveal that by 1990, several factories in Detroit and elsewhere were building cars that kept getting bigger and more expensive. Ford wanted to make cars as cheap as possible to that more people could buy them. By 1980, he had the car in production that put America on wheels. This was the model-T Ford manufactured on the first modern assemble line and this marked the beginning of mass production in auto industry.

Present the automobile is a commonly used product but it is an extremely complex and technologically sophisticated one. Today's automobile is a complex integrated product with more than 3,000 parts that all need to work in harmony (Wikipedia, 2012). Automobile plays a major role in people's lives whether it is used for daily transportation or used for pleasure. In this regard, the development of the vehicle industry is instrumental to personal life. Today the automobile industry is one of the biggest in the world.

Job of Automobile Roadside Automobile Mechanics

Kirpal **(**2006**)** stated that the task of auto mechanic involves inspiration, maintenance and repair of cars and light trucks. He further stated that Automobile Roadside Mechanics performs routine services on vehicles and light trucks to keep them running well such as testing, inspection and lubrication of engines and component parts of the vehicle. They often follow a checklist to be sure they examine potential trouble spots. Belts, hoses, plugs brake and fuel systems are items mechanics may install or repair accessories, such as heaters and windshield wipers. Automobile Mechanics are also known as service technician should acquire those skills, knowledge so as to enable them identify vehicles that are OBD-certified.

Khurmi and Gupta, (2007) stated that after a critical examination is carried out on a vehicle, theAutomobile Roadside Mechanic usually gives detailed explanationsto Vehicle Owners on the symptoms and possible vehicle faults. They further stated that for any Automobile Roadside Mechanic to cope up with the fast moving trend of technology on automobiles, they must acquire those performance skills in proficiently handling various computerized diagnostic equipments for the diagnosis and repair of modern automobiles. Theyuse variety of testing equipment such as hand held diagnostic computers and compression gauges. The relevant adjustments and repairers are then made to restore the vehicle back to sound performance. Often review work orders and create a plan of action were made by them and with some help from supervisors or master craftsman or auto professional. Sometimes, the replace or rebuild systems that are badly damaged.They also revealed that most Automobile Roadside Mechanics are void of the fundamentals of the theoretical operational principles of automobile technology.Hillier et al (1991) disclosed that Automobile Roadside Mechanics doubtless have the capacity to procure computerized diagnostic equipments, but they lack the technical skills for its application. He also added that for or large repairs, Automobile Roadside Mechanics estimate the cost and get the

customers approval before doing any work. Vehicle Owners when satisfied with repair worksdone by Automobile Roadside Mechanics, pay standard price – a good sum of money. Usually some Automobile Roadside Mechanicshave standardized charges for services rendered.He also noted that for a very good and thorough job performed by Automobile Roadside Mechanics, customers; Vehicle Owners should learn to say "thanks" as a sign of gratitude and appreciation which won't cost much regardless of the fact that you theVehicle Owner is actually paying for the services rendered.

They further assertedthat Auto Mechanics who work in large shops may specialize in one or more areas. For example, automatic transmission technicians work on gear trains, hydraulic pumps and otherparts of a transmission. Tune up technicians adjust timing and valves and adjust or replace spark plugs and other parts. Front end mechanics align and balance wheels and repair steering and suspension systems. Brake repairers adjust brakes and replace damage brake linings and pad. In small shops, mechanics must know about all areas of car repair to enjoy his job.

Wikipedia (2012) reveals that today's auto mechanics use a variety of tools in their work. They use power tools such as pneumatic wrenches to remove bolts quickly. They use machine tools such as lathes and grinding machines to rebuild brakes. They use welding and flame cutting equipment to remove and repair exhausts systems they also use jacks and hoist to lift cars and engines. In addition, mechanics use common hand tools such as spanners, screw drivers and pliers to work on small parts. Some mechanics use electronic component. For example, they use infra-red engine analyzers and computerized diagnostic devices. These devices diagnose problems and make precise adjustments. Other modern equipments used in automobile workshops are:

• Computerized air conditioning equipment

• Computerized brake tester

• Computerized compressed air equipment

• Computerized emission and diagnostic equipment

• Computerized jacking equipment

• Computerized lubrication equipment

• Computerized tyre and wheel service equipment

• Computerized wheel alignment gauge

Automobile technology and innovation

Innovation may also be seen as new or recent technology. It is a new way of doing something. Amitabh (2009) defined innovation as the exploration of new ideas leading to the creation of a new product, process or service. He further stated that it is not just the innovation of new ideas that is important, but it is actually bringing it to market, putting it into practice and exploiting it in a manner that leads to new technological transformation and management re-construction. Innovation also means exploiting new technology and employing out of the box thinking to generate new value and to bring about significant changes in the society.

Schumpeter (1984) distinguished between invention and innovation; new or recent technology as an idea manifest and innovation as an idea applied successfully in practice. He further reveals that there are different types of innovation such as “product innovation” that entails the introduction of a new product or a service that is new or considerably improved, “process innovation” comprising the implementation of new or significant enhanced production or delivery method, “supply chain innovation” in which innovation transform the sourcing of input products from the market and the delivery of output products to customers and “marketing innovation” which results in the evolution of new methods of marketing with enhancements in product design or packaging, its promotion or among others.

Innovation leads to wealth creation.

Peter (2009) reveals that while innovation typically adds value, innovation may also have a negative or destructive effect as new developments clear away or change old organizational forms and practices. He further emphasized that organizations that do not innovate effectively may be destroyed by those that do. An organization that is not able to innovate faces decline and extinction. Innovation involves a high risk of costly research and development (R and D) that can eat up shareholders return. Research and developments is an innovative research phenomena which occur when research combined with practical applications lead to improved processes and new products in an industry (Wikipedia, 2012).

Eric (2008) identifies two sources of innovations; “manufacture innovation” where a person or company’s innovation is in order to sell the innovation and “end user innovation” where a person or company develops an innovation for their sole use because existing products do not meet their needs. He further stressed that competition is the determinant of innovation, productivity and wealth creation. Innovation, new or recent technology therefore involves the introduction of new products, new services, new processes, new business systems and new methods ofmanagement which have a significant positive impact on productivity and growth of an organization. For instance, Larson (2000) reveals that the world’s largest automobile manufacturer "General Motors (GM)" has me deep into innovation to broaden its original equipment manufacturer (OEM) alliances by acquiring other smaller companies and increasing its technical alliance with Honda and Toyota auto manufacturer. The GM's heritage in innovation includes first speedometer, first electric self starter, first fully automatic transmission, collapsible steering column, catalytic converter, first crash test dummies, first child restraint system, first computerized crash test, first integrated chassis control system and advanced virtual reality technology.

Competitive pressures have forced most automobile companies to increase their focus on innovation, the automobile industry has significantly expanded the electronics and computer content on the vehicle, with applications ranging from power train controls for improved fuel economy and reduced emissions, to enhanced safety systems and chassis controls to on board communication system (Eric, 2008). The precision and super fast speed of computers has made major advancements possible in auto engineering. Today, electronics comprises more than 25% of each automobile and that figure is expected to grow to more than 30% by 2012 (Wikipedia, 2012). Automotive computers and electronics takes care of everything from airbag safety systems and anti lock braking systems to fuel efficiency, clean auto technology and global positioning system (GPS) with the present trends in innovations in motor vehicle, it is obvious that it is only those auto mechanics that posses specialized skill that will survive in the auto mechanic job in the long term.

The product life cycle for automobiles continues to shorten due to competitive market pressures. This is so because competitive market forces have caused automakers to dramatically redesign car models every four: to five years. New technological developments have led to unique and innovative designs for future automobiles. Alternative fuel technologies such as electric hybrids and fuel cell cars have received considerable attention; International trade commission (ITC, 2002); Wikipedia (2012) reveals that the "big three" automakers in united states of America (USA) such as General Motors, Ford and Chrysler andother automakers like Honda and Toyota have gradually began to manufacture hybrid vehicles. Hybrid vehicles combine two or more sources of power, which are able to operate using a rechargeable battery and gasoline. It has to be noted that the Japanese biggest automaker Toyota, is one of the auto industries leaders in hybrid vehicle research and production with the introduction of its previous model. Salami (2007) pointed out that ford motor company has invested a lot in research and development (R and D) to produce more

alternative fuel vehicles and these involved:

• Developing a hybrid vehicle which will switch between gasoline and electric power and will achieve fuel economy.

• Developing fuel cell vehicle that will run on hydrogen and produce only water as a by-product.

• Developing more fuel efficient and cleaner diesel powered engines.

• Introducing many advanced safety technologies in their products such as personal safety, system to protect front seat occupants during frontal clashes.

Recently many automobiles are increasingly relying on more advanced electronics, computer and wireless communication systems to assist drivers and enhance safety. These technologies replace mechanical systems that power, steer and break the vehicle. For instance, general motors' (GM) has introduced the autonomy concept model which uses hydrogen fuel cell technology that powers electric motors in each wheel. The vehicle uses a chassis and replaceable body; allowing greater flexibility and freedom in designing the interior. Thevehicle operates using sophisticated computer and electronic systems. Voice activation is another technology being developed for use in vehicles. Voice activation systems operate internal climate controls, open doors and respond to navigational request by the driver. New development in the automobile electronic and communications technology is vehicle sensor technology. A sensor technology uses radar or laser technology to control systems that detect vehicle in front of them and automatically sends the signal to the Electronic Control Unit (ECU) (Salami, 2007).

Mandell (1986) commented that to be prepared to cope with changes technology

brings, computer literacy must be emphasized in training centers. He believed strongly that computers play important roles in our life and it has proven to be true because there is hardly any area of the society that have not been affected by this technology. Such areas may include manufacturing, construction, production and automobile service industry to mention a few. They have fully embraced the use of computer as a means of carrying out their various activities.

Adeniba (1996) drew our attention to the dynamic nature of computer technology and stated that, a nation that will exist in this technology age must not operate below a particular level of computer literacy and usage. Therefore our, work force must be exposed to the use of computer, in order to meet the challenges at stake. No technological improvement will reject the use of computer education. More so, Adeniba (1996) in his opinion said that for Automobile Roadside Mechanics, their exposure to computer application programmes will help build their ability to perform some operations on the computer since all of the automobile diagnostic equipments are basically computerized.

According to Nryston (1977), it is believed that innovation is a key element to success in any enterprise. In technology education there are numerous reasons why innovation is necessary to meet the need which is realization that technology education must in some measures contribute to the preparation of young people's life in a society, increasingly pervaded bytechnology feats by way of using multi diagnostics tool to identify results in engine and correct it. At early age of youth, it is always easy and obvious for skills to be acquired and turn out youth with increased initiative of technological advancement. A recent example is the antilock brake system (ABS), with its wheel speed sensors and hydraulic actuators, these components can be used by other system such as traction and vehicles stability control, follow on cruise control and even speedometer drive. If no antilock system,

most automakers would consider using speed sensors on all wheels which would have hinder the triggering of antilock braking system (ABS). It is therefore imperative for Automobile Roadside Mechanics to undergo retraining to acquire the relevant modern skills and impact same on the apprentices to ensure their better performance and satisfaction on jobs and consequently keeping customers coming.

Concept of Job Performance

So many concepts have been put forth on the subject of job performance with respect to a specified context of discussion. Among the most commonly accepted theories of job performance comes from the work of Campbell and colleagues McCoy, Oppler and Sager (1993) asserted that coming from a psychological perspective, they described job performance as an individual level variable. That is, performance is something a single person does. It is something done by the employee. This concept differentiates performance from outcomes. Outcomes are the results of an individual's performance, but they are also the result of other influences. They further clarified that performance does not have to be directly observable actions of an individual.It can consist of mental productions such as answers or decisions. However, performance needs to be under the individual's control, regardless of whether the performance of interest is mental or behavioral.

Despite the emphasis on defining and predicting job performance, it is not a single unified construct. There are vastly many jobs each with different performance standards. Therefore, job performance is conceptualized as a multidimensional construct consisting of more than one kind of behavior Campbell (1990).

Khurmi and Gupta (2007) typically, the basic job of an Automobile Roadside Mechanic is task specific and purely practical in nature. He also stated that most Automobile

Roadside Mechanics cannot easily identify computerized components or parts of modern vehicles; they also lack the very essence of its diagnosis. Rajput (2007) opined that the modern automobile engines are sufficiently complex to discourage, even the professional mechanics because modern vehicles rely on hi-tech electronics for controlling almost every system in them ranging from engine management to entertainment system and climate control. He also went further to state that the job of Automobile Roadside Mechanics is more tasking and involves among others, inspection, diagnosis, repairs and quality maintenance, to use automotive service information such as Vehicle Identification Number (VIN) and the on-board diagnostic (OBD) parameters in conjunction with the hand held diagnostic computer and variety of scan tools and diagnostic machines for repair and diagnostic work.For today's Automobile Roadside Mechanics to move on with the trend of technology thus boosting their job performance and as well keep their big customers coming, they need to posses the right skills to perform the new tasks modern mechanics.

Concept of job satisfaction

The concept of job satisfaction has been defined in many ways. However, the most-used definition of job satisfaction in organizational research is that of Locke (1976) who described job satisfaction as "a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences". Building on this conceptualization, Hulin and Judge (2003) noted that job satisfaction includes multidimensional psychological responses to one's job, and that such responses have cognitive (evaluative), affective (or emotional), and behavioral components.

According Herzberg (1974), there are two factors relating to satisfaction and motivation in the workplace; satisfiers and dissatisfies. Satisfiers relate to the content of the work such as "achievement, recognition for achievement, interesting work, increased

responsibility, growth and advancement Herzberg". He further asserted that dissatisfies are related to how employees are treated and include such items as "company policy and administration practices, supervision, interpersonal relationships, working conditions, salary, status, and security".

Job satisfaction as described by Michael (2004) explains how content an individual is with his or her job. The happier people are within their job, the more satisfied they are said to be. Logic would dictate that the most satisfied ("happy") workers should be the best performers and vice versa. Smith and Stone (1992) defined Job satisfaction as the feelings people have about their jobs. It has been specifically defined as a pleasurable (or unpleasant) emotional state resulting from the appraisal of one's job, especially a job well done, an affective reaction to one's job, an internal state of mind, an attitude towards one's job; it could be associated with a personal feeling of achievement, either quantitative or qualitative. Weiss (2002) stated that the feelings of an Automobile Roadside Mechanic will only culminate at a satisfaction when the vehicle he or she is handling adequately responds after repairs have been done. Job satisfaction takes into account feelings, beliefs, and behaviors of workers with respect to the job at hand. He also went further to say that for Automobile Roadside Mechanics to give standard skilled performance in the diagnosis and repair of modern vehicles which will consequently culminate at satisfaction, the must unavoidably acquire the relevant skills and as well acquire some of the computerized diagnostic equipments utilized in modern vehicle repairs.

Michael (2004) stated that the feelings of satisfaction also tell on vehicle owners whether the faults have been resolved by the Automobile Roadside Mechanic or otherwise. Vehicle owner can attest to the fact that they usually feel a great sense of relief, satisfaction and happiness whenever their vehicle faults are resolved. He also went further to opine that the other hand, they may feel a great deal of burden, dissatisfaction and sadness whenever

their vehicle faults still noticed even after repairs. These striking challenges are well potentiated enough to threaten the basic skills to performed tasks of modern Mechanics. He further said that Vehicle Owners lack confidence in Automobile Roadside Mechanic and also believe that Automobile Roadside Mechanics have insufficient skills for the diagnosis and repair works and thus

Apprenticeship System of Training Automobile Roadside mechanics

According to Uwameiye and Iyamu (2007), Apprenticeship is contractual agreement undertaken by the master craftsman and the apprentice through which the apprentice is trained for a prescribed work process through practical experience under the supervision of the master craftsman. It is a form of work place learning, which enables the apprentice to have on the job training. In Nigeria, apprenticeship has been an age long method used in training young people in trades as crafts agriculture, business and catering. Roadside auto mechanic apprenticeship is characterized by a contract agreement between a wayside master auto mechanic and his apprentice. In the contract a fixed fee is made payable by the apprentice to the master and in return, the apprentice is attached to the master's shop for a stipulated training period. The training place is a workshop set up, made up of the master mechanic and the apprentice. In most cases, where more than one apprentices, the master has full control of the training without any input from the government.

Although roadside apprenticeship has contributed immensely to the growth of the Nigeria economy, the training provided falls below modern training procedures (Okoro, 1993). There seem to be numerous lapses in the indigenous roadside apprenticeship. The Nigeria roadside apprenticeship is unorganized and unstructured. The indigenous apprenticeship as currently practiced lacks formal orientation and there is no curriculum used in the teaching of apprentices. What is taught depends on the jobs available and faults or problems at hand. There is no structural arrangement and organization of content in this

approach. What is taught seems arbitrary and haphazard. The mode of instruction is observation, practice and explanation (if question are asked). This is learning by imitation.

Okoro(1993) further reveals that it does not involve teaching of theoretical principles and the mode of training does not prepare apprentices for opportunities to judge situations based on available theoretical principles. The apprentice is trained to be like his master since they will definitely become Automobile Roadside Mechanics in the long run. Among the defects of the roadside apprenticeship system are lack of proper evaluation method and the possibility of poor skill formation in the apprentice who studied under a master with poor skills. Customers determined the mastery of apprentices through consistent approval of services rendered by the apprentices. Consistency in successful diagnosis of faults or demonstration of skill shows mastery. The expiration of the contract agreement does not mean that the apprentice is qualified. Learning through the apprenticeship system hinders skill acquisition and development by the apprentice and reduce their ability to repair modern motor vehicle. To be able to provide useful contributions to the national economy, these apprentices require a strong updating in technology and theoretical principles (Uwameiye andIyamu, 2007).

The more sophisticated automobiles become in North America, Europe, and Japan, the more difficult it is to service those exported to developing countries. This situation is Obvious in Nigeria where there is a low number of formal sector automobile service companies, thus leaving the informal sector with the tedious task of servicing cutting edge technology in modem automobiles. These auto mechanics use three major ways in servicing recent automobiles namely: reconverting to older models, manufacturing worn-out components and cannibalizing components from another recent model of the same car it (Ogwo, 2004). This maintenance technique gives an overview of the skills development situation of the informal sector automobile industry which could be more appreciated by

having an overview of the personnel and resources available in the sector.

The auto industry is one of the largest in the Nigerian informal sector. It includes a range of tradesmen auto mechanics, auto technicians, auto body mechanics, spare part dealers, vulcanizes etc. Ogwo (2004) reveals that many of the mechanics are ex-workers of the multinational auto companies while others are the products of the apprenticeship training programme of the informal sector. He further stated that the primary mode of admission into the apprenticeship program is through parental guardian recommendation and oral interview. The fees charge range from less than ₦5,000 to ₦10,000 (naira) for a training period of 3 to 4 years (auto electricians) or 5 to 6 years (auto mechanics) and there is basically no written curriculum for training the apprentices rather the nature of the clients (customers) reported problems dictates what an apprentice learns (Ogwo,2004).

Other skills development problem facing the informal automobile sector include lack of diagnostic or repair equipment, no regular or widespread retraining technical program (except for the fairly expensive one organized by Peugeot assembly of Nigeria in Kaduna which does not target the informal sector directly) and the non provision for the informal sub sectors in the National Automotive Policy (Uwameiye and Iyamu, 2007). Faced with these problems it is apparent the sector finds it increasingly difficult to copewith the maintenance of modern automobiles.

Indeed innovative policies are needed to provide sufficient stimuli for formal automobile companies to invest in training and the salvaging of the skills development situation in the informal auto industry (Mani, 2001).

The government needs to provide enabling policies targeted at the motor companies, foreign investors and international NGOs and agencies for retraining of the auto mechanics, regulating and certifying the training offered by the apprenticeship programmes.

Mani (2001) lamented that it amount to policy inconsistency to expect Nigeria citizens to

buy eight year old cars without also providing for their maintenance, especially as few citizens can afford the maintenance charges of the formal sector automobiles companies. Against the background of globalization, international agencies and regional bodies should established diagnostic centers and commission the development of capacity building programmes otherwise the roadside auto mechanic will be compromising the well being of the vehicles, their owners, other road users and economy of entire country. Help is needed right now.

New Approach for Automobile Diagnosis and Repairs

Today's, automobiles rely upon electronics and computers to control and monitor all aspects of vehicle operation such as speed, engine revolution per minute (RPM), coolant temperature, and oxygen sensor (Wikipedia, 2012). William and Donald (2007) reveal that, modern automobiles contains numerous on board computer chips which work in collaboration with the automotive electronic control unit (ECU) to monitor and control many systems such as the engine, transmission, power train, airbags and the antilock brake.

The **electronic control unit or module (ECU/ECM)**is the automotive system computer that receives information or signals from sensors and is programmed to centrally operate various systems, circuits, and actuators based on the information received. **Sensors** are input devices that convert physical conditions into electrical signals and send it to the ECU, while the **actuator** is an output device that converts electrical signals from the ECU into mechanical motion (Salami, 2004). While driving, if the vehicle's on board computer system detects a problem, the driver is informed using the "check engine" or "service engine soon" light on the vehicles dash board. This light is also known as the malfunction indicator light (MIL). When this light illuminates, a diagnostic trouble code is saved into the computer memory, ready for a scan tool to read the value and diagnose appropriately (Khurmi and

Gupta, 2007).

Scan tool: A scan tool is a device used to access on board diagnostic (OBD) information from the automotive computer memory (Kirpal, 2006). There are different sizes and shapes of scan tools. The two basic types of scan tools are the "stand alone" scan tool which does not require a computer and the "personal computer" (PC) based scan tools which requires a computer for its operation. Scan tools function only if it has good diagnostic software's which cost about ₦10,000 to ₦15,000 (naira). A scan tool cost between ₦100,000 to ₦300,000 (naira) depending on the capacity or number of vehicle makes and model it diagnose and repair.

Importance of scan tool: Hillier and Rogers (2007) reveals the following about the importance of scan tools: that scan tool help the auto mechanic to read diagnostic trouble code (DTC) reported by the ECU. DIC is a combination of alphabet and numbers which the ECU displays when there is a fault in the vehicle. The scan tool displays in real time, the value measured by any sensor. For instance, the diagnostic trouble code P0503 means (vehicle speed sensor intermittent).

- The vehicle in for repair makes you an informed consumer. For example, if the DIC indicates a faulty vehicle speed sensor and the auto mechanic talks about brake failure or engine overhaul, you will know the auto mechanics is wrong and therefore, you will want a second opinion before leaving the vehicle for repair. It helps consumers to access the job skills and competencies possess by auto mechanics.

- Scan tool is used for checking or evaluation when purchasing a used or 2nd hand vehicle to discover any possible mechanical or electrical problems.

- Once the vehicle is repaired, the scan tool can be used to erase the diagnostic trouble code and to extinguish the check engine light.

- A scan tool reads codes, clear codes and can tell which parts needs to be replaced. It can be used for advance diagnostics work.

- Code Reader: A code reader is a diagnostic tool that can access and display codes and also read diagnostic trouble codes. A code reader can also clear codes to turn off the malfunction indicator light (MIL). Rajput (2007) reveals that a code reader cannot be used for advanced diagnostic work because a code reader itself cannot tell you which Paris needs to be replaced. Therefore, he recommends a scan tool for advanced diagnostics word and trouble shooting. Trouble shooting in motor vehicle is the process of finding faults in a vehicle.

SCAN TOOL **CODE READER**

On board diagnostics (OBD): According to Wikipedia (2009) on board diagnostics (OBD) in an automotive context, is a generic term referring to vehicles self diagnostic and reporting capability. OBD is a computer based system found on most modem vehicles, whose main function is to control and monitor the emission levels. Duffy and smith (1992) pointed out that, it was the introduction of on board computers on vehicles in 1980 that made on board

diagnostics (OBD) possible. Google books (2010) reveal that there are three version of OBD: OBD -1, OBD-1.5 and OBD-11. OBD 11 is an improvement over OBD -1 in both capability and standardization OBD 1.5, a hybrid of OBD 1 and OBD 11. OBD-1 was an encouragement for auto manufactures to design reliable emission control system on motor vehicles throughout their useful life. It was also reveal that OBD-111 is in the regulatory development phase and involves more advance emission control and report capabilities. Scan tools that are compatible with OBD-11 are called OBD -11 scan tools and can either be stand alone or PC based OBD 11scan tools. European on-board diagnostics (EOBD) is a version of OBD -11 required in Europe since model year 2003 for diesel vehicles and since 2001for gasoline vehicles while Japanon board diagnostics (JOBD) is a version of OBD-l l for vehicles sold in Japan (Coombes, 2004).

OBD **Compatibility:**Coombes and Rogers (2006) reveals that it is only vehicles having OBD II certified logo under their hood(bonnet) that can be diagnose, repair and maintain using OBD II scan tools. Some old vehicles' made in 1980 and above are OBD II certified while some are not. To know if your vehicle is OBD II complaint, lift the hood (bonnet) and look for the OBD II certified sticker below:

Some 1994 and 1995 models are also supported. To see if your vehicle is compliant, pop the hood and look for this sticker:

To use scan tool, the scan tool is plug through the electric connector into a standardized socket usually under the dashboard in the diver's corner or in the vehicle hood (bonnet). Most scan tools use for diagnostics are portable hand-held scan tools.

National Automotive Council (NAC): the National Automotive Council is a product of the national automotive policy established in 1993 to regulate, monitor and control the activities in the automotive industry in Nigeria. It ensures standardization of teleological practices in Nigeria within the automotive industry (FRN, 1993).

Automotive Service Excellence (ASE): The national institute for automotive service excellence (ASE) was established in 1972 in America to regulate, and improve the quality of vehicle repair and service through the testing and certification of repair and services of automotive technician all over the world. The ASE certified technicians are highly respected in the automotive service industry and gets more jobs and pay. The (ASE) certificate enables consumers to distinguish between competent and incompetent automotive technician. Nigerians who wish to have ASE certification can undergo ASE certification courses for modern automotive technicians online (Wikipedia, 2010) or in ASE centers in Lagos, Abuja, Porthacourt, Kaduna, Anambra, and Kano.

ASE certified training programme are carried out in automotive workshop equips with variety of scan tools and computers under supervision and instruction from ASE certified instructors and ASE master certified instructors.

In Nigeria today, it is important for automotive technicians to acquire basic knowledge and skills in the use of scan tools for auto maintenance.' diagnosis and repair because of the complexity of computerization in modern vehicles. In fact, for advanced diagnostics on today's vehicles, a scan tool is an absolute must. It helps the auto mechanics to rapidly carry out advanced diagnosis and repairs within a short time.

Summary of Related Literature

The growth and development of the informal apprenticeship system was discussed. The effect of technological advancemanet in modern vehicle on the apprenticeship system of skill acquisition was also analyzed. Innovations in automobile industry are so obvious in modern vehicles to the extent that, diagnosis, maintenance and repairs are becoming difficult for the road side auto mechanics in Minna. Most of the literature reviewed agreed that apprenticeship system of training roadside auto mechanics has numerous lapses because it is not based on modern pedagogy of training and is therefore gradually losing significance. More so, lapses in the competencies of automobile roadside mechanics in handling modern automobiles appear to pose challenges to their job performance and job satisfaction.

CHAPTER III

METHODOLOGY

This chapter describes the research design, area of the study, population, sample, instrument for data collection, validation of the instrument, administration of instrument, method of data analysis and decision rule.

Research Design

This study employed descriptive survey method, where questionnaires were used to seek for opinions of the respondents. Olaitan and Nwoke (1999) defined a survey of research as a descriptive study in which the entire population or respective sample of the entire population is studied by collecting and analyzing data from the group through the use of questionnaires. Therefore, the survey design was considered suitable since the study will seek information from a sample that was drawn from a population using questionnaires.

Area of the Study

The study was carried out in Minna Metropolis, Niger State, Nigeria. This comprises of the following locations; Bosso, Maikunkele, Tunga, chanchaga, and Kpakungu in Minna Metropolis.

Population

The target population for this study was a total of 70 persons from these locations: Bosso, Maikunkele, Tunga, Chanchaga, and Kpakungu in Minna Metropolis.50 Automobile Roadside Mechanics, 10 from each location. Also,20 Vehicle Owners were selected from the above stated five locations, 4form each locations.

Sample

Convenient sampling was used in this study as a result of the scattered settlement or locations of Automobile Roadside Mechanic workshops Vehicle Owners in Minna Metropolis. Convenient sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher. In other words, subjects are selected just because they are easiest to recruit for the study and the researcher did not consider selecting subjects that are representing the entire population (Aloysius, 1998).

Instruments for data collection

The instrument for data collection was a structured questionnaire developed by the researcher. The questionnaire consists of two sections A and B. B was further divided into 3 sub-sections as shown.

SECTION A: Deals with respondent's personal data. The items here only elicited the personal data of respondents required from him.

SECTION B: Consists 45 questionnaire items:

SECTION B Identify how technological advancement in automobile affects the job performance of Automobile Roadside Mechanics in Minna Metropolis.

SECTION B II: Assessed what affect the job satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

SECTION B III: Determinedways of improving job satisfaction of automobile roadside mechanics in Minna Metropolis.

Validation of the Instrument

The instrument used for the study was validated by 2 lecturers in the Department of Industrial and a Technology Education, Federal University of Technology, Minna. All observations andcorrections raised were effected in the final copy before administering the instrument to the respondents.

Administration of Instrument

A total of 70 questionnaire were administered to the respondents by the researcher and a total of 64 were collect (i.e., 94% returns). Most of the respondents have low educational attainment, some of them secondary school drop outs while some are primary school leaving certificate holders. Where a respondent could not read or write, the researcher interpreted the questions and helped to fill in their responses on the questionnaire.

Method of Data Analysis

The data collected was analyzed using Statistical Mean ($\bar{X}$), Standard Deviation and t-test.

The Statistical Mean ($\bar{X}$) and Standard Deviation were used for analyzing the data collected from the selected respondent while the t-test was used for testing the hypothesis.

A four point rating scale was used to analyze the responses as seen below.

Strongly Agreed (SA) = 4 points

Agreed (A) = 3 points

Disagreed (D) = 2 points

Strongly Disagreed (SD) = 1 points

Scoring of the instrument

The scoring format used to obtain the mean is as follows:

$$\frac{\text{Total number of points}}{\text{Number of point rating}}$$

$$\frac{1 \text{ point} + 2 \text{ points} + 3 \text{ points} + 4 \text{ points}}{4} == \frac{10}{4} == 2.50$$

Decision Rule

To determine acceptance level, mean of 2.50 was used as deciding point between agreed and disagreed. Thus any item with responses with mean of 2.50 and above was considered agreed while responses below 2.50 was considered disagree. Also an inferential statistical t-test was used to test the hypotheses at 0.05 level of significance to compare the mean responses of two groups. A t-critical value of ± 2.00 was selected based on the degree of freedom at 0.05 level of significance.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

This chapter deals with the presentation and analysis of data with respect to the research questions and hypothesis formulated for the study. The result of data analysis for the research questions were presented first followed by those of the hypothesis tested for the study.

RESEARCH QUESTION 1:

To identify how technological advancement in automobile affects the job performance of Automobile Roadside Mechanics in Minna Metropolis?

TABLE 1:

Mean responses of Automobile Roadside Mechanics and Vehicle Owners on how technological advancement in automobile affects the job performance of Automobile Roadside Mechanics in Minna Metropolis.

				$N_1 = 50$	$N_2 = 20$
S/N	**ITEMS**	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}t$	**Remark**
1.	Automobile Roadside Mechanics cannot adequately afford recent automobile diagnostic devices?	1.80	3.20	2.50	Agreed
2.	Automobile Roadside Mechanics lack the basic knowledge of On-Board Diagnostics (OBD) techniques?	3.86	3.60	3.73	Agreed
3.	Automobile Roadside Mechanics face difficulties troubleshoot using various automobile diagnostic devices in modern automobile vehicles?	3.62	2.80	3.12	Agreed
4.	Exhaust gas analyzers for check out the gas emission controls on modern vehicles are too complex for Automobile Roadside Mechanics?	3.80	3.50	3.65	Agreed
5.	Automobile Roadside Mechanics don't know how to interpret diagnostic trouble codes?	3.00	2.80	2.90	Agreed
6.	Automobile Roadside Mechanics cannot utilize code readers to read trouble codes in modern vehicles?	3.42	2.90	3.16	Agreed
7.	Modern troubleshooting devices for modern vehicles are strange to Automobile Roadside Mechanics?	1.40	2.50	1.95	Disagreed
8.	The complexity of electronically controlled systems in modern vehicles easily confuses Automobile Roadside Mechanics?	3.16	3.30	3.23	Agreed
9.	Identifying sensors in modern vehicles is problematic for Automobile Roadside Mechanics?	3.00	3.00	3.00	Agreed
10.	Computerized ignition system is too complicated for Automobile Roadside Mechanics?	3.06	3.00	3.03	Agreed
11.	Proficient handling of faults in the electronic injection system is a problem for Automobile Roadside Mechanics?	3.32	3.60	3.46	Agreed
12.	Automobile Roadside Mechanics are competent enough to handle faults in electronic control units (ECU)?	3.36	3.80	3.58	Agreed
13.	Automobile Roadside Mechanics are competent to repair computerized gearbox faults?	4.50	1.70	3.10	Agreed
14.	Computerized vehicles are never repaired at the Automobile Roadside Mechanics?	2.00	1.50	1.75	Disagreed
15.	Automobile Roadside Mechanics finds it difficult to distinguish between sensors and transducers?	3.12	1.40	2.26	Disagreed

The data presented in table 1 reveal that all the respondents agreed with all the items with mean scores ranging between 1.75 – 3.73.

KEY:

N_1 = number of Automobile Roadside Mechanics

N_2= number of vehicle owners

$\bar{X}_1$ = mean of Automobile Roadside Mechanics

$\bar{X}_2$ = average mean of vehicle owners

RESEARCH QIESTION 2:

What affects the job satisfaction of Automobile Roadside Mechanics in Minna Metropolis?

TABLE 2:
Mean responses of what affects the job satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

			$N_1 = 50$		$N_2 = 20$
S/N	**ITEMS**	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	**Remark**
16	Vehicle owners always complain about vehicle faults even after repair is carried out?	2.00	2.30	2.15	Disagreed
17	Automobile Roadside Mechanics are never diligent in handling sensors and actuators, hence they damage them working while working on modern vehicles?	3.20	3.60	3.40	Agreed
18	Automobile Roadside Mechanics lacks the skill and knowledge on how the how the exhaust gas recirculation (EGR) works, hence may worsen the initial fault?	3.70	3.30	3.50	Agreed
19	Automobile Roadside Mechanics don't know what a code reader does?	3.30	3.60	3.45	Agreed
20	Automobile Roadside Mechanics lack knowledge on the operation of automobile system?	1.36	1.40	1.38	Disagreed
21	Automobile Roadside Mechanics lack the skills on how to use a compression gauge to locate compression pressure leakage in modern vehicles?	3.40	3.40	3.40	Agreed
22	Modern vehicle owners never bring their vehicles for repairs at any Automobile Roadside Mechanics due to fear of worsening the initial fault?	1.60	1.50	1.55	Disagreed
23	Automobile Roadside Mechanics are poor in handling scan tools in maintenance work?	3.70	3.00	3.35	Agreed
24	Owners of vehicles lack confidence in Automobile Roadside Mechanics, thus, they remain with the Automobile Roadside Mechanics until the work is done?	2.70	3.40	3.05	Agreed
25	Automobile Roadside Mechanics cannot repair faults in the electronic control unit of modern vehicles?	3.70	2.90	3.30	Agreed
26	Most automobile Roadside Mechanics are computer illiterate thus they cannot operate modern computerized diagnostic tools?	3.30	3.40	3.35	Agreed
27	Automobile Roadside Mechanics will never scan the electronic control unit/module (ECU/ECM) after sensors are replaced in modern vehicles?	2.80	3.70	3.25	Agreed
28	Automobile Roadside Mechanics easily gets angry when customers complain bitterly about a well done job but not tidy?	1.30	1.40	1.35	Disagreed
29	Automobile Roadside Mechanics never get a "job well done" remark from their customers the vehicle owners?	1.40	1.20	1.30	Disagreed
30	Automobile Roadside Mechanics don't get paid for work/job done?	1.20	1.10	1.15	Disagreed

The data presented in table 1 reveal that all the respondents agreed with all the items with mean scores ranging between 1.15 – 3.50.

RESEARCH QUESTION 3:

What are the ways adopted to improve job satisfaction of Automobile Roadside Mechanics in Minna Metropolis?

TABLE 3:
Mean Responses of Automobile Roadside Mechanics and Vehicle Owners on the ways adopted to improve job satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

		$N_1 = 50$	$N_2 = 20$		
S/N	**ITEMS**	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	**Remark**
31	Automobile Roadside Mechanics should purchase modern troubleshooting devices like scan tools and code readers?	3.80	3.90	3.85	Agreed
32	Automobile Roadside Mechanics should acquire adequate skills through training in the use of code readers trace fault codes?	4.00	3.60	3.80	Agreed
33	Automobile Roadside Mechanics should acquire knowledge on how to identify Automobile sensors?	3.90	3.70	3.80	Agreed
34	Evening schools should be organized for Automobile Roadside Mechanics?	3.00	3.00	3.00	Agreed
35	Periodic training and retraining should be organized Automobile Roadside Mechanics to upgrade their skills, knowledge and technical aptitude?	3.80	4.00	3.90	Agreed
36	Automobile Roadside Mechanics should be able to identify an OBD-II certified vehicle?	3.70	3.60	3.65	Agreed
37	Automobile Roadside Mechanics should learn how to identify Automobile actuators?	3.80	3.80	3.80	Agreed
38	Automobile Roadside Mechanics should understand the principle of operation of the electronic control unit (ECU)?	3.20	3.50	3.35	Agreed
39	Automobile Roadside Mechanics should be able to distinguish between sensors and transducers?	4.00	3.90	3.95	Agreed
40	Vehicle owners should occasionally show some sense of appreciation whenever a job is well done?	4.00	3.60	3.80	Agreed
41	Automobile Roadside Mechanics should acquire the skills and knowledge on how to use the electronic gas recirculation (EGR) to check out the gas emission controls on modern vehicles?	4.00	3.70	3.85	Agreed
42	Vehicle owners are always happy and willing to pay up for a job well done?	4.00	4.00	4.00	Agreed
43	Automobile Roadside Mechanics should use the knowledge and skills of modern diagnosis in the diagnosis of modern vehicles?	3.70	3.80	3.75	Agreed
44	Automobile Roadside Mechanics liaise with university lectures to acquire more knowledge on recent technology in the automobile sector so as to enhance their performance?	2.20	3.40	2.80	Agreed
45	The usage of hydraulic lift by Automobile Roadside Mechanics to lift modern vehicles so as to perform repairs and maintenance work?	3.30	4.00	3.65	Agreed

The data presented in table 1 reveal that all the respondents agreed with all the items with mean scores ranging between 2.80 – 4.00.

Ho_1:

There will be no significant difference in the mean responses of Automobile Roadside Mechanics and Vehicle Owners on how technological advancement in automobile affects the job performance of Automobile Roadside Mechanics in Minna Metropolis.

TABLE 4:
t-test analysis of Automobile Roadside Mechanics and Vehicle owners how on recent technologies in automobile affect the job performance of Automobile Roadside Mechanics in Minna metropolis.

				$N_1 = 50$		$N_2 = 20$	
	S/NITEMS	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	**t-cal**	**Remark**
1	Automobile Roadside Mechanics cannot adequately afford recent automobile diagnostic devices?	1.80	1.36	3.20	0.56	-6.09	NS
2	Automobile Roadside Mechanics lack the basic knowledge of On-Board Diagnostics (OBD) techniques?	3.86	0.12	3.60	0.24	4.42	S
3	Automobile Roadside Mechanics face difficulties troubleshoot using various automobile diagnostic devices in modern automobile vehicles?	3.62	0.79	2.80	1.02	3.23	S
4	Exhaust gas analyzers for check out the gas emission controls on modern vehicles are too complex for Automobile Roadside Mechanics?	3.80	0.04	3.50	0.25	5.06	S
5	Automobile Roadside Mechanics don't know how to interpret diagnostic trouble codes?	3.00	0.90	2.80	0.96	0.80	NS
6	Automobile Roadside Mechanics cannot utilize code readers to read trouble codes in modern vehicles?	3.42	0.60	2.90	1.09	2.02	S
7	Modern troubleshooting devices for modern vehicles are strange to Automobile Roadside Mechanics?	1.40	0.57	2.50	1.45	-3.29	NS
8	The complexity of electronically controlled systems in modern vehicles easily confuses Automobile Roadside Mechanics?	3.60	0.46	3.30	1.01	0.60	NS
9	Identifying sensors in modern vehicles is problematic for Automobile Roadside Mechanics?	3.00	1.24	3.00	0.80	0.00	NS
10	Computerized ignition system is too complicated for Automobile Roadside Mechanics?	3.80	0.20	3.00	1.40	2.74	S
11	Proficient handling of faults in the electronic injection system is a problem for Automobile Roadside Mechanics?	3.32	0.22	3.60	0.24	-4.51	NS
12	Automobile Roadside Mechanics are competent enough to handle faults in electronic control units (ECU)?	3.36	0.60	3.80	0.16	-4.78	NS
13	Automobile Roadside Mechanics are competent to repair computerized gearbox faults?	4.50	0.90	1.70	0.61	14.93	S
14	Computerized vehicles are never repaired at the Automobile Roadside Mechanics?	2.00	1.00	1.50	0.25	3.29	S

15	Automobile Roadside Mechanics finds it difficult to distinguish between sensors and transducers?	3.12	0.55	1.40	0.24	18.20	S

KEY:

N_1= number of Automobile Roadside Mechanics

N_2 = number of Vehicle Owners

SD_1= standard deviation of Automobile Roadside Mechanics

SD_2= standard deviation of Vehicle Owners

t-cal = t-calculated. t-critical (t-table value) = ± 2.00

$\bar{X}_1$ = mean of Automobile Roadside Mechanics

$\bar{X}_2$ = mean of Vehicle Owners

S = significant

NS = not significant

df (degree of freedom) =$(N_1 + N_2)$– 2 = (50 + 20) – 2 = 68

The analysis in table 4 showed that the t-cal values of 8 items; 2, 3, 4, 6, 10, 13, 14 and 15 were greater than the t-value, while 7 items; 1, 5, 7, 8, 9, 11 and 12 were below the t-value (± 2.00)

Therefore, the null hypothesis was rejected for each of the 8 items, while it was accepted for each of the 8 items. This implies that there is no significant difference for items accepted but there is significance difference for the items rejected in the mean rating of Automobile Roadside Mechanics and Vehicle Owners on howtechnological advancement in automobile affects the job performance in Minna Metropolis.

Ho_2:

There is no significant difference in the mean responses of Roadside Automobile Mechanics and Vehicle Owners on what affect the job satisfaction of Automobile Roadside Mechanic in Minna Metropolis.

TABLE 5:
t-test analysis of Automobile Roadside Mechanics and Vehicle owners on what affects the job satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

$N_1 = 50$ $N_2 = 20$

S/N	ITEMS	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	t-test	Remark
16	Vehicle owners always complain about vehicle faults even after repair is carried out?	2.00	1.70	2.30	0.41	-1.17	NS
17	Automobile Roadside Mechanics are never diligent in handling sensors and actuators, hence they damage them working while working on modern vehicles?	3.20	0.96	3.60	0.24	-2.74	NS
18	Automobile Roadside Mechanics lacks the skill and knowledge on how the how the exhaust gas recirculation (EGR) works, hence may worsen the initial fault?	3.70	0.21	3.30	0.61	2.87	S
19	Automobile Roadside Mechanics don't know what a code reader does?	3.30	1.45	3.60	0.24	-0.24	NS
20	Automobile Roadside Mechanics lack knowledge on the operation of automobile system?	1.36	3.47	1.40	0.24	-0.08	NS
21	Automobile Roadside Mechanics lack the skills on how to use a compression gauge to locate compression pressure leakage in modern vehicles?	3.40	0.84	3.40	1.88	0.00	NS
22	Modern vehicle owners never bring their vehicles for repairs at any Automobile Roadside Mechanics due to fear of worsening the initial fault?	1.60	0.84	1.50	0.45	0.64	NS
23	Automobile Roadside Mechanics are poor in handling scan tools in maintenance work?	3.70	0.21	3.00	1.00	3.10	S
24	Owners of vehicles lack confidence in Automobile Roadside Mechanics, thus, they remain with the Automobile Roadside Mechanics until the work is done?	2.70	1.01	3.40	1.88	-1.58	NS
25	Automobile Roadside Mechanics cannot repair faults in the electronic control unit of modern vehicles?	3.70	0.22	2.90	1.29	2.76	S
26	Most automobile Roadside Mechanics are computer illiterate thus they cannot operate modern computerized diagnostic tools?	3.30	1.01	3.40	0.84	-0.42	NS
27	Automobile Roadside Mechanics will never scan the electronic control unit/module (ECU/ECM) after sensors are replaced in modern vehicles?	1.80	0.96	1.70	0.61	0.61	NS
28	Automobile Roadside Mechanics easily gets angry when customers complain bitterly about a well done job but not tidy?	1.30	0.21	1.40	0.24	-1.47	NS
29	Automobile Roadside Mechanics never get a "job well done" remark from their customers the vehicle owners?	1.40	0.24	1.20	0.16	4.06	S
30	Automobile Roadside Mechanics don't get paid for	1.20	0.16	1.10	0.09	3.30	S

work/job done?

The analysis in table 5 show that the t-cal values of all the items were below the t-table value except for 18, 23, 25, 29 and 30. Therefore, the null hypothesis was rejected for each of the five items while it was accepted for the ten items.Hence the opinion of the respondents differed in five items but did not differ in the ten items in relation to the ways to be adopted to enable Automobile Roadside Mechanics to cope with technological advancement in automobile.

FINDINGS

The following findings were made according to the research questions raised for the study. The findings were based on the data collected and analyzed.

Findings related to how technological advancement in Automobile industry affects the job performance of Automobile Roadside Mechanics in Minna Metropolis. Both respondents agreed to the followings:

1. Automobile Roadside Mechanic finds it problematic to identify sensors.
2. Computerized ignition system is too complicated for Automobile Roadside Mechanics.
3. Automobile Roadside Mechanics lack the basic knowledge of On-Board Diagnostic techniques.
4. The complexity of electronically controlled systems in modern vehicles easily confuses Automobile Roadside Mechanics.
5. Automobile Roadside Mechanics face difficulties troubleshooting using various automobile diagnostic devices on modern automobile vehicles.

Findings related to what affect the job satisfaction of Automobile Roadside Mechanics in Minna Metropolis. Both respondents agreed to the followings:

1. Most Automobile Roadside Mechanics are computer illiterate.
2. There is usually of lack of diligence on the part of some Automobile Roadside Mechanics while handling sensors.

3. Vehicle owners believe Automobile Roadside Mechanic's skills are insufficient; therefore they find little confidence in them, thus, they often times remain with them until the job is done.
4. Automobile Roadside Mechanics lackknowledge on the operation of automobile system.
5. Automobile Roadside Mechanics lacks the skills on how to use a compression gauge to locate compression pressure leakage in modern vehicles.
6. Automobile Roadside Mechanics cannot repair faults in the Electronic Control Unit of modern vehicles.

Findings related to ways adopted to improve job satisfaction of Automobile Roadside Mechanics in Minna Metropolis. Both respondents agreed to the followings:

1. Evening schools should be organized for Automobile Roadside Mechanics.
2. Periodic training and retrainingprogrammes should be organized for Automobile Roadside Mechanics to upgrade and update their skills, knowledge and technical aptitude.
3. Vehicle owners should show some sense of appreciation whenever a job is well done.
4. Automobile Roadside Mechanics should acquire the skills and knowledge on how to use the exhaust gas analyzer to check out the gas emission controlon modern vehicles.
5. Automobile Roadside Mechanics should purchase modern troubleshooting devises like scan tools and code readers.
6. Automobile Roadside Mechanics should be able to identify OBD-II certified vehicles.

DISCUSSION OF FINDINGS

The findings also revealed Automobile Roadside Mechanic finds it problematic to identify sensors. This agrees with Khurmi and Gupta (2007) in saying that, typically, the basic job of an Automobile Roadside Mechanic is task specific and purely practical in nature and most Automobile Roadside Mechanics cannot easily identify computerized components or parts of modern vehicles, also, they lack the very essence of its diagnosis.

The findings also revealed that computerized ignition system is too complicated for Automobile Roadside Mechanics. It also revealed that Automobile Roadside Mechanics cannot read trouble codes much more interpret them. This is in line with the findings of Mandell (1986) who pointed out that to be prepared to cope with the changes technology brings, computer literacy brings and computer application must be emphasized in the training centers.

The findings also indicated that Automobile Roadside Mechanic lack the basic knowledge of On-Board Diagnostic (OBD) techniques. This agreed with Cranny, Smith and Stone (1992), theystated that for Automobile Roadside Mechanics to lack the require skills and knowledge needed to perform adequate and accurate diagnosis, repairs, and maintenance of modern vehicles, the job performance and satisfaction of the Automobile Roadside Mechanics will be greatly impinge and counterproductive to the Automobile Roadside Mechanics.

The complexity of electronically controlled systems in modern vehicles easily confuses Automobile Roadside Mechanics. This is in the view point of Coombes and Rogers, (2006)

who in their opinion stated that the complexity of electronically controlled vehicle systems easily posse confusion to someAutomobile Roadside Mechanics.

Automobile Roadside Mechanics face difficulties troubleshooting using various automobile diagnostic devices on modern automobile vehicles. In line with this statement,Coombes and Rogers, (2006) also disclosed that as a result of the prevailing existence of hi-tech and increasingly newer computerized diagnostic equipments, most Automobile Roadside Mechanics who are unexposed to these technologieswill suffer unavoidably the difficulties of proficiently utilizing troubleshooting devices designed for modern automobile vehicles diagnosis and repairs.

Findings from Table 2 of this study indicated thatAutomobile Roadside Mechanics are computer illiterate. This agrees with Adeniba (1996) who said that with great consideration on the dynamic nature of computer technology, a nation that will exist in this technology age must not operate below a particular level of computer literacy and usage. More so, for Automobile Roadside Mechanics, their exposure to computer application programmes will help build their ability to perform some operations on the computer since all of the automobile diagnostic equipments are basically computerized.

Findings also indicated that Automobile Roadside Mechanics usually complicates simple faults during troubleshooting. This also agreed with Ogwo (2004) who lamented that the crude methods, manual tools and equipments used by Automobile Roadside Mechanics usually complicates minor automobile faults or creates new problems in the system.

The findings of the study also revealed that Vehicle Owners believe Automobile Roadside Mechanic’s skills are insufficient and lack confidence in Automobile Roadside Mechanics. This is in line with Ogwo (2004) who revealed that Owners of modern vehicles lacks

confidence in Automobile Roadside Mechanics to service cutting edge technology in modern vehicles.

The findings of the study also indicated that Automobile Roadside Mechanics should be taught theoretical operational principles of automobile technology. This agrees with Gupta (2007) who revealed that most Automobile Roadside Mechanics are void of the fundamentals of the theoretical operational principles of automobile technology.

The findings reveal that Automobile Roadside Mechanics lacks the skills on how to use a compression gauge to locate compression pressure leakage in modern vehicles. This thus agrees with Khurmi and Gupta, (2007) who in their opinion, stated that for any Automobile Roadside Mechanic to cope up with the fast moving trend of technology on automobiles, they must acquire those performance skills in proficiently handling various computerized diagnostic equipments for the diagnosis and repair of modern automobiles.

Findings from the study indicated thatFaults in the electronic control unit (ECU) are too complicated for Automobile Roadside Mechanics. This also is in the view point ofCoombes and Rogers, (2006) who stated that the complexity of electronically controlled vehicle systems easily posse confusion to someAutomobile Roadside Mechanics.

Findings from the study indicated that Automobile Roadside Mechanics usually get well paid for job done; this was asserted by Khurmi and Gupta, (2007) Vehicle Owners when satisfied with repair works done by Automobile Roadside Mechanics, pay standard price – a good sum of money. Usually some Automobile Roadside Mechanics have standardized charges for services rendered.

Findings from table 3 revealed that evening schools should be organized for Automobile Roadside Mechanics. This view was supported by Uwameiye and Iyamu (2007) who recommended that, to be able to provide useful contributions to the National Economy,

Automobile Roadside Mechanics must be provided with some form of formal education to reconstruct a sound base of logical reasoning and simple analysis of faults in modern vehicles.

Findings from the study indicated that periodic training and retraining courses should be organized by Automobile Roadside Mechanics to upgrade their performance skills. This was buttressed by Mani (2001) who asserted that innovative policies are needed to provide sufficient stimuli for informal automobile companies to invest in training, retraining and salvaging of the skills development situation in the informal auto industry.

Findings also indicated that it is of grave benefit or importance for Vehicle Owners tooften show some sense of appreciation whenever a job is well done. This therefore is in line with the above statement, Hillier et al(1991)noted that noted that, for a very good and thorough job performed by Automobile Roadside Mechanics, customers; Vehicle Owners, should learn to say “thanks” as a sign of gratitude and appreciation which won’t cost much, regardless of the fact that you the Vehicle Owner is actually paying for the services rendered.

Findings culled from this study also revealed that Automobile Roadside Mechanics should acquire the skills and knowledge on how to use the exhaust gas analyzer to check out the gas emission control on modern vehicles. This agrees with Khurmi and Gupta, (2007) who in their opinion, stated that for any Automobile Roadside Mechanic to cope up with the fast moving trend of technology on automobiles, they must acquire those performance skills in proficiently handling various computerized diagnostic equipments for the diagnosis and repair of modern automobiles.

Findings from this study revealed that it would be of grave benefit to Automobile Roadside Mechanics when they purchase computerized diagnostic equipments for diagnosing and repairing modern vehicles. This was buttressed by Weiss (2002) as he stated that for

Automobile Roadside Mechanics to give standard skilled performance in the diagnosis and repair of modern vehicles which will consequently culminate at satisfaction, the must unavoidably acquire the relevant skills and as well acquire some of the computerized diagnostic equipments utilized in modern vehicle repairs.

From the findings, it was indicated that it is of benefit if Automobile Roadside Mechanics are able to identify OBD-II certified vehicles. This agrees with Kripal (2006) who stated that Automobile Mechanics are also known as service technician should acquire those skills, knowledge so as to enable them identify vehicles that are OBD-certified.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of the study

In the quest to satisfy the dynamic nature of human needs, vehicles manufactured by Automobile industries nowadays are incorporated or dominated with high level electronic components or devices which has really altered processes and procedures involved in their repair and maintenance as they require certain computerized diagnostic tools. This has led to the discouragement of Automobile Roadside Mechanics as they find it absolutely challenging and frustrating to handle modern vehicles as it negatively affects their job performance and satisfaction.

The technological advancement made in automobiles has altered the technical competence or work skills needed by Automobile Roadside Mechanics for effective repair and maintenance of modern vehicles. This is why this study tends to determine the impact of technological advancement on the job performance and satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

The study used a survey research approach to find out how the technological advancement in automobile affect the job performance of Automobile Roadside Mechanics in Minna Metropolis, what affect the job satisfaction of Automobile Roadside Mechanics and ways to adopt to improve job satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

Forty five (45) items were generated in the questionnaire to elicit the required information from Automobile Roadside Mechanics and Vehicle Owner's responses. The questionnaire was validated by 2 lectures in the Department of Industrial and Technology Education. A total of 70 validated questionnaires were issued to 50 Automobile Roadside Mechanics and 20 Vehicle Owners in Minna Metropolis. The instruments used for data collection was analyzed using mean, standard deviation and t-test statistics.

Implications of the Study

It could be deduced from the study that technological advancement in automobile adversely affects the job performance and satisfaction of Automobile Roadside Mechanics in Minna Metropolis. This implies that technological advancement has greatly reduced the performance skills and satisfaction of Automobile Roadside Mechanics. This study also has implication for the challenges posed by technological advancement in the handling of modern vehicle. This implies that the training and retraining of Automobile Roadside Mechanics is insufficient because of the following deficiencies: dearth of curriculum, dearth of theoretical principles, dearth of standards for evaluation and falls bellow modern teaching procedures and dearth of interest of most Automobile Roadside Mechanics. This also implies that so long as the deficiencies are corrected, the Automobile Roadside Mechanics will acquire the relevant knowledge and develop modern performance skills needed for them to improve job performance and satisfaction.

The findings of the study will also assist the federal government as they will be able to lease with the various state representatives of the National Automotive Councilto draw out plans on programmes to provide adequate facilities and personals that will make available modern performance skills on that are required for repairing and maintaining of modern vehicles. By so doing, skilled and knowledgeable Automobile Mechanics will be produced

who will in turn train other upcoming Automobile Mechanics, thus perpetuating the trend of skilled and knowledgeable Automobile Mechanics in every state of the federation and the country in general.

Conclusions

In conclusion, it was discovered form the study that the technological advancementin automobile adversely affected the job performance of Automobile Roadside Mechanics in Minna town due to the deficiencies or inadequacies of trainingprogrammes organized for Automobile Roadside Mechanics.

To this end, it therefore mean that efforts should be made in the direction of not just planning but as well implementing a realistic curriculum that shall be used to train of Automobile Roadside Mechanics who want it, need it and can make profit by it, thereby enabling them acquire and possibly develop modern work skills needed for the repair and maintenance of modern vehicles, thus boosting their job performance and satisfaction as well in the efficient handling of simple and complex faults on modern vehicles.

Another very important thing to mention is the issue pertaining to the interest of Automobile Roadside Mechanics. It is of grave importance that they develop interest in the utilization of technological advancementused to diagnose faults in modern vehicles; this will help by serving as a drive to go for more retraining programmes.

Vehicle Owners should also show some sense of concern by wisely advising Automobile Roadside Mechanics who are their customers to improve their performance skills on the repair and maintenance of modern vehicles so as to enable them perform better on their jobs which will definitely culminate at satisfaction in the end.

Recommendations

Based on the findings of the study the following recommendations are made:

1. Automobile Roadside Mechanics should change their mentality on acquiring performance skills and knowledge in handing computerized diagnostic equipments and its applications thus become mechca-tronics and as well computer literate.
2. Bodies like, Auto Professionals and Experts like National Automotive Council (NAC), should teach Automobile Roadside Mechanics how to identify on-board-diagnostic devices and their principal application on modern vehicles.
3. Automobile Roadside Mechanics should attend evening school to obtain theoretical knowledge that governs the operations and technicalities accompanying various systems of modern vehicles.
4. Federal Ministry of Works and Transportation in collaboration with the National Automotive Council (NAC) should provide necessary and relevant facilities that would be used for impacting into Automobile Roadside Mechanics the practical applications of computerized diagnostic equipments to enable them adequately cope with the prevailing recent technologies in modern vehicles.
5. Automobile Roadside Mechanics should be taught the basic principle guiding the operations of the brain box technically referred as Electronic Control Unit (ECU) and possibly how it can be repaired.
6. Automobile Roadside Mechanics should be taught how indentify an OBD-certified vehicle.

7. Automobile Roadside Mechanics should equip their workshop with moderncomputerized diagnostic equipments in order to cope with the repairs due to the fast growing trend of hi-tech vehicles in the automobile industry.
8. Automobile Roadside Mechanics should develop personal interest for computerized diagnostic equipments to enhance satisfaction.

Suggestions for further research

Based on the finding of the study, the following suggestions were made for the study:

1. Developing a curriculum for the training and retraining of Automobile Roadside Mechanicson the use of sophisticated and computerized automobile diagnostic equipment.
2. The implication of technological advancement to the 21st century.
3. Developing a mechanism that will enable Automobile Roadside Mechanics acquire and develop those performance work skills needed to improve their job performance and satisfaction.

References

Adeniba, S. B. (1996) Pre University Computer Education inn Nigeria, Policy and Prospectects. *Journal of National Association of Teachers of Technology* (NAAT), Lagos: West Publishing Company 1(6), pp 26 – 30.

Aloysius, E. U. (1998). *Practical guide to writing Research Project Reports in Tertiary institutions.* John Jacobs Classic Publishers Ltd, Enugu pp. 76 – 77.

Amitabh, S. (2009). Why Innovation is Important. Retrieved on 28th June, 2012 form http://innovation.tech.org.

Bono, L. H. and Judge G. K. (2003).*The Extensive Concept of Job Performance and Satisfaction.*Retrieved on June 23th from http://www.jst.org/stable/html.

Campbell, J. P. (1999). *Research on Job Performance in Organizations.*Smith Stably Publishing Company Ltd. pp. 99 – 103.

Durham, U. O. (1999).*The Relationship between Organizational Culture and Job satisfaction.* Sherike Publishing House Ltd, Delhi. pp. 123 – 125.

Federal Republic of Nigeria (1993) National Automotive Council Guidelines. Lagos, Federal Minister of Industry. 19.

Gonwalk, N. L. (2010). *Technology Education for National Development.*Conference paper of the Nigerian Association of Teachers of Technology held in University of Jos. 20th November 1990. pp. 5 – 6.

Google Books (2012).OBD Analysis.Retrieved on July 21st from http://translate.google.com//OBDhtml.

Herzberg, et al. (1974).*The Concept of Job Satisfaction and motivation in organizations.*Hamburg Publishing Company Ltd, Germany. pp.87 -89.

Hillier et al (2004) *fundamentals of Motor Vehicle Technology,* 5th Edition.Nelson Thornes Ltd. United Kingdom. pp. 150 – 156.

CoombesP and Rogers D. (2006) *Power Train Electronics.*5th Edition.Nelson Thornes Ltd. U. K. pp. 120 – 125.

Hulin, G. I. and Judge, G. (2003).Job Satisfaction Postulations.Retrieved on July 15th from http://www.jsti.org/Hulin/Judge/job.html.

Khurmi, R .and Gupta J. K, (2007).*Mechanical engineering*Erasia Publishing House Ltd, Delhi. pp. 455 – 458.

Kirpal, S. (2006) *Automobile Engineering*. (2) 46. Lomus offset press, Dehli.

Larson, C. F. (2000). R&R in Industry.Retrieved on August 27th from http://www.iriline.org on July 23th, 2012.

Locke, K. (1976). *Job Performance and Satisfaction.*Marks Gillian Publishing Company Ltd, Frankfurt, Germany. pp. 125 – 127.

Mani. S. (2001) Globalization and the Retrieved from http//www.iriline.org on August 27th, 2012.

Mendell, S. L. (1986). Computer Literacy for Technological Advancement.Retrieved on August 30th from http://www./computer/litracy/org/html.

Nystron, D. (1977). The Changing Role of the Curriculum Education.*Journal of Industrial Teachers Education*8, (3), pp. 5 – 8.

Ogwo, B. A. (2004). Informal Sector Technical Skills Development Experiences in the Maintenance of Modern Automobile in Nigeria. Retrieved on August 27th from http://www.intech.unu.ed

Okoro, O. M. (1993) *Principles and Methods In Vocational And Technical Education In Nigeria.* University Trust Publishers.Nsukka pp. 58 - 59.

Olaitan, S. O. and Nwoke, A. (1999).*Research in vocational and technical Education,* Onitsha; Noble Graphics Press. pp. 42 – 46.

Oppler, N. J. and Sager, U. (1993).*The Psychology of Job Performance.*Junil Publishing Company Ltd, New Dehli. pp. 227 – 229.

Peter, D. (2009) Innovation in Motor Vehicles. Retrieved on 12 July from http://innovation.journal/data/html.

Rajput, R. K. (2007). *Internal Combination Engines*.LaximaiPulications Ltd New Dehli. pp. 135 – 139.

Salami, K. A. (2004) Auto Technology Fundamental.*Series II, Ibadan* University Press. pp. 34 – 38

Salami, K. A. (2007). Emission Control Technology by Automotive Industry: Trends and challenging. *Inaugural lectures series 10 presented at the Federal Ninesity of Technology*, Minnapp. *1- 17*

Schumpeter, J. (1948). The Theory of Economics Development.Harvard University Press. Boston. Retrieved from http://www.harvard.books.com/html

Ukongon, M. C. (1997), Techncal and Vocational Education as a shock absorber for unemployment strees. Journals of technocal Education in Nigeria (JOKEN) (8). pp. 49 – 51.

Uwameiye, R. and Iyamu E. O. (2007). Training Methodology used by the Nigerian Indigenous Apprenticeship Systems. Retrieved on August 27th from http://www.voc.edu.journal/data/html.

Weiss HM, Cropanzano R. (1996). Affective events theory: a theoretical discussion of the structure, causes and consequences of affective experiences at work. Research in Organizational Behavior 8: 1±74.

Weiss HM, Nicholas JP, Daus CS. (1999). An examination of the joint effects of affective experiences and job beliefs on job satisfaction and variations in affective experiences over time. Organizational Behavior and Human Decision Processes 78: 1±24

Weiss, H. M. (2002). Deconstructing job satisfaction: separating evaluations, beliefs and affective experiences. Human Resource Management Review, 12, 173-194

Wikipedia (2012).Automotive Service Excellence.Retrieved on June 30th from http://ASEcertification/online.html.

Wikipedia (2012).Job performance and satisfaction.Retrieved on June 16th from http://wikibooks/jobperformanceandsatisfaction.org/mahtml.

Wikipedia (2012).Modern Automotive Service Technicians.Retrieved on June 30th from http://mast/course.com.html.

William, H. C. and Donald, L. A. (2007).*Automotive mechanics.*McGraw Hill Publishing Company Ltd, New Delhi. pp. 222 – 229.

APPENDIX A

APPENDIX B

FORMULAR

Mean $\bar{X} = \frac{\sum fx}{\sum f}$

$\bar{X}$ =Mean

$\sum$ = The Sum of

X = The Frequency of each point in the scale

Standard deviation

$$SD = \sqrt{\frac{\sum f(x-\bar{x})}{\sum f}}$$

X = Mean

$\sum$ = The Sum of

X = The Score

F = The Frequency

t-test Formula

$$t\text{-test} = \frac{\bar{X}-\bar{X}2}{\sqrt{\frac{s_1^2}{N_1}+\frac{s_2^2}{N_2}}}$$

$\bar{X}_1$ = Mean Score of Automobile Roadside Mechanics

$\bar{X}_2$ = Mean Score of Vehicle Owners

S_2 = Variance of Automobile Roadside Mechanics

S_1 = Variance of Vehicle Owners

N_1 = Number of Automobile Roadside Mechanics

N_2 = Number of Vehicle Owners

Hypotheses 1, item 1, standard for Automobile Roadside Mechanics responses

S/N	F	FX	$X - \bar{X}$	$(X - \bar{X})^2$	$F(X - \bar{X})^2$
4	35	140	0.20	0.04	1.40
3	10	30	-0.80	1.60	16.0
2	5	10	-1.80	3.24	16.20
1	0	0	-2.80	7.84	0.00
	$\sum f = 50$	$\sum fx = 190$			$\sum f (X - \bar{X})^2 = 33.60$

$$\bar{X}_1 = \frac{\sum FX}{\sum F} = \frac{190}{50} = 3.80$$

$$S_1^2 = \frac{\sum f (X - \bar{X})}{\sum F} = \frac{33.60}{50} = 0.70$$

$$SD_1 = \sqrt{\frac{\sum f (X - \bar{X})2}{\sum f}} = \sqrt{\frac{33.60}{50}} = \sqrt{0.70} = 0.84$$

Hypotheses 1, item 1, standard for Automobile Roadside Mechanics responses

S/N	F	FX	$X - \bar{X}$	$(X - \bar{X})^2$	$F(X - \bar{X})^2$
4	10	40	0.75	0.57	5.70
3	5	15	-0.25	0.06	0.30
2	5	10	1.25	1.56	7.80
1	0	0	-2.25	5.06	0.00
	$\sum f = 20$	$\sum fx = 65$			$\sum f (X - \bar{X})^2 = 13.80$

$$\bar{X}_2 = \frac{\sum FX}{\sum FX} = \frac{65}{20} = 3.25$$

$$S_2^2 = \frac{\sum f (X - \bar{X})}{\sum F} = \frac{13.80}{20} = 0.69$$

$$SD_1 = \sqrt{\frac{\sum f (X - \bar{X})2}{\sum f}} = \sqrt{\frac{13.80}{20}} = \sqrt{0.69} = 0.8$$

t-calculated =

$$= \frac{\bar{X} - \bar{X}2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}} = 2.31$$

$$\frac{\bar{X} - \bar{X}2}{\sqrt{\frac{0.84}{50} + \frac{0.80}{20}}} = \frac{0.55}{0.24} = 2.31$$

t-calculated = 2.31

APPENDIX C

FEDERAL UNIVERSIT Y OF TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

RESEARCH QUESTIONAIRE

AUTOMOBILE ROADSIDE MECHANICS AND VEHICLE OWNERS

QUESTIONAIRE

Research Topic: Impact of technological advancement on the job performance and satisfaction of Automobile Roadside Mechanics in Minna Metropolis.

Instruction: Please read the questions and respond appropriately. Indicate your choice with a tick [✓]

Response option: Strongly Agree = SA, Agree=A

Disagree = D, Strongly Disagree = SD

SECTION A:

NAME OF AUTOMOBILE WORKSHOP…….....

……

……

LOCATION……

……

AUTOMOBILE ROADSIDE MECHANIC ☐ VEHICLE OWNER ☐

Please tick appropriately.

SECTION B

QUESTION 1:

To identify how technological advancement in Automobile industry affects the job performance of Automobile Roadside Mechanics in Minna Metropolis?

	Items	SA	A	D	SD
1	Automobile Roadside Mechanics cannot adequately afford recent automobile diagnostic devices?				
2	Automobile Roadside Mechanics lack the basic knowledge of On-Board Diagnostics (OBD) techniques?				
3	Automobile Roadside Mechanics face difficulties troubleshoot using various automobile diagnostic devices in modern automobile vehicles?				
4	Exhaust gas analyzers for check out the gas emission controls on modern vehicles are too complex for Automobile Roadside Mechanics?				
5	Automobile Roadside Mechanics don't know how to interpret diagnostic trouble codes?				
6	Automobile Roadside Mechanics cannot utilize code readers to read trouble codes in modern vehicles?				
7	Modern troubleshooting devices for modern vehicles are strange to Automobile Roadside Mechanics?				
8	The complexity of electronically controlled systems in modern vehicles easily confuses Automobile Roadside Mechanics?				
9	Identifying sensors in modern vehicles is problematic for Automobile Roadside Mechanics?				
10	Computerized ignition system is too complicated for Automobile Roadside Mechanics?				
11	Proficient handling of faults in the electronic injection system is a problem for Automobile Roadside Mechanics?				
12	Automobile Roadside Mechanics are competent enough to handle faults in				

	electronic control units (ECU)?				
13	Automobile Roadside Mechanics are competent to repair computerized gearbox faults?				
14	Computerized vehicles are never repaired at the Automobile Roadside Mechanics?				
15	Automobile Roadside Mechanics finds it difficult to distinguish between sensors and transducers?				

QUESTION 2:

What affects the job satisfaction of Automobile Roadside Mechanics in Minna Metropolis?

	Items	SA	A	D	SD
16	Vehicle owners always complain about vehicle faults even after repair is carried out?				
17	Automobile Roadside Mechanics are never diligent in handling sensors and actuators, hence they damage them working while working on modern vehicles?				
18	Automobile Roadside Mechanics lacks the skill and knowledge on how the how the exhaust gas recirculation (EGR) works, hence may worsen the initial fault?				
19	Automobile Roadside Mechanics don't know what a code reader does?				
20	Automobile Roadside Mechanics lack knowledge on the operation of automobile system?				
21	Automobile Roadside Mechanics lack the skills on how to use a compression gauge to locate compression pressure leakage in modern vehicles?				
22	Modern vehicle owners never bring their vehicles for repairs at any Automobile Roadside Mechanics due to fear of worsening the initial fault?				
23	Automobile Roadside Mechanics are poor in handling scan tools in maintenance work?				
24	Owners of vehicles lack confidence in Automobile Roadside Mechanics, thus, they remain with the Automobile Roadside Mechanics until the work is done?				
25	Automobile Roadside Mechanics cannot repair faults in the electronic control unit of modern vehicles?				
26	Most automobile Roadside Mechanics are computer illiterate thus they cannot operate modern computerized diagnostic tools?				
27	Automobile Roadside Mechanics will never scan the electronic control unit/module (ECU/ECM) after sensors are replaced in modern vehicles?				
28	Automobile Roadside Mechanics easily gets angry when customers complain bitterly about a well done job but not tidy?				

29	Automobile Roadside Mechanics never get a “job well done” remark from their customers the vehicle owners?				
30	Automobile Roadside Mechanics don’t get paid for work/job done?				

QUESTION 3:

What are the ways adopted to improve job satisfaction of Automobile Roadside Mechanics in Minna Metropolis?

	Items	SA	A	D	SD
31	Automobile Roadside Mechanics should purchase modern troubleshooting devices like scan tools and code readers?				
32	Automobile Roadside Mechanics should acquire adequate skills through training in the use of code readers trace fault codes?				
33	Automobile Roadside Mechanics should acquire knowledge on how to identify Automobile sensors?				
34	Evening schools should be organized for Automobile Roadside Mechanics?				
35	Periodic training and retraining should be organized Automobile Roadside Mechanics to upgrade their skills, knowledge and technical aptitude?				
36	Automobile Roadside Mechanics should be able to identify an OBD-II certified vehicle?				
37	Automobile Roadside Mechanics should learn how to identify Automobile actuators?				
38	Automobile Roadside Mechanics should understand the principle of operation of the electronic control unit (ECU)?				
39	Automobile Roadside Mechanics should be able to distinguish between sensors and transducers?				
40	Vehicle owners should occasionally show some sense of appreciation whenever a job is well done?				
41	Automobile Roadside Mechanics should acquire the skills and knowledge on how to use the electronic gas recirculation (EGR) to check out the gas emission controls on modern vehicles?				
42	Vehicle owners are always happy and willing to pay up for a job well done?				
43	Automobile Roadside Mechanics should use the knowledge and skills of modern diagnosis in the diagnosis of modern vehicles?				
44	Automobile Roadside Mechanics liaise with university lectures to acquire more				

	knowledge on recent technology in the automobile sector so as to enhance their performance?				
45	The usage of hydraulic lift by Automobile Roadside Mechanics to lift modern vehicles so as to perform repairs and maintenance work?				