Assessment of Technical Innovation among Auto-Allied Artisans in Southwestern Nigeria

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Abstract
The researchers examined the available technical innovations among auto-allied artisans in Southwestern Nigeria**.** These artisans comprise the auto-mechanics, auto-panel beaters, auto-electricians, auto-painters and auto-tyre repairers. It also identified the factors influencing the innovations and impact of the technical innovations on their performances. The researchers adopted survey research design, while multi-stage sampling technique was used to elicit information from the respondents in Lagos, Ogun and Oyo states. Four hundred (400) copies of questionnaire were administered. Results of the study revealed that 50.4% of auto allied artisans operates as standalone, while, 49.6% operates from mechanic villages and the technical innovations among auto-allied artisans are mainly adaptation, rather than modification and improvement. Majority of the auto-allied artisans were engaged in technical innovations in their different area of specialisations, but wants to adapt because of the rapid change occurring in technical innovation. Correlation analysis of the factors influencing technical innovations among auto-allied artisans showed that there exist positive and significant relationship between maintainability and flexibility in use with other sources ($p< 0.05$, $r = 0.218$), customers' affordability ($p< 0.05$, $r = 0.164$), technical innovations among the artisans. It was, therefore, concluded that these factors contributed immensely to the identified technological innovations among auto-allied artisans in their different areas of specialisations.

Keywords: Technical Innovation, Auto-Allied, Artisans, Southwest

Introduction
Technical innovation is a specific collection of equipment, skills, knowledge, aptitudes, and attitudes that confer the ability of a firm to operate, understand, change and create production processes and product (Marcelle, 2004). The advancement in the level of technical know-how and widespread application of technical innovations resulting in high productive capability and economic growth is not new in developed nations. For developing countries that are on the path to technological and economic catch-up, strengthening such technological capability and innovations are their pursuits (Adeoti & Adeoti, 2010). Technical innovation has received considerable attention of many researchers worldwide. This is with a view to understanding those factors responsible for the differences among the countries classified as developed, newly developed and less

developed. In fact, technical innovation is a major contributory factor to the paradigm shift that occurred in the ways nations relate and compete. Specifically, technological competitiveness, which researchers refer to as a game of nations, has been an indicator for measuring economic performance and standards of living of nations (Khalil, 2000). As a consequence, developed and developing nations are now categorised as having desirable and undesirable economic status respectively. Hence, an attempt to move from the undesirable status, by the less developed nations, to the desirable status requires a technological ladder, which is explained to be synonymous to technological capability. Various research studies, together with expert opinions have attributed the failure to social, economic and political factors. However, in addressing these challenges, various policies have been adopted. One of such policies is International Technology Transfer (ITT) which is regarded as a factor to the success of the newly industrialised countries (NICs) of the East and South- East Asia (Ogbimi, 2007). This could be one of the reasons most African governments depend on the industrialised and the newly industrialised nations for technological support to develop their economies.

Product innovation in automobile industry started globally with the establishment of the first car which was built by Karl Benz in 1885; although, innovations in the internal combustion engine started in 1806 (IBM, 2006). It must be said that other forms of innovations have played important roles in the development of products in the automobile industry. The attempt at technical innovation among auto-allied artisans in Nigeria started with the establishment of the first Nigerian automobile assembly plant in 1959. The assembly plant was the Bedford truck assembly plant by Niger Motors (a division of UAC of Nigeria), assembling from semi-knock down kits in Lagos. Further to this initiative and as part of the strategic national technological and economic development of the country, the Federal Government of Nigeria established two assembly plants for cars; they were the Peugeot Nigeria Ltd (PAN) Kaduna, Volkswagen of Nigeria Ltd (VWON) Lagos. The use of automobile vehicles on our roads plays a key role in road transportation system. In Nigeria where land transport is largely in use compared to water, air as well as other modes of transportation, the use of automobile vehicles, either diesel or petrol driven is predominant. However, the vehicles cannot remain new forever. Modern automobile is a blend of 20th century and 21st century technology. The designs of modern vehicles have advanced to a very sophisticated level. Unlike the old mechanical operated vehicle systems, the modern vehicles are being operated and controlled by computerised electrical sensors. Indeed, almost every other function within the engine is controlled by an on-board computer (Modern Rider, 2014). Moreover, common to majority of the new trend cars is the brain box and other electronic gadgets that sense instant faults in the vehicle and immediately notifies the driver through the dashboard display. The modern trend of mechanical and auto-allied services, therefore, requires the use of more complex and highly technological specialty diagnostic equipment to analyse vehicle faults for repair and service. To ensure this for efficiency, safety, comfort, style and so on, competent professional hands are required (Chron, 2014). As vehicle technology and maintenance processes are advancing, the problems facing automobile garages in the country have rather compounded.

The automobile industry is characterised by the issues of incompetence and inefficiencies on the part of the auto-allied artisans as a result of inadequate or no application of technical innovations which in turn, affects their performances. Nigeria is blessed with so many local technologies which comprises various sectors of industry such as mining, steel, textile, agriculture, pottery, automobile service renders and so on. The inability to develop Nigeria's local technologies has resulted in the dependence of imported technologies for which the country has no resource or research base (Oluwale, 2010). Progressive technological capability thus implies the development and utilisation of local technology with a view to promoting independence in the development of technology. The ability to use local resources to adapt various products and materials, including machinery and equipment has been observed to be a major advantage to the informal sector under which the automobile industry and the auto-allied artisans fall.

After the shutdown of some local vehicle assembly plants (Peaugot & Volkswagen) due to high costs and inefficient utilisation of capacity, the demand in Nigeria has been higher than the availability of vehicles. The situation has led to a great rise in importation of second-hand vehicles of different brands which are maintained, repaired, re-constructed and kept functioning by the local auto-allied artisans. This has been done mainly by the creativity and expertise of the auto-allied artisans and not with the assistance or aid of any foreign training. The automobile industry in Nigeria has been solely focused on the auto-mechanics alone and various researches and studies have been carried out on their technological capability building and innovation. The rapid increase in technology and innovation in automobiles lately has proved that auto-mechanics cannot function on their own without the contributions of other auto-allied artisans, which comprise auto-electricians, auto-painters, auto-panel beaters and auto-tyre repairers. Oluwale (2010) has also previously looked into the automobile industry and examined the technical innovations among auto-mechanics.

Micro and Small Scale Automobile Workshop

The development of small-scale business has been a subject of discourse among scholars and policy makers in most developing nations, as a means of improving the living conditions of its citizens. Awoleye *et al* (2019) used SMEDAN enterprise classification and described micro enterprises as commercial businesses that have ten or fewer employees and small-scale enterprises as businesses with 11- 49 employees. Small-scale business in Nigeria is divided into three sectors: (i) production sector, including agricultural processing, manufacturing and mining (ii) service and (iii) trading sector, including wholesales and retails. Small scale enterprises usually operate in informal and semi-formal sector (Fabayo, 2009).

Small-scale business represents the overwhelming majority of industrial capacity in developing countries. Shokan (2000) lists some of them as the provision of employment, innovation and area of marketing for goods and services which are offered for sales. A lot of youths, retired workers and out of school graduates are now gainfully employed, thereby reducing the unemployment rate and its attendant social complication of armed robbery and white collar crimes. It helps to bring about new goods and services and supply the needs of large industries that have to rely on the small scale operators for

business success. It is a base for the development of appropriate technology and provides a veritable ground for skilled, unskilled and semiskilled workers. It has provided productive self-employment to a number of educated and less educated young men and women. Ayozie (2001) specifically mentioned the role in the accelerated industrial development, which offers better potential for employment generation and wider dispersal of industrial ownership. The employees live in the community in which the business is located, they usually have one, but many several shop locations, all in the same city or metropolitan area. An automobile workshop qualifies as a small-scale business as it possesses the outlined characteristics.

Automobile, according to Fetherston (2009) is a self-propelled vehicle used primarily on public roads. Abwage (2009) defines automobile as a self-propelled land vehicle, usually having four wheels and an internal combustion engine, used for personal and public transportation. It is of different types according to styles, number of doors and purpose of uses. Thus, we have cars having four wheels and can carry up to six people, including the driver; vans, minivans or buses, designed to carry more passengers; pickups or trucks depending on their sizes and designs, to carry cargo; sport utility vehicles also known as SUVS, used for driving in mud or snow (Fertherson, 2009). However, when these vehicles developed one fault or the other, they are being taken care of in an automobile workshop and by a competent motor vehicle mechanic.

A workshop, according to Jubril (2011) is a place, area, room or building where machines, equipment, hand tools, workbenches and materials are used in manufacturing or repairing things. Therefore, an automobile workshop is a place where basic vehicle maintenance is carried out by auto-allied artisans. Hiller & Coombes (2004) defined an auto-mechanic as a skilled personnel who specialises in automobile maintenance, repairs and sometimes modifies. Penn (2009) defines an auto mechanic as a skilled personnel, trained in any of the trades in auto mechanics, which include: auto body repairs and spray painting, auto electrical work, auto-body mechanic work, auto-body building (panel beating) and auto parts merchandising. An auto mechanic may be knowledgeable in working on all parts of a variety of car models or may specialise either on a specific skill area of automobile or on a specific model or brand of car. His job includes accurate diagnosis of car problems and repair. For a small scale business, like an automobile workshop to be established and also to succeed, there are some skills needed to be possessed by the individual. According to Osuala (2004), competition is a major force driving business to be more efficient and to employ strategies that will improve production, service and product quality. The automobile mechanic therefore needs to possess both employability and technical skills for the operation of automobile workshop. Employability skills are those basic skills or general work skills necessary for getting, keeping and doing well on a job (Robinson, 2000). A grouping of such skills is summarised by Osuala (2004) as follows: Individual competence: communication skills, comprehension, computation and culture, Personal reliability skills: personal management, ethics and vocational maturity, Economic adaptability skills: problem solving, learning employability and career development and group and organisational skills: inter-personal skills, organisational skills and skills in negotiation, creativity and leadership.

On the other hand, technical skills are job-specific related skills required to perform a particular job (Robinson, 2000). He further stated that technical skills involve: specialised knowledge, analytical ability within a specialty and faculty in the use of tools

and techniques of the specific discipline. Technical skills are required in different occupational areas of auto mechanics such as engine servicing, repair and maintenance, auto body building; auto electricity/electronics, vulcanising, steering and suspension, braking system, and auto air conditioning. These skills according to Osinem & Nwoji, (2010) include safety and health skills, basic and advanced machine operation skills, technical writing skills, bulletins and sketching/drawing skills. The success or failure of any business depends to a very large extent on the skills possessed by the operator of the business. Unfortunately, people do not consider the place of these skills such as the employability and technical skills in the establishment and success of their business like the automobile workshop; hence, the need to study the employability and technical skills needed to establish a small-scale automobile workshop for enhancing job creation, entrepreneurship development and wealth generation. The influx of automobile importation in recent times into the country has led to the need for the establishment of small-scale automobile workshop in all regions of the country.

Nature of Automobile Repair Industry in Nigeria

Automobile repair works can be categorised under the term service industry. Service industry connotes a wide range of activities which has various definitions by different authors. Duchi (2005) defined service industry as industry devoted to the repairs, servicing and maintenance of goods as distinct from manufacturer. Duchi (2005) also whose writing on the informal sector, identifies service industry as "the roadside and empty lot mechanics who will weld on a burnville cocoa tin to the exhaust pipe of the civil services Mercedes, the leather worker making hand bags for tourist trade, the furniture makers, the men who convert empty cans from garages twice in a day and have them processed into serviceable lamp by sunset." Automobile repair service industry carries out the repair services and maintenance of motor vehicles; thus, enhancing the road worthiness of all types of motor vehicles. The nature of operations of this automobile repair services can best be appreciated if we classify them.

Classification of Automobile Repair Services

Classification of the automobile services in Nigeria can either be according to types of workshops or according to the hierarchy of vehicles repaired. Duchi (2005) in the research works on automobile repairs workshops in Zaria, Jos, Kaduna, Kano and Kaduna respectively classified the automobile services industry according to the type of workshop and level of services provided. He identified the following three types of automobile repair workshop:

i. **Modern/standard Garages**

This refers to garages or organised motor repair service workshops that are characterised by advanced technical skills and equipment, higher servicing cost and formal servicing procedures resulting in delays. They in addition, undertake repairs and services as well as sales of vehicles and spare parts on formal sites approved by authorities. Examples of these standard garages are SCOA motors, Leventis Motors, UTC Motors and Mandilas; many of which have closed down in most Nigerian towns giving rise to the dominance of the other two types.

ii. **Fuelling Stations**

This category of motor service workshops undertakes the sale of fuel and minor maintenance work such as change of oil and lubrication, wheel balancing and alignment, etc. These have the tendency to locate linearly along major roads in the urban areas.

iii. **Roadside Workshops**

These are usually sole proprietor-operated workshops in urban areas and are characterised by poor aesthetic surrounding, indiscriminate disposal of waste such as vehicle scraps, used engine oil, closeness to roads, operates in the open air, under sheds of trees or in temporary sheds. They require little space for establishment and locate linearly along major traffic routes. The "roadside" mechanic workshop can further be classified according to the type of vehicle repaired. These repairs include vulcanising (tyre-repairs), battery charging, auto-electrical repairs or rewire, car upholstery, auto panel-beating, auto-painting and maintenance of all kinds of light kinds of cars, saloon car, medium cars, like minibuses, delivery van, land rover and heavy duty vehicles such as lorries, tippers, tractors and tankers. These types of auto repairs are broadly classified as light vehicle repair. The medium vehicle repair workshop, this category of auto repair service industry deals with the repair, servicing and maintenance of all medium sized vehicles, such as mini–buses, delivery van, land rovers, etc. The heavy vehicle repair workshops specialises in the repairs, servicing and maintenance of all kinds of heavy duty vehicles such as lorries, 40 and 50 seater buses, tippers and tankers.

Location Pattern of Automobile Repair Services in Nigeria Cities

It has been observed that automobile service industry follows the same location pattern as other informal sector enterprises in most developing countries such as Nigeria. Akinbinu (2001) in his study of auto–mechanics villages in Ibadan observed that auto–repair workers exist in the form of clusters with three of such clusters in Ibadan North, two clusters in Ibadan Southwest and one in Oluyole. He further stated that the distribution pattern tallies with the population of the local government areas and there are no known clusters of mechanics and other auto repair workers in such local governments in the city as Ibadan North- East and Ibadan South-West. The ownership of these clusters are private, however, the lands on which they are located are rented from either public (e.g. Nigerian Railway Corporation) or private bodies. In the federal capital city, Abuja where strict enforcement of land use act is carried out, an area was designated outside the city core for the operation of auto-repair works. The Apo mechanic village in Abuja accommodates all types of auto–repair activities as well as vehicle spare parts sales; as such auto–repair services are restricted to that area. In almost all towns in Northern Nigeria such as Kaduna, Minna, Lokoja, Kano, attempts made to relocate these artisans have not yielded any positive result as they are still found scattered in every nooks and crannies of the urban areas. In Lokoja for instance, the place acquired by the government for the auto–repair artisans were so remote that when the first occupiers relocated to the area, they suffered theft from criminals as their tools and customers' car valuables were

stolen overnight when they close from operation. This forced them to abandon the place and find their way back into the city core.

Nature and Dimensions of Innovations

An innovation may be present in many forms, such as product and process innovation, radical and incremental innovation or administrative and technological innovation. An organisation's ability to create such innovations has long been recognised as one of the key determinants for it to survive and succeed (Wang & Ahmed, 2004). As innovations exist in various forms, organisational innovativeness can be categorised into various dimensions of organisational innovativeness. However, the number and the nature of these dimensions vary to a great extent, depending on the author. According to Garcia & Calantone (2002), innovativeness is most frequently used as a measure of the degree of newness of an innovation. Johannessen *et al* (2001) opined that in order to isolate a useful definition and measure of innovation, three newness- related questions should be addressed: what is new, how new and new to whom? Therefore, they conducted a study in which they analysed six different types of innovative activity: new products, new services, new methods of production, opening new markets, new sources of supply and new ways of organising.

Technological innovative capacity relates to the firm's capacity to engage in the introduction of new processes, products or ideas in the organisation. The increasing importance of innovation is due in part to the globalisation of markets. For a company to be successful, it is not enough to be innovative; it must be more innovative than its competitors. The effective deployment of innovation has been widely recognised in recent years as a means of building sustainable competitive advantage and thereby, enhancing organisational performance. Its emergence is as a result of several activities spanning a length of time, depending on the type of technology. The idea that technological innovation is a competitive instrument essential for firms' long-term success and survival is widely recognised. Through innovation, organisations diversify and adapt and even rejuvenate or "reinvent" to fit the changing conditions of the technology and the market. Innovativeness is an organisational culture that encourages employees to be innovative and indicates an organiation's receptiveness to pursue the development of new products or processes. Innovativeness implies a firm being proactive by exploring new opportunities rather than merely exploiting current strengths (Menguc & Auh, 2006).

In Porter's analysis of competitive advantage, it was concluded that technology is an important competitive factor in the value-adding business of a firm. Identifying why and how firms adopt technological innovations, however, is fundamental for ensuring a successful adoption process (Swanson & Wang, 2005). There are clear indications in the literature that the competitiveness, growth and development of enterprises are related to the importance, velocity and paths of their innovation processes. The proportion of enterprises in a given country that introduces at least, one technological innovation, whether product or process, within a certain period (innovation rate) is a fair indicator of the innovation dynamism of the country; thus, innovativeness has been studied from many perspectives in several fields, including marketing, management, sociology, economics, psychology and engineering. The results of these studies have led to the development of two distinct innovativeness perspectives. The first perspective, largely developed from the marketing, sociology and psychology literature, focuses on consumer

innovativeness. The second perspective largely developed from the management, economics and marketing literature, focuses on firm innovativeness.

Technical Innovation

Schumpeter sees innovation as a function of entrepreneurial activity in which "new combinations" of existing resources occur. The definition offered by Schumpeter in the Theory of Economic Development (1934) is continuing to be referential in associating "new combinations" of production factors of new products and services, introducing new production processes, marketing and business organisation. In principle, the literature operates with distinguishing invention from innovation. In the same Schumpeterian context, Oslo Manual (2005) defines innovation to be an activity that produces new or significantly improved goods (products or services), processes, marketing methods or business organisation; they are specific for companies at whose level technologic activity predominantly occurs. While inventions may result from different economic and social environments, innovations are mainly a result of the firm's activity. To be capable to utilise an invention and turn it into innovation, auto-artisans should efficiently combine information, human, financial and material resources and existence of a functional distribution system is needed. The subsequent improvements in an invention after its first introduction may be vastly more important, economically, than the initial availability of the invention in its original form. Hence, invention can be often an outcome of a long process in which numerous interrelated innovation processes are involved. Innovation processes do not show the same characteristics regarding financial resources engaged and obtainable outcomes, but present differentiations at the enterprise level according to the innovation type, auto-artisans size or its strategy and experience in innovation area. Diversity of innovative processes generates difficulties in analysing costs and results of innovation activities by using micro-aggregated data. Common features of innovation processes are:

i. **Improvement:** This implies exploring opportunities for achieving new/improved goods (products and services) based on technical knowledge as well as the market demand change or a combination of the two. Investment efforts of technological innovation predominantly correspond to development and production engineering, in which knowledge is accumulated by experience in production, learning by using and learning by doing (Niemi *et al* 2009).

ii. **Modification:** Makes a small change to an existing process or product.

iii. **Adaptation:** Introduces a completely new type of production process with a range of applications which gives rise to a whole new type of innovative products.

Difficulties in analysing innovation business activity are due, in our opinion, to the fact that innovation is not a linear process consisting of sequential, time and conceptual-distinctive stages that define unidirectional causalities. Innovation is based on the use of previously acquired knowledge, on the results of new technologies, on the technological development or on the new combinations of existing technology. R&D is only the tip of technological development and innovation process and, in addition to research and development, it requires acquisition, integration into practice and the use of technological skills to high levels of complexity, productivity and quality, but also designing, engineering and managerial abilities for acquisition of technology and to

ensure a continuous flow of improvements and generate innovations. R&D is more relevant for firms near the technological frontier or at the frontier. Technology acquisition and the use of skills, on the other hand, are more relevant for auto-artisans that assimilate technology to create improved technologies. Auto-artisans innovate consequently to demand on the market and in principle, innovation process begins with reviewing and combining all existing knowledge, which supposes inclusively appealing to innovation users and the use of information as important innovation sources. Opening to new ideas and innovative solutions is essential, especially in the early stages of the process, allowing decision-making through ideas, knowledge and skills combination and congealing them in different ways leads to more complex innovations. Auto-artisans must have the ability to identify the appropriate technologies they need, to assess technological options for using or their modification and last, but by no means to least, to integrate new technologies into production processes.

Methodology

The study area of this research work was in Southwestern Nigeria. It is one of the six geopolitical zones in Nigeria and comprises Lagos, Ogun, Oyo, Ondo, Osun and Ekiti states. The target population for this study comprises the auto-allied artisans which are the auto-mechanics, auto-electricians, auto-tyre repairers, auto-panel beaters and auto painters**.** The population of this study comprises all the auto-allied artisans in Southwestern Nigeria

A multi-stage sampling technique was used in the course of this study. The first stage was the stratified sampling whereby three states (strata) were identified- Lagos, Ogun and Oyo States. The second stage was the random selection of respondents across the five targeted areas- auto-mechanics, auto-electricians, auto-tyre repairers, auto-panel beaters and auto-painters. Two hundred (200) copies of questionnaire were administered to respondents in Lagos state, 125 Ogun state and 75 Oyo state and 400 respondents in all for this study. Primary data were used for the study. Primary data were collected with the aid of two research instruments: questionnaire and an interview schedule. A set of questionnaire was designed for the respondents in the select Southwestern states. The questionnaire elicited relevant information on the socio-demographic data of the respondents and the set objectives of the research. The questionnaire was administered by hand delivery to the respondents with varying levels of flexibility in monitoring the way it was answered. Help was given to the not-so-educated respondents by explaining the content of the questionnaire. The method of data analysis that was used in the study includes descriptive statistics such as frequency, percentages mean and standard deviation. Inferential statistics was also used. The error level that was accepted in this work was 5%. Hence, data were analysed, using Statistical Package for Social Sciences (SPSS 20) software.

Results and Discussion

This session includes the results and interpretation of the data collected through questionnaire to examine technical innovations among auto-allied artisans in Southwestern Nigeria. About 400 copes of questionnaire were administered to the respondents of different age, tribe, religion, education and gender. Three hundred and two

(302) copies of questionnaire were collected from the field, which represents a reasonable return.

Table 1: Percentage Distribution of Respondents

States	Distributed	Retrieved	Percentage %
Lagos	200	123	61.5
Ogun	125	119	95.2
Oyo	75	60	80.0
Total	400	302	75.5

Table 1 reveals the distribution of questionnaire in Lagos, Ogun and Oyo states respectively. Two hundred (200) copies of questionnaire were distributed in Lagos state out of which one hundred and twenty-three (123) were retrieved (representing 61.5%). In Ogun state, one hundred and twenty-five (125) copies of questionnaire were distributed out of which one hundred and nineteen (119) where returned (representing 95.2% of the distribution); 80% of the seventy-five (75) distributed copies of questionnaire were retrieved (60) in Oyo state. The total number of retrieved copies represents a return rate of 75.5%.

Table 2: Demographic Information of the Respondents

Variable	Frequency (302)	Percent %
Gender		
Male	297	98.6
Female	5	1.4
Age of the Respondent		
Under 21	29	12.1
21- 30 years	135	41.6
31 - 40 years	112	35.0
41 years and above	26	11.3
Marital Status		
Married	178	57.6
Single	119	41.0
Divorced	5	1.4
Total	**302**	**100.0**

Table 2 shows the socio-demographic characteristics of the respondents for this study. The gender distribution of the respondents shows that 98.6% are male, while female represents about 1.4% of the respondents. This is an indication that males are majorly artisans. Age distribution of the respondents shows that 12.1% of the surveyed respondents fell under 21 years of age, 21 to 30 years of age constituted about 41.6% of the respondents, while those who are above 31 to 40 years constituted 35%, while those that were 41 years above stood at 11.3% and about 3.6% were above 41 years of age. This distribution shows that most of the respondents are youths and vibrant. This reflects the fact that the youths are the major players in auto-allied artisanship in Southwestern Nigeria.

Table 3: Distribution of Monthly Income of Respondents

Variable	Frequency	Percentage %
Below ₦10000	59	19.5
₦11000 – ₦20000	53	17.5
₦21000 – ₦30000	54	17.9
₦31000 – ₦40000	47	15.6
₦41000 – ₦50000	42	13.9
₦51000 and above	47	15.6
Total	**302**	**100.0**

Table 3 shows the income distribution of the respondents which indicates that 19.5% earn a monthly income below ₦10000, 17.5% earns between ₦11000 and ₦20000 monthly; 17.9% earns ₦21000-₦30000, those who earn ₦31000 to ₦40000 naira monthly represent about 15.6%; 13.9% earns between ₦41000-₦50000 and 15.6% earn above ₦51000 naira. This agrees with the report of Freel (2005) that auto-allied technological innovation depends on the volume and utilisation of monthly income.

Table 4: Educational Background of Respondents

Items	Frequency	Percentage %
Primary School Leaving Certificate	22	8.8
Junior Secondary School Certificate	47	15.7
Senior Secondary School Certificate	148	46.8
ND/NCE certificate	56	18.2
B.Sc./ HND	26	9.6
M.sc/Ph.D.	3	0.8
Total	**302**	**100.0**

Table 4 reveals the educational distribution of the respondents; 46.8% holds SSCE, 18.2% claimed to have obtained ND/NCE as their highest qualification; 18.2% holds certificate of OND; 9.6% has B. Sc/HND certificate. This implies that the respondents are well-informed and educated. Reliable information is expected from them. This result corroborates the positions of Jung *et al* (2003) and Freel (2003) that the quality of artisans' education does have a positive influence on auto-allied technical innovation.

Table 5: Area of Specialisations and Period of Operation of Auto-allied Artisans

Parameters	Frequency (302)	Percentage %
Specialisation		
Auto-mechanics	89	28.1
Auto-electricians	68	22.0
Auto-panel beaters	69	22.3
Auto-tyre repairers	53	17.9
Auto-painter	23	9.6
Period of Operation		
Morning to evening	299	99.2
Morning	3	0.8

For table 5, the period of operations distribution of the respondent shows that 99.2% of the respondents operate between morning and evening; 0.8% operates only in the morning. The distribution of the respondents in terms of specialisation shows that 28.1% of the respondents were auto-mechanics, while 22.0% were auto-electricians; 22.3% were auto-panel beaters; 17.9% of the respondents were auto-tyre repairers and 9.6% were auto-painters.

Table 6: Types of Workshop and Sources of Training

Type of workshop	**Frequency**	**Percentage %**
Stand-alone	152	50.4
Auto-allied village	150	49.6
Total	**302**	**100**
Sources of Training		
Apprenticeship	172	53.2
Technical school	102	33.6
Polytechnic	9	4.4
University	6	3.0
Auto-manufacturer/dealer	13	5.8
Total	**302**	**100.0**

The sources of training and types of workshop of the respondents were examined in the table 6. The table shows that high proportion of the auto-allied artisans operate as a stand-alone with percentage of 50.4% and about 49.6% operate from mechanic villages. In terms of sources of training of the respondents 53.2% acquired their knowledge of auto-allied through apprenticeship, 33.6% got their training through technical school and a meagre proportion of 4.4% got well-trained in terms of trade in polytechnic. 5.8% through auto-manufacturer dealer.

Table 7: Technical Innovations among Auto-allied Artisans

Variables	**Modification**	**Adaptation**	**Improvement**
Innovation in auto painting			
Oven for baking of cars	92(30.9%)	106(35.0%)	104(34.2%)
Spraying booth for spraying of cars	102(33.6%)	107(35.3%)	93(31.1%)
Automatic spraying machine and nozzle	101(33.3%)	109(35.8%)	92(30.9%)
Innovation in aAuto-tyre Repairing			
Digital tyre changing machine	105(34.7%)	96(32.0%)	101(33.3%)
Digital wheel-balancing machine	104(34.4%)	94(31.4%)	104(34.2%)
Digital alignment machine	97(32.2%)	104(34.4%)	101(33.3%)
Digital gauging system	97(32.2%)	108(35.5%)	97(32.2%)
Innovation in Auto Mechanics			
Diagnostic machines	108(35.5%)	95(31.7%)	99(32.8%)
Suspension system	93(31.1%)	91(30.6%)	118(38.3%)
Steering System	92(30.9%)	101(33.3%)	109(35.8%)
Transmission system	73(25.6%)	104(34.2%)	125(40.2%)

Break system	105(34.7%)	104(34.2%)	93(31.1%)
Lubricating system	99(32.8%)	115(37.5%)	88(29.8%)
Automatic car lifting	94(31.4%)	109(35.8%)	99(32.8%)
Innovation in Auto-electrician			
Diagnostic machines	92(30.9%)	106(34.7%)	104(34.4%)
Ignition system	97(32.2%)	98(32.5%)	107(35.3%)
Charging system	107(35.3%)	95(31.7%)	100(33.1%)
Cooling system	106(34.7%)	117(38.0%)	79(27.3%)
Fuel system	97(32.2%)	120(38.8%)	85(28.9%)
Innovation in Auto-panel Beating			
Paintless dent repair (PDR)	95(32.0%)	104(34.2%)	103(33.9%)
Electric Grinder and Cutting Disc	106(35.0%)	106(35.0%)	90(30.0%)
Automatic Body Jack	103(34.2%)	95(31.7%)	104(34.2%)

The table 7 shows the major technical innovations engaged by auto-allied artisans in the selected survey area. The auto-allied artisans were categorised into auto-painters, auto-tyre repairers, auto-mechanics, auto-panel beating and auto-electrician. Technical innovations among auto-painters can be classified into modification, adaptation, improvement. Adaptation constitutes the highest proportion in technical innovation in oven for baking of cars as regarding the involvement of auto-painter in technical input. Modification accounted for 30.9%, while improvement represents about 34.2%. In terms of spraying booth for spraying of cars, adaptation accounted for 35.3%, closely followed by modification 33.6%. Automatic Spraying Machine and Nozzle also experienced adaptation of 35.8%, 33.3% modification and improvement accounted for 30.9%. The respondents report that innovation in auto-tyre repairing comprises of digital tyre changing machine, digital wheel-balancing machine, digital alignment machine, digital gauging system.34.7% of the respondents claimed that they carried out modification on digital tyre changing machine, 32.0% were of the view that they have adapted to the innovation, while 33.3% asserted that they engaged in improvement of the innovation. For the digital wheel-balancing machine, 34.4% were of the opinion that they had carried out modification on the system, while 31.4% accounted for adaptation and 34.2% claimed to have carried out improvement on the digital wheel-balancing machine. In addition, 32.2% have modified digital alignment machine, 34.4% adapted it and 33.3% improved on it.

For the auto mechanics, this shows that the respondents mostly carried out modification (35.5%) in the case of diagnostic machines. Suspension system was modified by 31.1% of the respondents, 38.8% adapted it. Steering system was improved by 35.8% of the respondents, 33.3% adapted it, while 30.9% modified. For the break system 34.7% claimed to have modified, 34.2% adapted it and 31.1% improved on it. Lubricating system also shows that high proportion of the auto-mechanics adapted it with percentage of 37.5% and 32.8% modified it. In the case of auto-electrician, ignition system was modified by 32.2% of the surveyed respondents, 35.3% improved on it. This is an indication that the respondents engage more in improvement of ignition system.

However, the case of charging system shows that people engage more in modification than adaptation and improvement, with 34.7% modification, 31.7% adaptation and 33.1%. Fuel system was modified by 32.2%, 38.8% adaptation and 28.9% improvement. Innovation in auto-panel beating reveals that 34.2% adapted Paintless dent repair (PDR), while 33.9% improved and 32.0% modified it. Electric grinding and cutting disk were modified by 35.0% and adapted by 35.0%, while 30.5 improved. In the case of automatic body jack, 34.2% modified, 34.2% improved it and 31.7% adapted it.

Table 8: Correlation of Factors influencing Technical Innovation among Auto-allied Artisans

	Y	**X_1**	**X_2**	**X_3**	**X_4**	**X_5**	**X_6**	**X_7**	**X_8**	**X_9**	**X_{10}**
Y	1										
X_1	0.089	1									
X_2	0.032	0.035	1								
X_3	0.081	-0. 011	-0.069	1							
X_4	0. 058	-0.015	0.001	0.106	1						
X_5	-0.059	0.028	0.164**	0.022	0.218**	1					
X_6	-0.037	-0.192**	-0.127*	-0.004	0.168**	-0.131*	1				
X_7	0.012	0.065	0.135*	-0.039	0.209**	0.122*	0. 358**	1			
X_8	0.048	-0.031	0.022	-0.081	0.267 **	-0.080	0.259**	0.294**	1		
X_9	-0.019	0.106	-0.103	0. 171**	0.171**	0.022	0.097	0.053	0. 339**	1	
X_{10}	0.010	0.025	0.114*	0.018	0.111	0.019	- 0.076	0.213**	0.148*	0.297**	1

*. Correlation is significant at the 0.05 level (2-tailed), **. Correlation is significant at the 0.01 level (2-tailed).

Correlation was used to determine the relationship between the dependent variable and independent variables for the study. Table 8 shows that customers cannot afford the original parts, X_2 and flexibility in use with other sourceX_5 are significant at 0.05 (r = 0.164) and have a positive relationship. This shows that both factors have effect on technical innovation among auto-allied artisans. Maintainability has a positive and significant relationship at 0.05 with Flexibility in use with other sources (r = 0.218), Government support (r = 0.168), Educational background (r = 0.209), Skills of workforce (r = 0.267) and working equipment are expensive (r = 0.171). However, reliability and government support (r =-0.192) are negatively and significantly correlated at 0.05 level of significance, which means that their relationship does not influence technical innovations among auto-allied artisans.

Y= Monthly Income X_1 = Reliability
X_2 = Customers cannot afford the original parts
X_3 = Environmental friendliness
X_4 = Maintainability
X_5 = Flexibility in use with other sources
X_6 = Government support
X_7= Educational background

X_8 = Skills of workforce
X_9 = Working equipment are expensive
X_{10} = Original parts are not available

Conclusion

Technical innovation is the ability to create new technologies and to develop new products processes or new industries in response to changing economic environment. In this paper, therefore, technical innovations present among the auto-artisans were assessed. The researchers concluded that majority of the auto-allied artisans that were involved in technical innovations in their different areas of specialisations used adaptation to evolve in the rapid change occurring. Based on the results and conclusion, the researchers recommend that auto-allied artisans could achieve more if they are brought together in clusters. To this end, the government could work together with their association to enact a policy to drive this. The government should, therefore, create auto-allied artisans village in order to bring these craftsmen together so as to harness resources to be able to achieve more technical innovations. In addition, government should subsidise the acquisition of necessary equipment and technologies and should assist in further development of their technical capacities in order to facilitate and sustain progressive developments in the field.

References

Abwage, M. (2009). Techniques for making the study of automobile mechanics attractive to female students in technical colleges in Taraba state. An unpublished B.Sc. Thesis. University of Nigeria, Nsukka.

Adeoti, J. O. & Adeoti, A. I. (2010). Technological capability, innovation capacity and agro-industry development in Nigeria. NISER, Ibadan, Nigeria/Department of Agricultural Economics, Ibadan, Nigeria.

Ayozie, D. O. (2001). *A handbook on small scale business for national diploma students*. Abeokuta: Danayo Inc. Coy.

Chron. (2014). Factsheet: What kind of equipment does an auto mechanic use? Retrieved from http://www.work.chron/kind-equipment-auto-mechanic-use-25000.html.

Duchi, P. (2005). Planning for auto repair service industry in Zaria urban area, Kaduna State. An unpublished burp dissertation. Department of urban and regional planning. ABU Zaria.

Fabayo, J. A. (2009). Small and medium enterprises development strategy: A critical option for sustainable long–term economic development in Nigeria. A paper presented at the first Annual International Conference on: Effective Management of Small and Medium scale Enterprises for sustainable Economic Development held at Abraham Adesanya Polytechnic, Ijebu-Ode held from 25-27 August.

Freel, M. S. (2003). Sectoral patterns of small firm innovation, networking and proximity, *Research Policy*. 32, 751–770.

Garcia, R. & Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: A literature review. *Journal of Product Innovation Management*, 19 (2), 110-132.

Menguc, B. & Auh, S. (2006). Creating a firm-level dynamic capability through capitalising on market orientation and innovativeness. *Journal of the Academy of Marketing Science*, 34, 63-73.

IBM Corporation. (2006). Expanding the innovation horizon: The Global CEO Study 2006. Electronics Industry Point of View.

Johannessen, J., Olsen, B. & Lumpkin, G.T. (2001). Innovation as newness: What is new, how new and new to whom? *European Journal of Innovation Management*, 4 (1), 20-31.

Khalil, T. (2000). Management of technology. The Kkey to competitiveness and wealth creation. New York: McGraw Hill;

Marcelle, G. M. (2004). Technological learning: strategic imperative for firms in the developing world. Thomson Learning. Innovation and productivity in formal and informal firms in Ghana.

Niemi, P., Huiskonen, J. & Kärkkäinen, H**.** (2009). Understanding the knowledge accumulation process: Implications for the adoption of inventory management techniques. *International Journal of Production Economics,* 118(1), 160-167.

Ogbimi, F.E. (2007). Promoting sustainable economic growth and industrialisation: solution to mass unemployment and poverty. *Afr. J. Trad. Cam,* 4 (4), 541 – 552.

Oluwale, B. A. (2010). A study of technological capability buildings in auto-mechanics industry in Southwestern Nigeria. A thesis submitted in partial fulfillment of the requirement for the award of the degree of Doctor of philosophy in Technology Management, Obafemi Awolowo University, Ile-Ife, Nigeria.

Osinem, E. C. & Nwoji, U. C. (2010). *Student industrial work experience in Nigeria: Concept, principles and practice.* Enugu: Cheston Agency Ltd.

Osuala, E. C. (2004). *A handbook on vocational technical education for Nigeria.* Uruoowolu-Obosi: Pacific Publishers.

Robinson, J. P. (2000). Technical and employability skill in the work place. *The workplace*, 5(3), 1-3.

Shokan, O. (2000). Small scale business in Nigeria. Lagos: Shona Publishers.

Swanson, E. B. & Wang, P. (2005). Knowing why and how to innovate with packaged business software. *Journal of Information Technology*, 20(1), 20-31.

Wang, C. L. & Ahmed, P. K. (2004). Development and validation of the organisational innovativeness construct. *European Journal of Innovation Management*, 7 (4), 303-313.

Uwaleke, U. (2017). Enhancing domestic production as a panacea for growth and foreign exchange conservation. *The Bullion,* April – June.