DETERMINANTS OF MODERN AUTOMOBILE TECHNOLOGY ADOPTION AMONG MECHANICS IN MICRO AND SMALL ENTERPRISES IN KENYA

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Determinants of Modern Automobile Technology Adoption among Mechanics in Micro and Small Enterprises in Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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This thesis has been submitted for examination with our approval as university supervisors.

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DEDICATION

This thesis is specially dedicated to my parents.my wife Purity, my children and my siblings

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ABBREVIATIONS AND ACRONYMS

ABS	Antilock Braking System
CBS	Central Bureau of Statistics
EFI	Electronic Fuel Injection
EU	European Union
GDP	Gross Domestic Product
ICEG	International Center for Economic Growth
ILO	International Labor Organization
KIPPRA	Kenya Institute for Public Policy Research and Analysis
MCN	Municipal Council of Nakuru
MSME	Micro Small and Medium-sized Enterprises
NAJUKA	Nakuru Jua Kali Association
OECD	Organization for Economic Cooperation and Development
GoK	Government of Kenya
MSE	Micro and Small Enterprises
UNCTAD	United Nations Conference for Trade and Development
VVTi	Variable Valve Timing with intelligence

DEFINITION OF TERMS

Adoption: Adoption is a decision of full use of an innovation as the best course of action available (Innova, 2012). In this study, adoption is the employment of the latest technology in the diagnosis, service and repair of modern automobiles by mechanics in micro and small enterprises.

Automobile: Wheeled machines driven by an engine. They commonly referred as, automotives or motor vehicles.

Compatibility: The degree of innovation perceived consistent with existing value or previous experience and need to the potential adopter (Morgan, 2013). In this study, compatibility is the similarity or difference in the technology used between modern and older model vehicles.

Complexity: The degree of innovation perceived as difficult to be comprehended or utilized (Morgan, 2013). In this study, complexity is the ability or inability to diagnosis, service and repair of modern automobiles as compared to older models.

Early adopters: These are the 'visionaries' who blend an interest in technology with a concern for significant professional problems and tasks (Innova, 2012).

Early majority: These are the 'pragmatists'. Although fairly comfortable with technology in general, their focus is on concrete professional problems rather than on the tools (technological or otherwise) that might be used to address them (Innova, 2012).

Entrepreneur: An entrepreneur may be defined in a simplistic manner as a person who is able to look at the environment, identify opportunities to improve the environment, marshal resources, and implement actions to maximize those opportunities (Okpara, 2011; Hisrich & Peters, 2003). In this study, this term

was used in a broad sense to include the owners and managers of micro and small enterprises.

Informal sector: A "way of doing things characterized by (a) ease of entry; (b) reliance on indigenous resources; (c) small scale operations; (d) labor intensive and adaptive technology; (e) skills acquired outside of the formal sector; (f) unregulated and competitive markets" (Okpara, 2011). In this study, this sector may be referred to as Jua Kali.

Innovation: Seen from the perspective of users, a technical solution is viewed as innovation if it is new or it is regarded as new by the individual or organization. Therefore it is not always very important whether or not an idea is truly new since it was applied or invented. What is important is, whether it is new for the individual or organization adopting it or for the adopter (Jolly, 2011).

Innovators: These are the 'techies', the experimenters who have technology as a central interest in their lives and pursue new technology as soon as it appears, no matter what its function is (Jolly, 2011).

Invention: The creation of a new product or service that did not exist before (Jolly, 2011). In this study, inventions include the electronic fuel injection systems (EFI), safety air bags, automatic transmission systems, central locking systems among others.

Jua Kali: The term "Jua Kali," literally means "hot sun" in Kiswahili referring to enterprises which carry out their businesses under the hot sun without adequate shelter or workshop space (Bokea & Mullei, 1999). However within the scope of this study, "Jua Kali" refers to mechanics operating in the in the informal sector.

Laggards: These are people who most likely never to adopt at all (Innova, 2012). In this study, these are mechanics with no or very low levels of formal education and thus lack the capacity of comprehending electronic integrated systems

Late majority: These are the conservatives or 'skeptics'. They share the attitude of the early majority, though being less comfortable with technology (Innova, 2012).

Micro and Small Enterprises: In this study, a micro enterprise means a firm, trade, service, industry or a business activity whose annual turnover does not exceed five hundred thousand shillings and which employs less than ten people while a small enterprise means a firm, trade, service, industry or a business activity whose annual turnover ranges between five hundred and five million shillings; and which employs between ten and fifty people (RoK, 2012).

Observability: Result of an innovation is available for other parties (Morgan, 2013). Observability in this study includes the availability of modern vehicle diagnostic tools and equipment in as many garages as possible for other mechanics to see and emulate.

Relative advantage: The level of innovation perceived as better that previous one (Morgan, 2013). In this study, relative advantage is the establishment whether modern automobiles offer more advantages in terms of : fuel efficiency, power output, exhaust emissions, durability among others as compared to older models.

Skill: Skill is defined as the ability to do something or perform a specific task well at a pre-determined level of proficiency (Oxford Advanced Learner's Dictionary). In this study, skill is the ability of mechanics to diagnosis, service and repair motor vehicles as to the automobile manufacturers' specifications.

Sub-Sector: This study focused on the service sectors where mechanics in micro and small enterprises operate. Sub-sectors are broad sub-divisions of the manufacturing and service sectors (RoK, 2012).

Technology adoption: The acceptance of an innovation or invention by at least one user (Jolly, 2011). In this study, technology adoption will mean that informal sector mechanics have acquainted themselves with modern vehicles operating mechanisms.

Technology diffusion: The process through which an individual or other decision maker unit passes from first knowledge of an innovation, to a decision to adopt or reject, to implementation of the new idea (Jolly, 2011).

Technology transfer: The process by which basic science research and fundamental discoveries are developed into practical and commercially relevant applications and products (Jolly, 2011).

Technology: The application of knowledge to the production of goods and services (Jolly, 2011). In this study, technology means the state-of-art systems and sub-systems that have been incorporated into modern automobiles to make them more efficient and effective.

VVT-i: Variable Valve Timing with intelligence. The technology was developed by Toyota to automatically and continuously vary the timing of the intake valves to improve engine performance. The "intelligence" aspect of VVT-i refers to the systems ability to sense driving conditions such as acceleration or going up or down hills.

ABSTRACT

Motor vehicle ownership has been on a steady and sustained increase in the recent past fuelled by the growth in the economy. However, most mechanics operating in micro and small enterprises in Kenya have not adopted modern automobile technology and thus face the challenge of servicing, diagnosing and repairing modern automobiles due to the dynamic technological innovations in the industry. Technology adoption is acknowledged to play an important role in the growth of enterprises by contributing directly to profitability and providing foundation for the evolution of operations from a micro to a medium level. This study aimed to determine factors that influence automobile technology adoption among mechanics in micro and small enterprises in Kenya. It focused on Nakuru town. The objectives of the study were to establish the role of: relative advantage, compatibility, complexity and Observability in the adoption of technology. The research used a descriptive cross sectional survey design and employed both probability and non-probability sampling techniques to collect quantitative and qualitative data from 132 mechanics sampled from an estimated population of 5,000 mechanics operating in the micro and small enterprises. Self-administered questionnaires along with direct observation were used to collect data. Data was analyzed using two statistical softwares: Statistical Package for Social Sciences (SPSS) and MiniTab version 16. Quantitative data enabled associational analysis, mainly; binary logistic regression and Chi-square. Qualitative data was used for content analysis. The findings revealed that along with formal education, technical training and experience levels of the mechanics, the conceptualized variables: relative advantage, compatibility, complexity and observability of a particular innovation play a significant role in technology adoption among automobile mechanics in micro and small enterprises. When repair workshops or garages don't adopt technology, it means their work cannot be consistently relied upon in terms of efficiency, safety and cost effectiveness. This implies that most work done by these fair to middling garages is pure guesswork, trial-and-error that we normally christen mechanical faults when accidents occur. The study recommended that the government should emphasize and invest in intellectual capital by way of developing relevant training curriculum for the mechanics based on industry and environmental needs. In addition, the government and all stake holders should create and encourage avenues that enable: technology transfer, technology promotion, technology deployment, technology innovation, technology development, technology research, technology assessment, technology information and communication, technology investment, technology collaboration and technology commercialization.

CHAPTER ONE
INTRODUCTION

1.1 Background of the study

This study sought to establish determinants of technology adoption among micro and small automobile mechanics operating in Kenya. It focused on Nakuru town. The development of the informal sector has long been regarded as crucial for economic development in both developed and developing nations as it plays an important role in job creation, poverty alleviation and in the utilization of local resources. A study conducted by Bureau and Fendt (2013), indicated that; micro and small enterprises (MSEs) represent 99% of an estimated 19.3 million enterprises in the European Union (EU), and; provide around 65 million jobs, representing two-thirds of all employment. In Latin-America, the vast majority (approximately 80-90%) of companies are micro enterprises. While in Brazil the economy expanded by only 2% in 2011, MSEs grew by 8.5%. In Colombia, MSEs accounted for 39% of all jobs and 67% of industrial jobs. Moreover, MSE membership in Colombia's chambers of commerce rose from an average of 22% in 2009 to 93% in 2012. In Japan, 81% of all employment is in MSEs where the average enterprise employs nine staff as opposed to four in the EU. In the Organization for Economic Cooperation and Development (OECD) countries, MSEs represent over 96% of enterprises in most countries and generate over half of private sector employment (Bureau & Fendt, 2013).

According to Kenya National Alliance of Street Vendors and Informal Traders (KENASVIT, 2011) the Micro and Small Enterprises (MSE) sector is the source of income for over 8 million people, who represent the majority of working Kenyans. In Kenya, sector is dominated by Micro Small and Medium-sized enterprises (MMSEs) involved in various activities such as woodwork, metal work, leatherwork, textile, handicraft, service industry, retail trade and motor vehicle repair among others. These enterprises in Kenya represent a vital part of the economy, being the source of various economic contributions through; the generation of income via exporting, providing new job opportunities, introducing innovations, stimulating competition, and engine for employment. In spite of their importance, this sector

faces many challenges, such as lack of access to credit, poor infrastructure, use of inappropriate technology and lack of intellectual capital among others. Intellectual capital appears as the most important and vital component of a knowledge-based economy (Karanja, Gakure, Were, Ngugi & Kibiru 2012).

However, in the present economy, small and medium enterprises are facing tremendous challenges and threats to survive in a competitive environment. As a matter of fact, SMEs are faced with the threat of failure with past statistics indicating that three out five fail within the first few months (Bowen, Morara & Mureithi, 2013).The impact of intellectual capital on the general performance of the Small and medium enterprises has become a very important issue now than ever, this is due to the level of globalization of whose outcomes are privatization and deregulation of markets, aggressive competition and the ever-rising expectations of customers. These dynamic changes are very much pronounced in the automobile industry where liberalization and globalization has resulted into an influx of various makes and models of motor vehicles all competing for the same market. In addition, these modern vehicles incorporate complex electronic components that require only skilled and knowledgeable mechanics to diagnose service and or repair (KEMRA, 2014). As a result of this, there is need for businesses to be at their best in order to be relevant in the environment. There is no known comprehensive study which has been conducted in Kenya to establish factors that determine automobile technology adoption among mechanics operating in the micro and small enterprises.

1.1.1 Micro and Small Enterprises

The focus of this study was on technology adoption among automobile mechanics in the micro and small enterprises (MSEs). In Kenya, MSEs usually employ less than 50 workers. Specifically, micro enterprises employ between 0–10 workers, whereas small enterprises have 11–49 workers (RoK, 2012). The MSE sector is very vibrant in Kenya, which, according to the 2009 census employs 8.2 million of the workforce, compared to only 2.8 million in the formal sector. The informal sector is characterized by strong social relationships and associations (Kinyanjui, 2011) but operates under difficult conditions, such as poor sanitary facilities, ramshackle

structures, poor waste disposal and a lack of water and electricity. Despite the sector‘s contribution to labor dynamics, MSE employment capacity has faced challenges in the form of poor infrastructure, high cost of production and credit, increased competition from cheap imports, and inadequate tools and equipment and more importantly lack of skills and knowledge. (Bowen et al, 2013).

To be competitive in an ever-changing global and national environment, the MSE demand an investment in intellectual capital. The vocational and education training (VET) programs need to produce not only high numbers of young people who are adaptable and able to learn job-related skills quickly, but also offer specific, tailored, onsite training courses that meet immediate skill requirements. Thus a blend of initial vocational training and on-going refresher and updating courses are a requisite mix. It has been widely acknowledged that more trainees are engaged in informal sector training than in all formal technical, vocational and entrepreneurship training (TVET) institutions in Kenya, for example, Barasa and Kaabwe (2011) put the figure at 71 per cent. Informal training involves learning through observing and doing, and it allows the transmission of the prevailing skills and practices with or without minimal, external resources (Warren, Kitagawa & Eatough 2011)).

Innovation is considered in many quarters as the key to success in business. Research shows clearly that most small and medium hospitality enterprises in Nigeria are not innovative and this affects negatively their level of growth. Most of the SME's have not been able to develop technological competences to acquire and apply from foreign firms. However, some adopt some degree of innovativeness. Not much is documented on small and medium enterprises innovation and its influence on firm growth in Nigeria .According to Gunday, Ulusoy, Kilic and Alpkan (2011) innovation is the best ay SME's can stimulate firm growth when they attach importance to innovative activities that build reputation in the market environment. Essentially the major reason for innovativeness is the desire to have increased business performance, higher turnover of products and services and increased competitive edge.

Although the majority of MSE employers in Kenya take part in informal training, studies have shown that most MSE owners do not have sufficient decision-making training or experience, with the typical owner–manager developing their management approach through routine trial and error (Barber, 2013; Bowen, Morara & Mureithi, 2013). Thus, they rely largely on an intuitive management style and they are concerned with daily processes rather than long-term decisions and strategic activities. The lack of managerial capability means MSE owner–managers may be inadequately prepared to adjust to environmental changes. Low levels of education have been observed as contributing to the failure rate of some Kenyan MSE (Bowen et al., 2013). Conversely, more knowledgeable employers are likely to be more productive through the ability to focus on activities that are more profitable, and are also more likely to be innovative (Sonobe et al., 2011). On-the-job training is the major contributor to labor capital world-wide. However, the competency of the MSE trainers is compromised by their low levels of education and poor attitude to their own skills upgrading, which LaPorte & Sanders (2013) attributed to perceived economic factors such as training fees, restricted time and qualified personnel. Further, the limited capacity of employers to manage their businesses (and particularly human resources) may contribute to the poor transferability of skills acquired by formal TVET graduates from the training institutions.

1.1.2 Technology Adoption

Understanding the factors influencing technology adoption helps us predict and manage who adopts, when, and under what conditions. Armed with this information we can assess where people are in the adoption process and support them as they move from technology acceptance through to usage. The process of adopting new innovations has been studied for over 40 years, and one of the most popular adoption models is described by Rogers in his book, Diffusion of Innovations (Sherry & Gibson, 2012). Much research from a broad variety of disciplines has used the model as a framework. Dooley (2009) and Stuart (2010) mentioned several of these disciplines as political science, public health, communications, history, economics, technology, and education, and defined Rogers' theory as a widely used theoretical framework in the area of technology diffusion and adoption. Rogers' diffusion of

innovations theory is the most appropriate for investigating the adoption of technology in higher education and educational environments (Dobson, Breslin, Suckley, Barton & Rodriguez 2014). In fact, much diffusion research involves technological innovations so Rogers usually used the word "technology" and "innovation" as synonyms.

According to Jolly (2011), adoption is a decision of full use of an innovation as the best course of action available" and rejection is a decision "not to adopt an innovation". Rogers defines diffusion as the process in which an innovation is communicated thorough certain channels over time among the members of a social system. As expressed in this definition, innovation, communication channels, time, and social system are the four key components of the diffusion of innovations. Rogers (2003) further categorized technology adopters into four categories: a) Innovators who tend to be experimentalists and "techies" interested in technology itself; b) early adopters who may be technically sophisticated and interested in technology for solving professional and academic problems; c) early majority who are pragmatists and constitute the first part of the mainstream; d) late majority who are less comfortable with technology and are the skeptical second half of the mainstream; and d) laggards who may never adopt technology and may be antagonistic and critical of its use by others. Rogers further asserted that the distribution of these groups within an adopter population typically follows the familiar bell-shaped curve and in order to enhance communication and promotion effectiveness towards a targeted audience and besides understanding of the adopters' characteristics, there are three factors that influence innovation adoption decision: innovation attitudes in a community, external network effect, and population characteristics through which diffusion is to occur.

1.1.3 Models of Technology Adoption

Rogers' foundational analysis and set of practices and categorizations have informed innovation studies over the last several decades. Rogers (1995) described technology diffusion as 'the process through which an individual or other decision maker unit passes from first knowledge of an innovation, to a decision to adopt or reject, to

implementation of the new idea'. He further asserted that diffusion involves two different actors: company or organization who will adopt the innovation or new technology and users or individual or organizations who will use the products or services regarded as new. Rogers (1995) conceived of the five attributes that influence technology adoption in the following ways: "Relative advantage; the degree to which an innovation is perceived as being better than the idea it supersedes. The degree of relative advantage is often expressed as: economic profitability, social prestige, or other benefits, compatibility; the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. An idea that is more compatible is less uncertain to the potential adopter, and fits more closely with the individual's life situation. Such compatibility helps the individual give meaning to the new idea so that it is regarded as familiar. Complexity; the degree to which an innovation is perceived as relatively difficult to understand and use. The more simplistic and less complex the innovation is, the easier it is for someone to adopt. Trialability; the degree to which an innovation may be experimented with on a limited basis. A trial is a way for a potential user to alleviate any hesitancy or doubt that they might have. The fifth attribute that can help explain the rate of adoption is observability. Observability is the degree to which the results of an innovation are visible to others (Rogers, 1995). Appreciating the fact that modern automobile technology come with many advantages; however complex, the Rogers model is the most suitable in attempting to explain various factors that influence adoption of technology within the informal automobile mechanics.

Technology Acceptance Model, developed by Davis (1989), is one of the most influential research models in studies of the determinants of technology acceptance to predict intention to use and acceptance of technology by individuals. Technology Acceptance Model has received considerable attention of researchers in the information system field over the past decade. In the Technology Acceptance Model, there are two determinants including perceived ease of use and perceived usefulness. Perceived usefulness is the degree to which an individual believes that using a particular technology would enhance his or her job or life performance. Perceived

ease of use is the degree to which a person believes that using a particular technology would be free of effort. Perceived ease of use and perceived usefulness positively affect the attitudes toward an innovation; and further, positively affect the individuals' intentions to use and the acceptance of a technology. In addition, perceived ease of use positively affects the perceived usefulness, and both of perceived ease of use and perceived usefulness are influenced by external variable.

Up to date, many researchers added new variables based on the Technology Acceptance Model. Lewis and Gagel (2012) added the construct of compatibility in the Technology Acceptance Model. Dishaw and Strong (1999) integrated Technology Acceptance Model with Task-technology Fit. Johnson (2009) added cognitive absorption, playfulness and self-efficacy based on Technology Acceptance Model. Iztok and Krsto (2014) added subjective norms with Technology Acceptance Model. Juneseuk and Hakyeon (2013) integrated peer Influence with Technology Acceptance Model. Chiu et al. (2010) added personal innovativeness with Technology Acceptance Model. Kuskie (2014) and Alan, Scott, and Alejandro (2015) added the construct named trust with Technology Acceptance Model Jing, Xuefeng, Donghua and Xiao (2015) integrated technology readiness with Technology Acceptance Model.

Chen et al. (2009) synthesized the essence of technology readiness, Technology Acceptance Model, and Theory of Planned Behavior to propose an integrated model for understanding customers' continued use of self-service technologies. Lee (2009) united the Technology Acceptance Model with Theory of Planned Behavior, perceived risk and perceived benefit to understand the adoption of Internet banking. Based on the various models used in previous literature review, this study chose to use relative advantage, compatibility, complexity and observability as the conceptualized independent variables that influence technology adoption. After being aware of a technology, each mechanic individually forms an attitude as to whether a particular innovation or invention has: a relative advantage over a previous one is compatible is easy to use and its benefits are clearly observable.

1.1.4 Micro and Small Automobile Enterprises in Kenya

Having acknowledged the importance of the informal sector (MSEs) especially in job creation and exploitation/utilization of local resources, the question of its sustainability arises. The Sessional Papers No. 2 of 1992 and 2005 (RoK, 1992, 2005) clearly summarizes the problem of technology in Kenya. These papers state that MSEs have restricted levels of technology, inappropriate technology and inadequate institutional capacity to support adaptation and absorption of modern technological skills. In addition to this, the twin processes of globalization and liberalization, combined with rapid advances in information and communication technologies, are creating new dynamics in business operations, enterprise development and international competition. Kenya's existing enterprise development strategies may no longer be effective in light of the changes in the environment.

In Kenya, repairs to motor vehicles are undertaken in either of two places: dealer (formal) garages and Jua Kali (informal) garages. Majority of the mechanics in Jua Kali garages are male. This is due to the public perception of automotive industry in general and the nature of working environment in the Jua Kali garages in particular. Lack of tools and equipment means that one uses a lot of extra energy and spends long hours in scorching sun. Majority of the Jua Kali garages are found in urban centers (Wanyeki, 2014). This is because in urban centers is where most motorists are found and also where supporting businesses (spare part shops, petrol stations, etc.) are found. Those garages located in the outskirts of town are to be found in the densely populated estates and this is because the high rate of unemployment in such estates forces many people to start Jua Kali businesses including garages. The majority of the Jua Kali garages are located in temporary workshops. This could be attributed to the ownership of the plots within town in that most Jua Kali garages rent the places they are using and therefore cannot make permanent improvements on the plots (Wanyeki, 2014).

According to Kenya Motor vehicle repair association (KEMRA) (2014), most garage owners/managers have had some form of formal education. This is because the nature of activities in garages requires some technical understanding and so it is

imperative that the owners/managers have some basic education. In contrast, the majority do not have professional qualifications. This seems to be because those with formal training normally secure jobs in the formal sector and it is only after retirement from the formal sector that some venture into the Jua Kali sector. Also there is perception by some of the owners/managers (and even some members of the public) that the curricula in technical training institutions are outdated, and hence not relevant to the job market. Most garages handle less than five cars a day. This is due to their capacity in manpower and space. Plot owners don't restrict the numbers or kinds of tenants in their plots so long as one can find space and is ready to pay rent. This makes most garages to be congested and restricts the number of cars at any given time and also the number of mechanics.

Majority of the Jua Kali garages perform both minor services and major services. This is because the services involve routine maintenance and schedule services which in most cases are done upon the requests of customers. There is nothing much that requires specialized personnel and equipment and anybody with basic automotive knowledge can do. It involves visual checks, adjustments and component replacement (i.e. changing oil, fuel and oil filter, spark plugs, brake pads and shoes). Mechanics in the informal sector perform the bulk of the repairs yet most of them do not have the right equipment and many have had no formal education in repairs of motor vehicles. In the automotive industry, the repair of motor vehicles is one activity that the Jua Kali sector has come up as an alternative to the formal (dealer) sector.

Technological inventions, innovations and developments in electronics, hydraulics and pneumatics have revolutionalized the automobile industry. In light of the these developments, the informal sector mechanics must be equipped with appropriate technical skills in order to have a competitive edge as far as servicing or repairing modern vehicles is concerned (WB, 2013). Low costs of training (apprenticeship) in this sector attract potential mechanics. However the quality of services offered in this sector is much lower than those offered in more formal settings (Kipkurui, Kithyo, Okemwa & Korir, 2004). This may be attributed to lack of proper tools and

equipment and also lack of capacity to adopt modern technology. In spite of these developments, there is no known study that has been undertaken to provide some insight as to the slow pace of technology adoption among the informal mechanics. Yet, the mechanics have not kept up with the changes and this has had a negative impact on the quality of the repairs they undertake on motor vehicles.

1.2 Statement of the Problem

According to Kenya Motor Repairs Association (KEMRA, 2014), micro and small enterprise garages so far employ about 85,000 mechanics across Kenya. However, only 20 percent of MSE garages and workshops adhere to a modicum of professional standards. Even then, these standards are not centrally regulated. A summary report of a National Highway Transport and Safety Authority (2013) task force that studied consumer losses in auto repair and maintenance found that consumers lose about $20 billion annually due to improper or unnecessary repair and maintenance practices. The losses consist of wasted repair expenditures, wasted fuel, avoidable accidents and pollution, and reduced car life occasioned by improper diagnosis and repair of modern automobiles. Another study conducted by Morgan (2013) during the month of November 2013 on world traffic deaths by region revealed the following number of deaths due to motor vehicle accidents: South-East Asia 335,000, Western Pacific 334,000, Africa 194,000, Middle East 123,000 South America 94,000, Europe 92,000 and North America 52,000. Most of these accidents were caused by driver error or mechanical failure. Mechanical failures are, in turn, caused by incompetent mechanics. With increasing technical sophistication, mechanics require continuous development of technical skills necessary for them to remain relevant in their practice or otherwise "perish" Barber (2013).

When repair workshops or garages don't embrace an established code of standards, it means their work cannot be consistently relied upon in terms of safety and cost effectiveness (M'Mutirithia, 2014). This implies that most work done by these fair to middling garages is pure guesswork, trial-and-error that we normally christen mechanical faults when accidents occur. Adoption of modern automobile technology would ensure accurate and reliable diagnoses, repair and or service of vehicles. It is

critical for the informal mechanics to adopt modern auto technology in order to alleviate the possible challenges.

1.3 Study Objectives

1.3.1 General Objective

The general objective of this study was to assess the determinants of modern automobile technology adoption among mechanics in micro and small enterprises in Kenya.

1.3.2 Specific Objectives

1) To establish the influence of relative advantage in the adoption of modern automobile technology among the informal mechanics in Kenya.
2) To determine the influence of compatibility on modern automobile technology adoption among the informal mechanics in Kenya.
3) To establish the influence of complexity on the adoption of modern automobile technology among the informal mechanics in Kenya.
4) To determine the influence of observability in the adoption of modern automobile technology among the informal mechanics in Kenya.

1.4 Study Hypotheses

1) H_0: Relative advantage does not influence the adoption of modern automobile technology among the informal mechanics in Kenya
2) H_0: Compatibility has no influence on adoption of technology within the informal automobile mechanics in Kenya.
3) H_0: Complexity or 'ease to use' does not affect adoption of technology within the informal automobile mechanics in Kenya.
4) H_0: Observability does not play any role in the adoption of technology within the informal automobile mechanics in Kenya.

1.5 Justification of the Study

This study is important in a number of ways: first, the study ventures into a field critical to the development of human resources. In particular, this study focused on

the development of informal automobile mechanics operating MSEs, whose role has been underestimated both at the local and national level, resulting in little effort being directed at developing and exploiting the inherent potential. Further, the globalized economy is seriously campaigning for greener energy solutions. Therefore, minimization of harmful carbon emissions exhausted from the increasing number of automobiles is crucial. This can be achieved only if the mechanics adopt technologies that can enable them to; effectively and efficiently service and repair vehicles as per the manufacturers' standards. This will also lead to fuel efficiency in a country like Kenya where fuel prices are considerably very high. Also identifying the technological challenges facing informal mechanics may be meaningful in terms of the types of intervention (finance, training, management, and technology) donors from the developed countries may provide.

Secondly, much data regarding MSEs is still needed and thus this study generated information on the status of mechanics operating in Kenya and Kenya as a whole. The goal here is a move towards liberating mechanics from their socio-cultural, psychological and economic handicaps through developing approaches that enhance adoption of modern technology. Finally, the study is justified on the grounds that the information availed will assist the Kenya government and other stakeholders in policy formulation and in the development of appropriate approaches for future interventions, so as to effectively cater for entrepreneurs in MSE sector. It is hoped that this study adds to the available body of knowledge and increase the understanding of how to best empower mechanics in the informal sector, so that they in turn can contribute more meaningfully to economic development.

1.6 Scope of the Study

The study was conducted in Nakuru town's industrial area where most informal garages are located and only informal (Jua Kali) motor vehicle mechanics who work on light cars, light and heavy trucks were investigated. Mechanics working on motor cycles, farm tractors and earth moving machines were not included in this survey.

1.7 Limitation of the Study

This study was limited to Nakuru town. A significant proportion of informal mechanics are apprentices with little or no formal education. Due to this reason, some have developed a “techno phobia” and thus were not comfortable to respond to the survey. In addition, mechanics with lower formal education levels; for instance primary school leavers are not able to interpret vehicle manufacturers’ manuals and schematic diagrams. Use of modern diagnostic tools may also prove challenging since most require basic computer skills. And because of most of the mechanics have not conformed to the regulatory demands of the industry and the county government, they did not easily cooperate fear of taxation if documented. In mitigation, a humble explanation, in Kiswahili; as to the importance of the study was made and that the recommendations after the findings are geared to improve the sector. It was further clarified that the study was solely academic and that the local authorities were not involved as to unveil those who have not conformed to the laid down regulations.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

Micro and Small Enterprises (MSEs) in Kenya operate within restricted levels of technology and most of them use inappropriate technology. They lack capacity for modern technological adoption and absorption. In some instances, small enterprises simply have no way of gauging the appropriateness of technologies (KIPPRA, 2007). Until many users; in this case the informal automobile mechanics, adopt a new technology, it may contribute little to their well-being (Hall & Khan, 2002). This chapter discusses various theories of technology diffusion and adoption, the conceptual framework, empirical literature, critique of literature relevant to the study and research gaps.

2.2 Theoretical Framework

The decision of whether an individual will adopt a particular technology and the time frame involved with that decision has been a long source of research across multiple disciplines, and it influences business, school, and everyday life. However, the concept of technology literacy is increasingly becoming integrated into mandated curricula (Shield, 2013). Adoption theory examines the individual and the choices an individual makes to accept or reject a particular innovation. In some models, adoption is not only the choice to accept an innovation but also the extent to which that innovation is integrated into the appropriate context. Adoption theory, then, is a micro perspective on change, focusing not on the whole but rather the pieces that make up the whole while diffusion theory takes a macro perspective on the spread of an innovation across time. In contrast, diffusion theory describes how an innovation spreads through a population (Anderson & Harris, 2010; Wicklein, 2012, Pucel, 2008 and Pucel, 2014).

2.2.1 Theories of Technology Diffusion and Adoption

Innovation typically involves broad aspects of curriculum and instruction and might encompass a wide range of technologies and practices. One theory dichotomy relates to the scale of innovation efforts by distinguishing between macro-level theories and micro-level theories. Macro-level theories focus on the institution and systemic

change initiatives. Micro-level theories, on the other hand, focus on the individual adopters and a specific innovation or product rather than on large-scale change. The decision of informal automobile mechanics to adopt modern technology is a complex process with a wide number of influencing factors. A key issue in trying to determine future adoption of a technology is to understand why an individual would adopt one technology while resisting another. According to Straub (2009), "technology adoption is (a) a complex, inherently social, developmental process; (b) individuals construct unique (but malleable) perceptions of technology that influence the adoption process; and (c) successfully facilitating a technology adoption needs to address cognitive, emotional, and contextual concerns". A number of models and theories have arisen which aim to uncover the factors that will influence the adoption of technology. These factors range from focus on the technology itself through to the psychological characteristics of the individual (Dillon & Morris, 1996). Due to the wide ranging issues of why an individual would accept or reject a technology, it is unlikely that a single-variable explanation could account for this decision. Theories have been developed to help understand adoption and have been used to explain adoption in the educational context.

2.2.2 Technology Acceptance Model

Technology Acceptance Model, developed by Davis (1989), is one of the most influential research models in studies of the determinants of technology acceptance to predict intention to use and acceptance of technology by individuals. Technology Acceptance Model has received considerable attention of researchers in the information system field over the past decade. In the Technology Acceptance Model, there are two determinants including perceived ease of use and perceived usefulness. Perceived usefulness is the degree to which an individual believes that using a particular technology would enhance his or her job or life performance. Perceived ease of use is the degree to which a person believes that using a particular technology would be free of effort. Perceived ease of use and perceived usefulness positively affect the attitudes toward an innovation; and further, positively affect the individuals' intentions to use and the acceptance of a technology. In addition, perceived ease of use positively affects the perceived usefulness, and both of

perceived ease of use and perceived usefulness are influenced by external variable. Up to date, many researchers added new variables based on the Technology Acceptance Model. Jing, Xuefeng, Donghua and Xiao (2015) added the construct of compatibility in the Technology Acceptance Model. Dishaw and Strong (1999) integrated Technology Acceptance Model with Task-technology Fit. Lewisand Gagela (2012) added cognitive absorption, playfulness and self-efficacy based on Technology Acceptance Model. Venkatesh and Davis (2000) added subjective norms with Technology Acceptance Model. LaPorte and & Sanders (2013) integrated peer Influence with Technology Acceptance Model. Juneseuk and Hakyeon (2013) added personal innovativeness with Technology Acceptance Model. Shield, G. (2013) and Iztok, and Krsto (2014) added the construct named trust with Technology Acceptance Model.

Pucel (2008) and Johnson (2009) integrated technology readiness with Technology Acceptance Model. Chen et al. (2009) synthesized the essence of technology readiness, Technology Acceptance Model, and Theory of Planned Behavior to propose an integrated model for understanding customers' continued use of self-service technologies. Lee (2009) united the Technology Acceptance Model with Theory of Planned Behavior, perceived risk and perceived benefit to understand the adoption of internet banking. Chen and Chen (2009) re-examined the Technology Acceptance Model to understand the automotive telematics users' usage intention. Stern et al. (2008) proposed a revised Technology Acceptance Model to investigate the consumers' acceptance of online auctions. Serenko et al. (2007) modified Technology Acceptance Model to assess user acceptance of interface agents in daily work applications. Chen et al. (2009) proposed an integrated model including Technology Acceptance Model, Theory of Planned Behavior, and Technology Readiness to explain the users' adoption of self-service technologies.

A number of theories have been advanced by Rogers (1962, 1995, & 2003) and they include: a) Innovation decision process theory which asserts that, potential adopters of a technology progress over time through five stages in the diffusion process. First, they must learn about the innovation (knowledge); second, they must be persuaded of

the value of the innovation (persuasion); they then must decide to adopt it (decision); the innovation must then be implemented (implementation); and finally, the decision must be reaffirmed or rejected (confirmation), b) Individual innovativeness theory which argues that, individuals who are risk takers or otherwise innovative will adopt an innovation earlier in the continuum of adoption/diffusion, c) Rate of adoption theory, asserting that diffusion takes place over time with innovations going through a slow, gradual growth period, followed by dramatic and rapid growth, and then a gradual stabilization and finally a decline and d) the perceived attributes theory. The perceived attributes theory forms a strong basis for the conceptualized variables of this study.

2.2.3 The Innovation Decision Process Theory

The innovation decision process theory is one the many theories advanced by Rogers (1995) which asserts that Potential adopters of a technology progress over time through five stages in the diffusion process. First, they must learn about the innovation (knowledge); second, they must be persuaded of the value of the innovation (persuasion); they then must decide to adopt it (decision); the innovation must then be implemented (implementation); and finally, the decision must be reaffirmed or rejected (confirmation). This theory focuses on the user or adopter.

2.2.4 The Perceived Attributes Theory

In order to enhance communication and promotion effectiveness towards a targeted audience and besides understanding of the adopters' characteristics, there are three factors that influence innovation adoption decision: innovation attitudes in a community, external network effect, and population characteristics through which diffusion is to occur. Rogers (2003) identified five attributes of innovation that influence the diffusion process. Four of these attributes: relative advantage, compatibility, complexity and observability are hypothesized in this study as having a key influence to the adoption of technology within the informal automobile mechanics.

An innovation is considered for adoption if: it has an advantage over other innovations or the present circumstance (relative advantage). The relative advantage of one technology over another is a key determinant of the adoption of new technology. It is the level of innovation perceived as better that a previous idea. The issue of relative advantage has been shown to have a positive relationship with adoption of innovation (Tornatzky & Klein, 2011; Anderson & Harris, 2010; Grover & Güttler, 2013). Users need to be shown that modern automobile technology offers considerable benefit compared to traditional offering. A number of researchers have highlighted some of the key benefits that modern motor vehicles offer. Taking the Electronic Fuel Injection (EFI) system as an example, some of these advantages these include: (i) Uniform air/fuel mixture distribution. Each cylinder has its own injector which delivers fuel directly to the intake valve. This eliminates the need for fuel to travel through the intake manifold, improving cylinder to cylinder distribution. (ii) Highly accurate air/fuel ratio control throughout all engine operating conditions. EFI supplies a continuously accurate air/fuel ratio to the engine no matter what operating conditions are encountered. This provides better driveability, fuel economy, and emissions control. (iii) Superior throttle response and power. By delivering fuel directly at the back of the intake valve, the intake manifold design can be optimized to improve air velocity at the intake valve. This improves torque and throttle response. (iv) Improved emissions control. Cold engine and wide open throttle enrichment can be reduced with an EFI engine because fuel "flooding" in the intake manifold is not a problem. This results in better overall fuel economy and improved emissions control. (v) Improved cold engine start ability and operation. The combination of better fuel atomization and injection directly at the intake valve improves ability to start and run a cold engine. (vi) Simpler mechanics, reduced adjustment sensitivity. The EFI system does not rely on any major adjustments for cold enrichment or fuel metering. Because the system is mechanically simple, maintenance requirements are reduced (Innova, 2011; Growse, 2012 & Hayden, 2009).

An innovation is considered for adoption if it fits in or is compatible with the circumstances into which it will be adopted (compatibility).This is the degree an

innovation is perceived to be consistent with existing values or previous experience and need to the potential adopter. If the adopters require adjusting their existing routine and or the innovation or invention is in contrast to their attitudes, the more unlikely they are to adopt it (Appleton, 2012).. In addition the user's previous experience of adoption of new tools, whether this was a positive or negative experience will also influence the adoption of technology. A negative previous experience can result in innovation negativism which is where a negative previous experience with one innovation can negatively impact the adoption of another. In the case of automobiles, the diagnosis, service or repair of electronic fuel injection and automatic transmission systems is quite different from the traditional carburetor and manual gearbox systems. In the case of auto-body mechanics' tasks; the introduction and use of fibre glass, aluminium, and hard plastics as auto-body panels has necessitated the development of newer paints like spike hecker, metallics and sadocrylls. The repair of these panels may require complete replacement or advanced welding equipment like the tig and mig welders unlike the conventional arc and oxy-acetylene welders used in the traditional mils steel panels. It is inevitable for the auto-body mechanics to adopt these innovations if they are to remain competitive in the industry (Growse, 2012).

An innovation is considered for adoption if it is not overly complex to learn or use (complexity). Complexity (ease of use or learning) of a technology will also impact on adoption. Perceived complexity of the technology can lead to increased uncertainty and perceived risk, and these in turn could lead to a resistance to adopt (Childress, 2011). According to Betts, Welsh and Ryerson (2011), to explore the complexity of an innovation, it is necessary to understand the contexts in which it occurs. Nowadays, automobile makers incorporate electronic systems to control vehicle functions. This development has dramatically increased the complexity of the systems found in automobiles (Edmunds, 2011). These complex systems have vastly improved vehicle performance, safety and fuel efficiency, but also increased the likelihood of breakdowns. The more interdependent parts a system has, the higher the probability that the system will fail, after all. However, the on-board computer has made troubleshooting much easier when something does go wrong. During the

1980s, a universal system was established by the Society of Automotive Engineers (SAE) known as the On-Board Diagnostic system (OBD-II). This system became mandatory in 1996. When something goes wrong in a vehicle fitted with an OBD-II system, a "Check Engine" light flashes on the dashboard. A mechanic can plug into the vehicle computer and retrieve a code. This code is then cross-referenced with a handbook of codes and their meanings, leading the mechanic to an accurate diagnosis of the vehicle's problem. Using OBD-II, diagnostic tools, repairs are reliable since trial-and-error is eliminated. On the other hand, when something does go wrong, the cost of repairing modern vehicles can be more expensive than it was to fix an older models a few decades ago. The more complex modern engines require competent computer literate mechanics to repair. Because of the increased difficulty in managing the number of parts that would require replacement in the event of a crash, the cost of modern cars is more expensive (Growse, 2012). Other innovations pose unique complications to informal mechanics. For instance most automatic transmission problems can't be fixed by an average mechanic. There are just too many specialized tools and pieces of equipment one will need before attempting any repair. Airbag Systems in modern vehicles are highly complex systems with a number of components that require exact replacement and testing procedures, which require expensive equipment to test, examine, analyze, and repair. In most cases, the repair involves replacement of components. Most of the crash sensors are 'one-time-use' components, and are replaced, as they are not repairable (Lemurzone, 2012).

An innovation is considered for adoption if it's results can be seen or observed (observability). Observability is where by an innovation use and effects must be visible by others. According to the Society of Automobile Engineers (SAE), all vehicles manufactured after the year 1996 must be OBD II compliant (Innova Electronics, 2012). And with the government of Kenya policy that all vehicles imported into the country must be less than 8 years old since manufacture, it then means that most vehicles in the country incorporate EFI systems. In the case of gear shifting mechanisms, 85% of automobiles manufactured globally use automatic or semi-automatic transmission systems; commonly known in Kenya as "automatic

gearbox" (Growse, 2012). For this reason, a large number of automobiles in Kenya, including heavy commercial vehicles use automatic transmission systems.

In this regard, the informal auto mechanics have no choice but to adopt these technologies if they are to remain in business. Overall for a technology to be adopted into the Jua Kali context, it needs to show relative advantage, compatibility and lack of complexity. In addition users, especially mechanics need to see a technology in action and be given a chance to try out this technology themselves. The innovation or invention itself is important to consider, however, as shown in the last two characteristics, the perception of the user is also important.

2.3 Conceptual Framework

Technology adoption is the best way SME's can stimulate firm growth when they attach importance to innovative activities that build reputation in the market environment. Essentially the major reason for technology adoption is the desire to have increased business performance, higher turnover of products and services and increased competitive edge (Sonobe, Yukichi & Yukata, 2011). Figure 2.1 depicts a conceptual framework illustrating some of the variables that will influence adoption of innovations by informal mechanics. The figure conceptualizes that the dependent variable; adoption, is influenced by an individual mechanics' perception on a particular innovation's relative advantage, compatibility, complexity and Observability.

These are the four independent variable attributes upon which an innovation is judged: that it has an advantage over other innovations or the present circumstance (relative advantage), that it fits in or is compatible with the circumstances into which it will be adopted (compatibility), that it is not overly complex to learn or use (complexity and that results can be observed (observability) . Relative advantage, compatibility, and complexity attributes are related to benefit costs in the innovation for the adopters. Individuals or organizations would likely adopt the innovation if: a) it offers clear benefits, b) it does not drastically disturb the life style of the existing pattern, and c) it is easy to understand. Observability attribute is related to risk.

Adopters will not adopt an innovation if its benefits are hard to observe. This characteristic may increase uncertainty level on the value of the innovation and therefore increase the risk of its adoption(Riddell & Song, 2014). Although the performance of innovation to meet the technical features and price requirements can influence the above five factors, at the end, it is the perception of the adopters which is the determining factor.

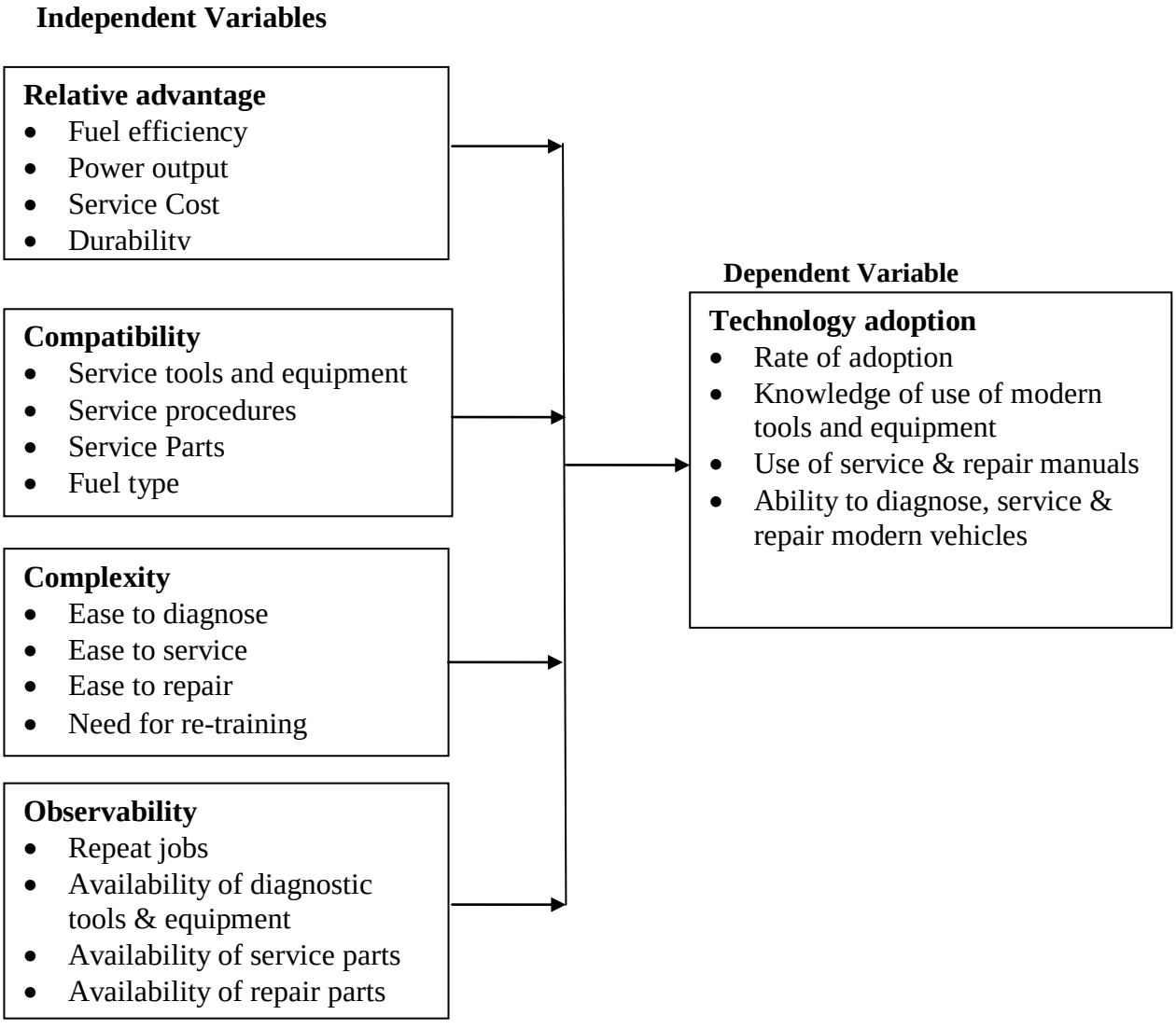

Figure 2.1: A Conceptual Framework

2.3.1 Relative Advantage of a Technology

Relative advantage is the degree to which an innovation is considered a better than an alternative innovation. The greater the degree an individual perceives the advantages of an innovation to be, the more rapid the innovation's rate of adoption will be (Rogers, 2003).

Micro and small enterprises must recognize that the adoption of innovation will either offer solutions to existing problems or present new production opportunities, such as increased productivity and improved operational efficiency. A rational adoption decision in an organization requires that one assesses the potential benefits of the new technology to the business (Autor, Frank & Richard 2012). Mechanics will adopt a technology when they see a need for that technology, believing it will either take advantage of a business opportunity or close a suspected performance gap. In this study, the mechanics must be convinced that modern vehicle innovations offer: fuel efficiency, better power output, less service cost and a longer life span.

2.3.2 Compatibility in Innovations

Compatibility is the degree of the consistency of the innovation with the existing values, past experience, and needs for potential adopters. If an idea is inconsistent with the values of a society, it will not be adopted in the same rapidity as if it is compatible (Rogers, 2003). And if previous technological ideas were introduced and were not accepted then the new ideas will be judged based on the performance of the previous ideas. When mechanics perceive that the technology they want to adopt is consistent with their daily routine and there is no much change in the tools, equipment and service procedures, they will adopt that technology. The greater the compatibility with the felt needs, the greater the adoption rate. Attributes of compatibility can impact on the decision to use new technology because technology often requires establishments to change their existing business practices and operations in order to increase the benefits of using the technology. In his study, Parr (2014) concluded that one of the major problems in the adoption process is the

incompatibility of new technologies with present standards and business procedures. Previously introduced ideas may hinder or help the adoption of new technology. Compatibility practices can have a positive role in deciding whether a new idea will be introduced.

2.3.3 Complexity of a Given Technology

This is the degree to which an innovation is perceived as difficult to understand and use. New ideas that are simpler to understand are adopted more rapidly than an innovation that require the adopter to develop new skills and understandings. When deciding to adopt an innovation, the inherent difficulty of using the innovation is a major concern to the user Riddell & Song, 2014). Complexity also goes beyond these elements; a potential user must also understand why the innovation is appropriate or beneficial. The chances that a mechanics will decide to implement technology that is complex are very low. Nomsa (2013) states that the adoption of modern automobile technology is highly related to this perceived complexity. Because of previous experience with technology, complexity will consequently be negatively associated with adoption and any subsequent technology that emerges will not be accepted. Very few MSEs will want to spend time training the employees on the level of expertise because that is time wasted for them. Motor vehicle garage owners would rather employ mechanics with the skills that are needed, than spend money on training. Studies show that an organization is less likely to accept a new technology if it expects that a high level of new expertise must be acquired by its employees. If employees find that it is difficult to use the technology they will not use the technology whatever benefits it may have (Kartwi & MacGregor 2011).

2.3.4 Observability of a Technology

Observability is the other critical factor that shapes innovation and diffusion. Observability refers to the ease with which a product's benefit s or attributes are

visible and observable (Rogers, 2003). The easier it is for mechanics to see the results of an innovation, the more likely they are to adopt it. Visible results lower uncertainty and also stimulate peer discussion of a new idea, as friends and neighbors of an adopter often request information about it. In this study, the frequency of repeat jobs, availability of diagnostic tools and equipment, availability of service and repair parts was observed. Observability attribute is related to risks. Adopters will not adopt an innovation if its benefits are hard to observe. These characteristic increases uncertainty level on the value of the innovation and therefore increase the risk of its adoption (Nomsa, 2013). According to the society of automobile engineers (SAE), all vehicles manufactured after 1996 must be on-board diagnostic compliant. This means they incorporate a central processing unit (CPU), are electronically fuel injected and electronically ignited. In addition 85% of all vehicles being manufactured today use automatic transmission systems. These are the major components of modern automobiles (Innova, 2013).

2.3.5 Technology Adoption

Successful adoption of a particular innovation should: score higher in terms of its relative advantage over existing practices, be compatible to previous practices, be easy to try, observable, and lower in its complexity to use (Rogers, 2003). Relative advantage, compatibility, and complexity attributes are related to benefit costs in the innovation for the adopters. Individuals or organizations would likely adopt the innovation if: a) it offers clear benefits, b) it does not drastically disturb the life style of the existing pattern, and c) it is easy to understand. Both triability and observability attributes are related to risks. Adopters will not adopt an innovation if its trial is difficult to do or its benefits are hard to observe. These characteristics increase uncertainty level on the value of the innovation and therefore increase the risk of its adoption. Although the performance of innovation to meet the technical features and price requirements can influence the above five factors, at the end, it is the perception of the adopters which is the determining factor (Rogers, 2003).

When a new technique has been adopted the speed at which other MSEs adopt may differ widely. This leads to what can be called the rate of diffusion (imitation). Empirical studies suggest that the adoption of a new technology follows a bell-shaped, or normal, distribution curve (Norris & Vaizey, 1973). By plotting cumulatively, the number of MSEs who adopt a new technology in any given period will give an `S'- shaped curve. Gabriel (1903) in his book "The Laws of Imitations", proposed that adoptions plotted against time assume a normal distribution, or if plotted cumulatively assume the `S'-shaped curve. There are two general reasons for the occurrence of this distribution. First, the diffusion process for MSEs is a learning process. MSEs who are potential users have to become aware of the technology and then to attempt to evaluate it. Consequently they may use the technology on a trial basis. The learning process takes place at this stage. Information about the technology has to be disseminated, and as it is adopted by other MSEs on an experimental basis the information becomes more reliable.

The importance of accumulated knowledge and expertise is another important factor determining whether firms are likely to adopt new technology or to act as sources of innovation (Gurisatti, Soli & Tattara, 1997). Doubts will be overcome, which will in turn reduce the risk of adopting the technology. The concept of the individual MSE adoption curve can be extended to a network group of MSEs where experience with a new technology increases as each successive MSE adopts the new technology. As a result, the distribution of MSEs adopting a technology might be expected to yield a normal curve. When only a small number of MSEs have adopted a technology, there are a small number of diffusers who can generate information on the technology and from whom the technological idea can spread. Diffusion rates at this point are low. When the number of MSEs using the technology increases, the "information base" broadens and because there is still a considerable number of MSEs who have not adopted the new technology the rate of diffusion increases (Fidler & Johnson, 1984). When there are a large proportion of MSEs using the technology the number of potential MSEs still remaining becomes small. The remaining MSEs will be resistant to change and there will be a slowdown in the cumulative number of MSEs using the new technology. This will yield an `S'- shaped curve.

Despite the shape of the curve for technology adoption appearing `S'-shaped, there will be differences in the speed at which technology is diffused and the length of the adoption process. Both within and between industries there will be considerable variations in the rate of the diffusion of technology between MSEs. Important factors which appear to affect the rate of diffusion (speed at which a new technology is accepted) are the characteristics of the MSE and the characteristics of the technology itself. Early work on the categories of adopters found that further to adoption following a normal distribution curve the distribution could be used to show the categories of adopters (Rogers, 1962). Figure 2.2 shows the categories of adopters with the majority of adopters lying between the mean and the mean minus/plus the standard deviation on the normal distribution curve.

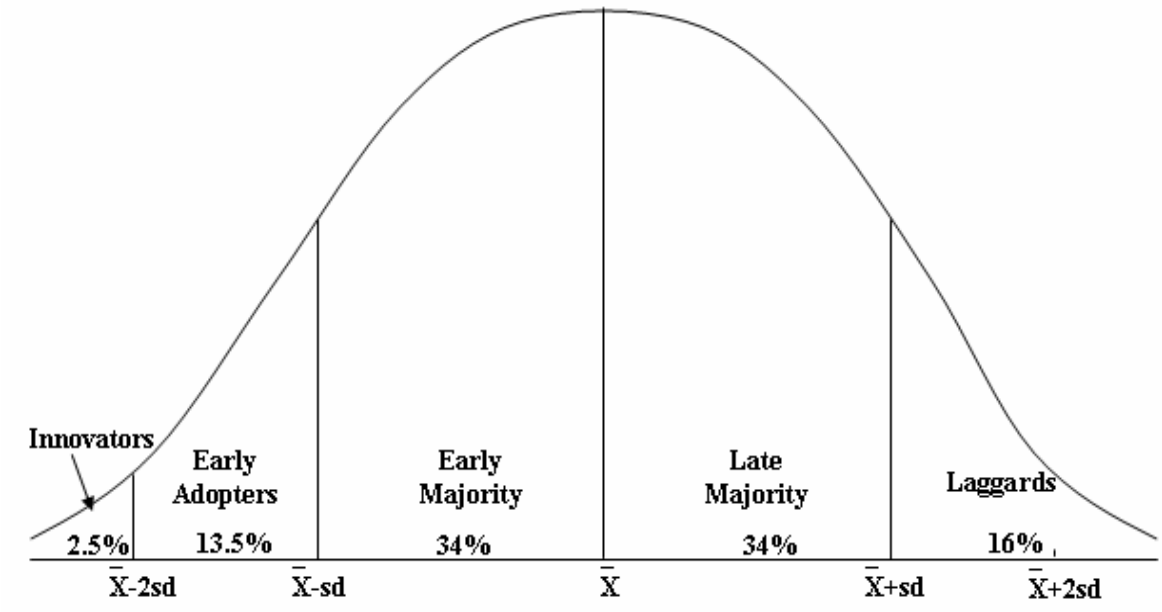

Figure 2.2: Adopter Categorization on the Basis of Innovativeness (Source: Rogers, 2003)

The categories of adopters can be described as follows: i) innovators; those who want to explore new technologies, ii) early adopters who adopt new technology if it is to their advantage, iii) the early majority who are intentional v) late majority who are sceptical and will adopt when the technology has diffused and v) the laggards are so in late adopting a new technology that it will have been superseded. The categories

of adopters, shows that, MSEs which adopt an innovation independently are innovators (Straub, 2009). MSEs that are early adopters will tend to be "technically progressive" and will be close to the best that can be achieved in the practice of applying technology (Brychan, 2000). It is expected that communication within the MSE is well organized and co-ordinated and there is willingness to share knowledge with other MSEs in its network

2.4 Empirical Literature

Technology adoption is a complex, inherently social, developmental process; individuals construct unique yet malleable perceptions of technology that influence their adoption decisions. This decision of whether an individual will adopt a particular technology and the time frame involved with that decision has been a long source of research across multiple disciplines, and it influences business, school, and everyday life. Therefore, it is essential to understand such aspects of the process such as the following: Why does one individual choose to adopt a technology while another resists? What is the influence of social context on the decision to adopt? These questions are addressed in the context of adoption and diffusion theories that suggest some attitudinal attributes that contribute to adoption.

2.4.1 Degree of Relative Advantage of a Technology

The relative advantage of one technology over another is a key determinant of the adoption of new technology. The issue of relative advantage has been shown to have a positive relationship with adoption of innovation (Tornatzky & Klein, 2012; Anderson & Harris, 2010; Teng, Grover, & Güttler, 2013). Users need to be shown that a new technology offers considerable benefit compared to traditional offering (Mac Callum, 2010). A study conducted by Abdullah (2013) titled "Perceived attributes of diffusion of innovation theory as predictors of internet adoption among the faculty members of Imam Mohammed bin Saud University". The general objective of the study was to examine faculty members' Internet adoption for academic and research purposes including teaching and academic research. The study uses both descriptive and explanatory research design and distributed 351 questionnaires of which 344 questionnaires, representing approximately 64% of the

total were returned completed. Multiple regression analysis showed that all attributes of innovation; relative advantage, compatibility, complexity, observability and triability individually predicted Internet adoption. The combination of all attributes indicated the model could predict Internet adoption among faculty. The data revealed 54.7% of IMSU faulty members used the Internet for research and academic activities twice a month or less, indicating a low Internet adoption rate. Statistically significant differences were noted among adopters and non-adopters relative to income level and English proficiency. The study recommended the following: Utilize electronic learning systems in teaching such as WebCT, market electronic databases to faculty members, hold workshops on Internet and databases information-seeking skills, increase Internet connection speed, establish enough computer labs and provide faculty members with training in the use of the Internet.

Another study by Saxena and Kehar (2011); "Innovation, Non-Expertise and Inabilities of Developing Countries E-Banking and E-Commerce" was carried out in India with a major objective to determine factors that influence the adoption of consumer oriented e-banking in various countries. Taking India and United States of America (USA) as case studies, the study used multivariate analysis of covariance (MANCOVA), correlation and multiple regression analysis to establish a relationship between adoption of modern banking technology and the Rogers innovation attributes. Findings were that relative advantage of a new technology had a positive relationship with adoption. This is corroborated by Tornatzky and Klein, (2012), Anderson and Harris, (2010), Teng, Grover, and Güttler, (2013) who also found that relative advantage has a positive relationship with adoption of innovation. Other studies, for instance; Lithogchail and Speece (2013) and Wanyoike (2013) found that the relative advantage of a new technology is positively related to adoption.

Mechanics need to be shown that modern automobile technology offers considerable benefit compared to traditional offering. A large number of researchers have highlighted some of the key benefits that modern vehicles offer, these include: better combustion leading to fuel efficiency, less harmful emissions, less frequent tune-ups, smoother and more dependable engine response during quick throttle transitions,

easier and more dependable engine starting, better operation at extremely high or low ambient temperatures, smoother engine idle and running, increased maintenance intervals among others (Growse, 2011). Overall modern motor vehicle technology does offer considerable advantages to mechanics and motor vehicle owners or users alike, however, the continued adoption needs to be encouraged for future uptake.

2.4.2 Level of Compatibility of a Given Innovation

A study was conducted by Kaushalya and Gapar (2014) titled "Postgraduate Students' Perceived E-Learning Acceptance: Model Validation". The purpose of the study was to compare the impact of innovation attributes on postgraduate students' e-learning acceptance between Sri Lanka and Malaysia. Using a cross sectional survey and a random sample of 400 respondents drawn from the postgraduate students in locally based universities in Sri Lanka and Malaysia, it was found that Sri Lanka and Malaysia has similar in e-learning acceptance in terms of observability and relative advantage which has a significant impact on attitude and intention of using e-learning. Complexity and observability were the least significant factors on e-learning acceptance in both Sri Lanka and Malaysia.

Compatibility of the innovation needs to align with individual's current values and experiences. The more compatible new automobile technology will be to mechanics and users the less a change of behavior is required, therefore, allowing for faster adoption. If a technology requires mechanics and users to adjust their existing behavior or is in contrast to their attitudes, the more unlikely they are to adopt (Lippert & Forman 2012). In addition the user's previous experience of adoption of new tools in work place, whether this was a positive or negative experience will also influence the adoption of new automobile technology. A negative previous experience can result in innovation negativism which is where a negative previous experience with one innovation can negatively impact the adoption of another (Saxena & Kehar, 2011). This may be a contributing factor among informal mechanics where previous technology has an impact on the perception and future adoption. Compatibility attribute is related to benefit costs in the innovation for the adopters. Individuals or organizations would likely adopt the innovation if it does not drastically disturb the life style of the existing pattern. Lithogchail and Speece (2013)

studied e-commerce adoption among owners, presidents and chief executive officers of small and medium enterprises in Thailand. The study randomly sampled 800 participants and conducted an interview to establish factors that influence the rate of e-commerce adoption among the SMEs. Multinomial logistic regression was deployed to analyze the data. Findings of the study indicated that relative advantage, compatibility and observability were positively correlated to the rate of e-commerce adoption while complexity had a negative correlation. In this study, compatibility emerged as the most important factor.

2.4.3 Perceived Complexity of a Technology

The complexity (ease to use or learn) of a technology will also impact on adoption. If the use of a new technology requires considerable learning it is less likely to appeal to users. In addition the perceived complexity of a technology can lead to increased uncertainty and perceived risk, and these in turn could lead to a resistance to adopt (Jolly, 2011). A study was conducted by Rahim, Ladipo and Kunle (2013) titled "Perceived attributes of successful and unsuccessful Innovations". The general objective of the study was to assess the perceived attributes of successful and unsuccessful innovations. The study used both descriptive and explanatory research design, using secondary information. It described the study variables and at the same time provided explanation on why certain innovations diffuse faster and why others fail. Findings of the study indicated that ease to use (complexity), relative advantage, compatibility and observability and in that order are the main factors that determine the rate of technology adoption. In a conclusion, understanding the diffusion process is really key to understanding how conscious innovative activities conducted by firms and governmental institutions in the area of research and development, transfer of technology, launching new products or creating new processes, enhance and improve economic and social welfare which are usually the end results of these activities. The study recommended that firms should research the demographic, psychographic, and the media characteristics of innovators and early adopters and channel communication and marketing strategies specifically at them.

Another study conducted by Owston, (2013); "Contextual factors that sustain innovative pedagogical practice using technology" revealed that ease to use or perceived complexity play a major role in technology adoption. The study applied a logistic regression model with a general objective of determining contextual factors that lead to sustainability of innovations. The study concluded that serviceability of an innovation is positively related to its sustainability. This is corroborated by Ngure (2013) who argues that due to the increasingly labyrinthine nature of the technology that is now incorporated into automobiles, most automobile dealerships and independent workshops nowadays provide sophisticated diagnostic computers to technicians, without which they would be unable to diagnose or repair modern vehicles.

In addition, Tan and Leo (2012) conducted a study to establish factors influencing the adoption of internet banking in Malaysia. The cross sectional survey sent out a questionnaire to 346 bank employees sampled from all banks in Malaysia. Appling a multiple linear regression model, the study unveiled that among other factors, relative advantage, compatibility and complexity influenced adoption. Identifying and closing skills deficiencies is vital to long-term economic prospects in order to sustain sectors like the informal motor vehicle mechanics that are at risk of disappearing, not being developed or leaving their main tasks to be taken up by formal dealership garages. Experience has shown that lack of skills is the principal factor related to poor quality and productivity and that attitude is often the constraint to turning ideas into products and a successful business (Morgan, 2014). Complexity attribute is related to benefit costs in the innovation for the adopters. Individuals or organizations would likely adopt the innovation if it is easy to understand (Rogers, 2003).

2.4.4 Observability of Innovations

Observability is whereby the innovation use and effects must be visible by others. The dynamic changes in of modern automobile technology are visible and their effects on users are also visible. A study by Wanyoike (2013); "Determinants of Information and Communication Technology adoption by small enterprises in urban

Kenya" used a logistic regression model to establish if there is any relationship between the Rogers (1995) technology adoption attributes and ICT adoption in Kenya. Findings were that: relative advantage, compatibility, and complexity and observability influence adoption of ICT among small enterprises. Advantages cited included: improved business efficiency and operational effectiveness, increase in speed and reliability of transactions among others (Giovani & Mario 2013; Becklinsale & Ram, 2010). Previous studies by Lithogchail and Speece (2013) and Saxena and Kehar (2011) found that Observability of a new technology is positively related to adoption.

Another study was conducted by Tully (2015) titled "Investigating the role of innovation attributes in the adoption, rejection, and discontinued use of open source software for development" with a general objective of investigating the role of innovation attributes in the adoption, rejection, and discontinued use of open source software for development. Drawing on technology adoption research, particularly diffusion of innovations, the study analyzed organizational adoption decisions of a new ICT by organizations in Nairobi, Kenya. Through a multi-case study and interviews with potential adopters, this research assessed the influence of perceived innovation attributes on adoption decisions regarding the Ushahidi Platform, a tool designed for collecting, aggregating, and mapping information. Findings suggest that perceptions of trialability and observability, two attributes that have been found to be less predictive in past research, were influential in the decision process.

2.5 Critique of Literature

Globally, a number of studies have been undertaken, out of which, most have employing the Rogers model of technology diffusion and adoption. MacCallum (2009), in her study; "Adoption Theory and the Integration of Mobile Technology in Education", applied the model to provide an overview of challenges of mobile technology adoption in the learning context. The study, carried out in New Zealand, unveiled that there are a wide variety of factors that influence the adoption of mobile learning. In agreement with Rogers, these factors included: the characteristics of the innovation, such as its relative advantage; compatibility; trialability, observability;

and complexity. In addition variables such as a technology's perceived usefulness, ease of use, individual attitudes and variables was also found to influence the rate of adoption. The research showed that due to the relative newness of mobile learning, only the innovators and early adaptors quickly adopted mobile learning, and that a critical mass was needed to enable mobile learning to truly become widely adopted. The study was conducted in a relatively developed country where the learners had access to the required material resources; in this case the mobile phones and no knowledge barrier. This is unlike the case of informal automobile mechanics in Kenya where both the equipments and knowledge are major constraining factors in speeding up the adoption rate.

Carayannis and Turner (2006) undertook a study on Public Key Infrastructure (PKI) adoption in the United Kingdom (UK). PKI is a set of codes, practices, policies and encryption techniques for the secure transmission of data over digital networks. The study provided a review of diffusion of innovation studies and of the important factors of diffusion as they relate to the uptake of a specific information technology security product. In particular, Carayannis & Turner related the adoption of PKI to the Rogers (2003) claim that successful diffusion depends on a relative advantage (as opposed to simply competitive advantage). In the case of PKI, widespread adoption was found to be slowed down by interoperability issues, difficulties in the cross-certification of institutional users, system access, and the overall complexity of the PKI solution; each of which are identified in the diffusion of innovation literature as essential for successful adoption. Thus, in spite of having a relative advantage over other digital security products by offering a more secure framework, PKI does not meet most of the other requirements for successful product adoption. Having done in the UK, a technologically and economically developed nation, and at macro level; resource availability was not a significant challenge as compared to developing countries like Kenya.

Another study "A Model of the Diffusion of Technology into MSEs, Foster (2014) found that; the rate of adoption of a new technology will be faster if it is compatible with the previous experience and present normative values of MSEs. The objectives

of the study were threefold: first, to investigate technology diffusion in the form of new or improved technology through formal and informal networks enabling learning by interacting; second, to develop a model of technology diffusion including external sources, channels of technology transfer, and mechanisms involved in the transfer of technology into innovative MSEs; and third, to relate the model to "best practice" and to note situations where "low activity" can be improved. The implications for policy relevant to technology and entrepreneurship arising from the model of technology diffusion were investigated and conclusions drawn. Brychan described two principal types of technology diffusion as: "disembodied" diffusion (the transmission of knowledge and technical expertise) and "embodied" diffusion (the introduction into production processes of machinery, equipment and components incorporating new technology) (Betts, Welsh, & Ryerson 2011).).

In the first case, the knowledge and technical expertise the informal mechanics possess is not at pace with the industry dynamics. In the second case, equipment and components like the electronic fuel injection scanners, trouble code readers, computerized engine analyzers among others are unavailable and inaccessible to a larger proportion of the Jua Kali mechanics in Kenya. Findings of the study revealed that sociological forces have an important role to play in the adoption of technology within MSEs. Further and in agreement with Rogers, the rate of adoption of a new technology was found to be faster if it is compatible with the previous experience and present normative values of MSEs. Other influences on the speed of diffusion included the complexity of the new technology and random influences.

2.6 Research Gaps

First, it is evident that most studies on adoption have been conducted on macro rather than micro levels, that is, they have focused on institutions and enterprises. Whereas this is important, an understanding of particular individuals, in this case individual mechanics; who operate the enterprises is considered more critical. This is not only because the future sustainability of the enterprises is largely the result of personal characteristics and traits that the entrepreneurs bring into the business environment, but also in corroboration with the individual innovativeness theory (Rogers 1995,

Moore, 1991). Second, most studies done so far have been conducted in developed economies with relatively enabling environments; in the entrepreneurial resource context. The studies have assumed the availability of basic resources necessary for enterprise growth: financial resources, human resources and material resources. This may not apply in most developing countries like Kenya, and Kenya in particular; where entrepreneurs in the informal sector are constrained with the necessary resources. Finally, there is no known technology adoption study that has been conducted within the informal or even formal automobile mechanics. Most Jua Kali automobile mechanics may not only lack the capacity to adopt modern auto technology, but a significant number lack awareness of the technologies; a technology transfer gap.

2.7 Summary of the Literature

Substantial literature, both theoretical and empirical; have corroborated in the explanation of factors that influence the diffusion of technology, that an individuals' perception of an innovation or invention play a major role. Adoption theories examine an individual and the choices that individual makes to accept or reject a particular innovation. In some models, adoption is not only the choice to accept an innovation but also the extent to which that innovation is integrated into the appropriate context. Adoption theory, then, is a micro perspective on change, focusing not on the whole but rather the pieces that make up the whole while diffusion theory takes a macro perspective on the spread of an innovation across time. A key issue in trying to determine future adoption of a technology is to understand why an individual would adopt one technology while resisting another. Innovation decision process theory asserts that, potential adopters of a technology progress over time through five stages in the diffusion process. First, they must learn about the innovation (knowledge); second, they must be persuaded of the value of the innovation (persuasion); they then must decide to adopt it (decision); the innovation must then be implemented (implementation); and finally, the decision must be reaffirmed or rejected (confirmation), b) Individual innovativeness theory which argues that, individuals who are risk takers or otherwise innovative will adopt an innovation earlier in the continuum of adoption/diffusion, c) Rate of adoption

theory, asserting that diffusion takes place over time with innovations going through a slow, gradual growth period, followed by dramatic and rapid growth, and then a gradual stabilization and finally a decline and d) the perceived attributes theory. The perceived attributes theory forms a strong basis for the conceptualized variables of this study. Perceived attributes like: relative advantage, compatibility, complexity and observability among others are key factors that influence the adoption process.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

The purpose of this study was to identify the determinants of modern automobile technology adoption among mechanics operating in micro and small enterprises in Kenya. . According to literature some suggestions exist as to why some of the users resist using new technology. The research methodology discusses the steps followed during the actual research process. These include: the research philosophy, the research design, target population, sampling techniques, data collection method and instrumentation, modes of data analysis and presentation and statistical model of analysis.

3.2 Research Philosophy

The research philosophy used in this study was positivism where hypotheses based on existing theories were tested through data analysis preceded by a survey. Two major research philosophies have been identified in the Western tradition of science, namely positivist sometimes called scientific and interpretivist also known as antipositivist (Galliers, 1991).However, it has often been observed (Benbasat.; Goldstein, & Mead, 1987) very accurately that no single research philosophy is intrinsically better than any other methodology, many authors calling for a combination of both in order to improve the quality of research (Kaplan & Duchon, 1988). Positivists believe that reality is stable and can be observed and described from an objective viewpoint (Levin, 1988), i.e. without interfering with the phenomena being studied. Interpretivists (anti-positivists) contend that only through the subjective interpretation of and intervention in reality can that reality be fully understood. The study of phenomena in their natural environment is key to the interpretivist philosophy However, recognizing the lack of objectivity sometimes associated with interpretivist research methods; this study adopted a positivist, quantitative approach to the development of our key research instrument. The positivist tradition has taken a firm hold (Hoepfl, 2014), Orlikowski and Baroudi (1991) noting that 96.8% of researches in the leading US journals conform to this

paradigm. Pervan (1994), in a review of 122 articles in the GSS literature, observes that only 4 (3.27%) could be described as interpretivist.

3.3 Research Design

This study was a descriptive research specifically deploying cross-sectional survey to gather information from informal automobile mechanics in Kenya in order to establish and assess the role of: relative advantage, compatibility, complexity and observability; in the adoption of modern auto technology. This type of design utilizes different groups of people who differ in the variable of interest, but share other characteristics such as socio-economic status, educational background among others (Hoepfl, 2014). This methodology is suitable for this study because informal mechanics tend to specialize in different areas like: auto-body, auto electrics, petrol and diesel powered engines though they have common socio-economic characteristics. The defining advantages of this design are that, it takes place at a single point in time, it does not involve manipulating variables, it allows researchers to look at numerous variables at once (training, income, experience) and is often used to look at the prevalence of phenomenon in a given population (Eisner, 2013). Since there is no manipulation of any variable, this design is reliable and if carried out in similar environments, it will yield similar results. This design estimates prevalence of an outcome of interest because the sample is usually taken from the whole population. Since cross-sectional designs generally use survey techniques to gather data, they are relatively inexpensive and take up little time to conduct others (Hoepfl, 2014).

3.4 Target Population

The population for the survey involved in this study consisted of an estimated 5,000 mechanics that according to Nakuru Jua Kali Association (NAJUKA) are operating in the informal sector in Kenya (NAJUKA, 2014). This is 5.88% of an estimated 85,000 motor vehicle mechanics operating in micro and small enterprises in Kenya (M'Mutirithia, 2014). The choice of Kenya was prompted by the fact that the town is one of the wealthiest in Kenya and has a huge agricultural, transportation and tourism potential. Road transport is the main mode of communication as witnessed

by a large number of vehicles in the town lately and an increasing number of automobile franchises and informal mechanics all positioning themselves to get a market share in terms of service provision given the potential demand. In addition, Nakuru is a representative of Kenya given that the rapid growth of the town has been accompanied by an increasing number of new model motor vehicles. Another reason is that, in Kenya, more than 95% of the informal mechanics are concentrated in one central point; the industrial area. This makes it convenient to access the target population within a short period.

3.5 Sampling Techniques and Sample Size

This study applied both probability and non-probability sampling techniques. "Probability sampling ensures the law of Statistical Regularity which states that if on an average the sample chosen is a random one, the sample will have the same composition and characteristics as the universe" (Kothari, 1990; p.60). Since the informal mechanics from which samples were drawn comprise of heterogeneous groups, stratified sampling technique was applied in order to obtain a representative sample. Using this technique, the mechanics were divided into five strata: auto-body vehicle mechanics, petrol vehicle mechanics, diesel vehicle mechanics, auto electricians and general vehicle mechanics. The stratification made it easy to assess more precisely how each of the four perceived attributes influences a particular innovation having in mind that a particular innovation is more crucial to the performance of a particular stratum. The use of stratified random sampling ensures that the sample is more likely to be representative and one can hope that each of the strata is represented proportionately within the sample (Black, 2012). Stratified sampling is not only more reliable and contains detailed information but it also accounts for the difference in subgroup characteristics. Purposive sampling was used to ensure that the units of observation are 'hands-on' mechanics. This is because some garage owners may not necessarily be mechanics.

The sampling frame comprised of all the 5,000 mechanics operating in Kenya. This population was then stratified according to each mechanics' area of specialization (category). The units of observation were the 197 managers or heads of the

permanent and semi-permanent garages operating in the town. These garages were comprised of: 73 auto body garages 28 petrol vehicle garages, 21 diesel vehicle garages, 10 auto electricians' garages and 65 general vehicle garages (NAJUKA, 2010). Equation (3.1) was used to determined proportionate stratum sample. In the equation, Sh is the sample size for the stratum, Nh is the population size for the stratum, N is the total population and S is the total sample size.

$$Sh = (Nh/N)*S \quad (3.1)$$

The appropriate sample size was extracted from the Krejcie, Robert V. and Daryle W. Morgan (1970) table, established as reliable in determining the sample size needed to be a representative of a given population. A value corresponding to the study's total unit of observation is 132. The distribution of the mechanics by category, and the sample selected thereof is presented in Table 3.1.

Table 3.1: Distribution of the mechanics as per category and sample size

Mechanic category	Category Population (Nh)	Sample size for stratum
Auto body mechanics	73	49
Petrol vehicle mechanics	28	19
Diesel vehicle mechanics	21	14
Auto electricians	10	7
General vehicle mechanics	65	43
TOTAL	**N=197**	**S=132**

3.6 Data Collection Procedures

The data was obtained from two main sources: primary sources which included direct interaction, observation and responses from a self-administered questionnaire; and secondary sources, mainly, from formal garages and available records at the enterprise level. Review of such works was useful in cross-checking and authenticating the primary data. Both open-ended and closed-ended questions were used to capture both general and specific information given by the respondents in order to address the specific objectives outlined in section 1.3.

3.6.1 Instrumentation

The data collection instrument gathered two broad types of data: qualitative and quantitative. Primary data from the respondents was collected using, mainly; structured multiple choice questions employing a four-point Likert; specifically, agreement scale type of rating with choices: strongly disagree, disagree, agree and strongly agree. This is a forced choice method since the middle option “neither agree nor disagree or neutral” is not available. A study conducted by Hoepfl (2014) found negligible differences between the use of "undecided" and "neutral" as the middle option in a 5-point Likert scale. The neutral option can be seen as an easy option to take when a respondent is unsure, and so whether it is a true neutral option is questionable. The survey data was further simplified by combining the four response

categories (strongly agree, agree, disagree, strongly disagree) into two nominal categories, agree and disagree. This offers other analysis possibilities. According to Stockburger (2007) responses to several four point likert questions may be summed, providing that all questions use the same likert scale. He further added that likert scale data can, in principle, be used as a basis for obtaining interval level estimates on a continuum Rating scales consist of numbers and descriptions which are used to rate or rank the subjective and intangible components in a research (Mugenda, 1999). This particular instrument was quite relevant in this study as it sought to assess attitudes and perceptions of the Jua Kali mechanics towards modern auto technology. The numerical scale helps to minimize the subjectivity and make it possible to use quantitative analyses. The questionnaire contained two sections: The first section sought background information of the mechanics while the second section addressed technical questions related to the four of the conceptualized variables. An observation check list was used to augment count data on the observability variable by noting and thus verifying the tools and equipment used by the mechanics in addition to clarifying information received from the respondents. The observation check list contained 16 items purposely selected in order to address all areas of specialization. These items are tools and equipments recommended by automobile manufacturers for diagnoses and repair of modern vehicles.

3.7 Pilot Study

To standardize the instrument, it was subjected to validity and reliability checks by pilot testing it among 25 motor vehicle mechanics, drawn proportionately from the various categories; in Gilgil town. This is slightly above the 10% of the actual sample size as recommended by Madriggal (1999) and Mugenda and Mugenda (1998). The internal consistency of the questionnaire was assessed using the Kuder Richardson (KR 20) formula:

Alpha = $[n/(n - 1)] \times [(Var_t - \Sigma Var_i)/Var_t]$

Alpha = estimated reliability of the full-length test

n = number of items

Var_t = variance of the whole test (standard deviation squared)

ΣVar_i = sum the variance for all n items

3.7.1 Reliability

Internal consistency reliability involves only one test administration and is used to assess the consistency of results across items within a test (consistency of an individual's performance from item to item & item homogeneity). It is also applied determine the degree to which all items measure a common characteristic of the person. The Kuder and Richardson Formula 20 test checks the internal consistency of measurements with dichotomous choices. It is equivalent to performing the split half methodology on all combinations of questions and is applicable when Items that have more than dichotomous, for instance likert scale scores: Values range from 0 to 1. A high value indicates reliability; while too high a value (in excess of .90) indicates a homogeneous test (Kelinger, 2000; Wiersma 1995). A figure above the threshold of 0.7 is recommended for surveys such as this one.

3.7.2 Validity

Kaiser-Meyer-Olkn (KMO) test was used to determine the sampling adequacy. The KMO statistic is a Measure of Sampling Adequacy, both overall and for each variable (Kaiser 1970; Cerny & Kaiser 1977; Dziuban & Shirkey, 1974). The KMO statistic is a summary of how small the partial correlations are, relative to the original (zero-order) correlations. The partial correlation for each pair of variables in the factor analysis is comprised of the correlation between those variables after partialling out the influence of all of the other variables in the factor analysis. KMO values greater than 0.8 can be considered good, i.e. an indication that component or factor analysis will be useful for these variables.

3.8 Data Analysis and Presentation

After collection, the data was first organized. The agreement scale was simplified by combining the four response categories into two nominal categories: disagree and agree, thus, the possibility of parametric analyses. The data was then coded before entry into the computer for analysis. The statistical softwares: Statistical Package for

Social Sciences (SPSS) and Minitab version 16 were used for preliminary analyses which involved production of frequency distributions and cross tabulations of the variables. To analyze qualitative data from open ended questions, the sub themes related to the adoption attributes: relative advantage, compatibility, complexity and observability formed the basis of content analysis. The responses relating to these themes were further categorized and coded. The coded data was 'input' into Minitab statistical software to generate the required descriptive statistics. Quantitative data provided a basis for two distinct statistical analyses: binary logistic regression and chi square. The main variables considered were: independent; relative advantage, compatibility, complexity and observability and their influence on the dependent variable, adoption.

The statistical significance of the overall logistic regression model was tested using chi-square, likelihood ratio test, and Wald test while individual regression coefficients were tested using Wald chi-square statistics. Goodness-of-fit statistics were generated to asses fit of the logistic model against actual outcomes. Predicted probabilities were validated using actual outcome to determine if high probabilities are indeed associated with events and low probabilities with non events.

3.9 Statistical Model of Analysis

The research involved testing hypotheses about the relationship between categorical outcome dependent variable technology adoption and four continuous independent variables. Thus a logistic regression model was used in the analysis. Peng, Lee and Ingersoll (2002) citing other researchers argued that from early 1980s, logistic regression has become more popular for analyzing statistical data with bionomial distribution given its availability in statistical packages like SPSS. The central mathematical concept that underlines logistic regression is the logit; the natural logarithm of an odds ratio (Peng, 2002). According to Peng *et. al* (2002),logistic regression is well suited for describing and testing hypotheses about relationships between a categorical outcome variable and one or more categorical or continuous predictor variable(s).The following logistic model was used to test the hypotheses:

$$\text{InY} = \frac{p}{1-p} = \propto + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + e$$

3.1

p = probability (Y= outcome of interest / X = x, a specific value of X

3.2

Where p is the probability of the outcome of interest, in this case technology adoption, α is the Y intercept, β is the regression coefficient of the independent variable and e ≈ 2.72 is the base of the system of natural logarithms. X can be categorical or continues but Y is always categorical. According to equation 3.1, the relationship between logit (Y) and x is linear. Yet according to equation 3.2, the relationship is nonlinear. For this reason, the natural log transformation of the odds in equation 3.1 is necessary to make the relationship between a categorical outcome dependent variable and its predictors linear. The value of the coefficients β determines the direction of the relationship between x and the logit of Y. When β is greater than zero (β > 0), a larger (or smaller) x values are associated with larger (or smaller) logits of Y. Conversely if β is less than zero (β < 0) larger (or smaller) x values are associated with smaller (or larger) logits of Y.

Within the framework of inferential statistics, the null hypothesis states that β = 0 or there is no linear relationship in the population. Rejecting such a null hypothesis implies that a linear relationship exists between x and the logit of Y. If a predictor is binary, then the odds ratio is equal to e; the natural logarithm base raised to the exponent of the slope; β (e^{α}). α and β are typically estimated by the maximum likelihood (ML) method which is preferred over weighted list squares approach by authors such as Heberman (1978) and Schlesselman (1982). The ML method is designed to maximize the likelihood of reproducing the data given the parameter estimates. The null hypothesis underlying the overall model states that all βs are equal to zero. A rejection of this null hypothesis indicates that at least one β is not equal to zero in the population, meaning that the logistic regression equation predicts the probability of the outcome better than the mean of the dependent variable Y. The

interpretation of the result is rendered using the odds ratio for both categorical and continuous predictors.

Binary logistic regression analysis was instrumental in testing of the hypotheses for two main reasons: The first is the prediction of group membership. Since logistic regression calculates the probability of success over the probability of failure, the results of the analyses are in the form of an odds ratio. Second, logistic regression also provides knowledge of the relationships and strengths among the variables (Hoepfl, 2014). This study hypothesized that adoption of automobile technology (Y) within the informal automobile mechanics in Kenya is a function of the Rogers (1995) perceived attributes, as presented in equation (3.3). In the equation, Y is a binary response adoption: Y_i is 1 if a technology has been adopted, Y_i is 0 if a technology has not been adopted, and; X = (x_1, x_2, x_3 and x_4) are explanatory variables: relative advantage, compatibility, complexity and observability respectively.

To establish the effect of the hypothesized independent variables on the dependent, the odds ratio (OR), which estimates the change in the odds of membership in the target group for a one unit increase in the predictor was generated. It was calculated using the regression coefficients of the predictors as exponents or exp. SPSS calculated this value of the ln (odds ratio) and presents it as Exp(B) in the results printout in the 'Variables in the Equation' as shown in Table 4.16. In addition; to determine which particular independent variables had effects on the dependent variable, the wald statistics significant levels were also generated.

For further analysis on the observability variable, chi-square was used to evaluate whether there were significant differences between tools and equipment used by the informal mechanics and those recommended by automobile manufacturers. Chi square test of homogeneity was specifically applied. This is concerned with the proposition that several populations are homogenous with respect to some characteristic of interest e.g. one may be interested in knowing if tools available from several mechanics are homogenous. The expected are the availability of tools and

equipment recommended by vehicle manufacturers and the observed are those observed by the researcher during the survey. The following formula was used to tabulate the chi square statistic.

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Where:

χ^2 = Calculated chi square

Σ = Summation

O = Observed value

E = Expected value

If the calculated value of χ^2 is greater than the table value. We reject the null hypothesis and conclude that the mechanics do not use and have not adopted the proper tools and equipment recommended by vehicle manufacturers.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

This chapter is organized into various parts including: demographic information of the respondents; age, level of formal education, formal technical training, area of specialization and experience of the mechanics, cross tabulations of the respondents' characteristics with the independent variables results and discussion. The various themes and results are presented in the form of frequency tables, pie and bar charts and cross tabulations while analyses involving testing of hypotheses are statistically presented.

4.2 Response Rate

The survey sampled 132 mechanics drawn from four areas of specialization and the general mechanics. Out of these, 127 mechanics responded to the survey. This indicates 96% response rate. Among the main reasons that can be attributed to this high response rate is that most Jua Kali garages are concentrated in one central area; industrial area of the town. In addition the researcher is also a mechanic in the town and is therefore quite familiar with the subjects operating micro and small enterprises in the area.

4.3 Pilot Study Results

Key indicators of the quality of a measuring instrument are the reliability and validity of the measures. The process of developing and validating an instrument is in large part focused on reducing error in the measurement process. Reliability estimates evaluate the stability of measures, internal consistency of measurement instruments, and interrater reliability of instrument scores. Validity is the extent to which the interpretations of the results of a test are warranted, which depends on the particular use the test is intended to serve (Kimberlin & Winterstein, 2012).

4.3.1 Reliability

Internal consistency is the most commonly used psychometric measure in assessing survey instruments and scales (Zhang, Waszink & Wijngaard, 2002). Cronbach alpha formula was applied to determine reliability based on internal consistency since this measure is viewed as an extension of the Kuder–Richardson Formula 20 (KR-20) used to measure dichotomous items (Kim & Cha, 2002). Constructs used in this study were tested for internal consistency using Cronbach alpha test and the results are depicted in Table 4.1 According to Nunnally (1978) and Malhotra (2004), the standard mimimum value of alpha is 0.7. Thus values of 0.916, 0.926, 0.959 and 0.978 are sufficient confirmation that the data for the four independent variables a homogeneous test.

Table 4.1: Cronbach Alpha Test for Independent Variables

Variable	**Cronbach Alpha**
Relative advantage	0.916
Compatibility	0.926
Complexity	0.959
Observability	0.978

4.3.2 Validity

Kaiser-Meyer-Olkn (KMO) test of sampling adequacy was carried out to determine if the sampling was adequate to yield distinct and reliable results. Kaiser (1974) cited by Field (2005) recommends accepting values greater than 0.5. Results in Table 4.2 indicate that the sampling was adequate for all the four variables.

Table 4.2: Sampling Adequacy Test

Test	Relative advantage	Compatibility	Complexity	Observability
KMO measure of sampling adequacy	0.789	0.749	0.668	0.891

4.4 Demographic Information

The survey targeted 132 informal mechanics in Kenya and out of these, 96% (127) responded positively to the questionnaire. A notable phenomenon was that the automobile repair sector is male dominated; the study having identified only three female in the sub sector. The respondents' age ranged from 18 to over 50 years as indicated in Figure 4.1. The results show that about half (49.6%) of the respondents were in the middle age group while only 6.3% were above 50 years. The mean age was 42.3 years.

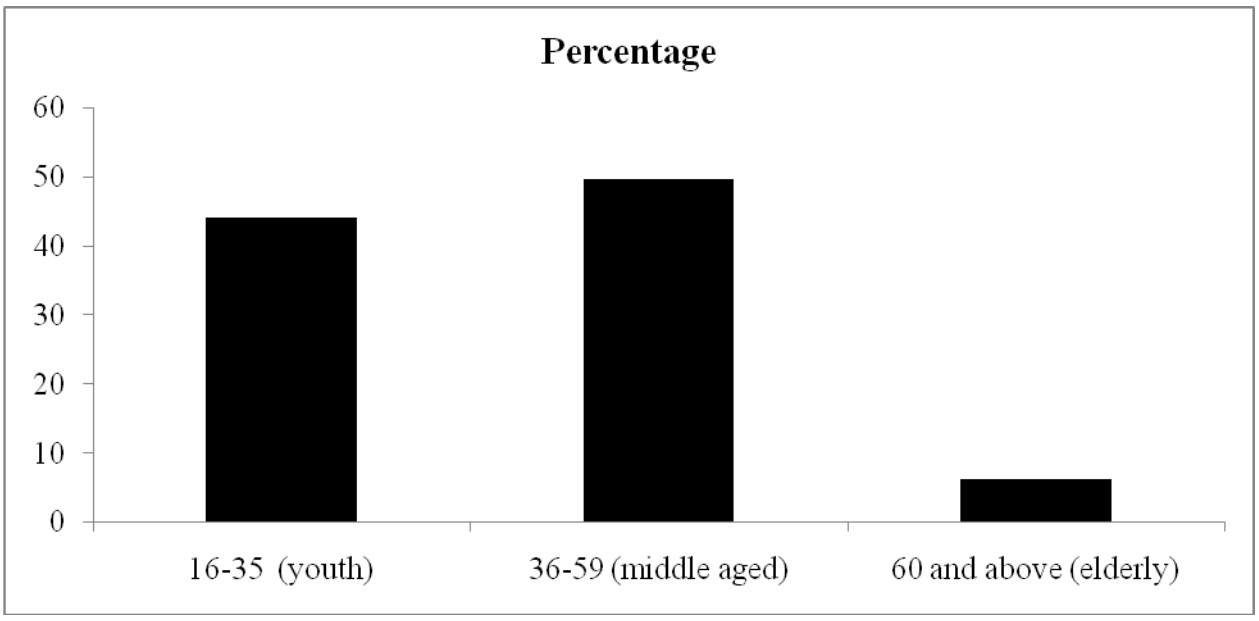

Figure 4.1: Distribution of respondents as per age group

From the findings, it can be concluded that mechanics in Kenya are generally middle-aged and youthful with 93.7% of them being under 50 years. This compares well with the 1999 National Baseline Survey (CBS, ICEG and K-REP) which estimated the National mean age of MSE entrepreneurs to be 35 years with 83% of them being in the age bracket of 16-45 years. The findings also compares favorably with those of (Paul, Silvester & Vera 2014) who found out that most of the entrepreneurs start business during their 30's and 40's. The dominance of the youth in the MSEs in the town may be explained not only in the context of lack of employment for the youth, but also due to the introduction of the Youth Development Fund by the Government of Kenya (ROK, 2007). This may have prompted their entry and participation in MSEs.

4.4.1 Education Level of the Respondents

The results reveal that out of 127 mechanics surveyed 49.6% of them had attained form four level of education and 37.8% were primary school leavers (Figure 4.2). Education enables awareness-building and technology demonstration. These measures seek to make potential users more knowledgeable about available technologies, their possible applications, and their benefits and costs (Gagel, 2012). Generally speaking, an entrepreneur's education is an important aspect in the general performance of an enterprise. In this study, the education attainment was measured by the number of years of formal schooling. These results corroborate the findings of Johnson (2009) who in his study on "the effect of education on business skills cognition" found out from a random sample of 208 MSE entrepreneurs, that those with secondary school education constituted a majority (52.5%), followed by those with primary level education (44%). Moreover, the findings from the study indicated that more education is associated with more knowledge and skills on the practice of business. Further, more education widens the scope of perception; hence enhancing an individuals' ability to perform certain tasks better Johnson (2009). This argument or fact is very much relevant especially in the emerging and development in the automobile technology.

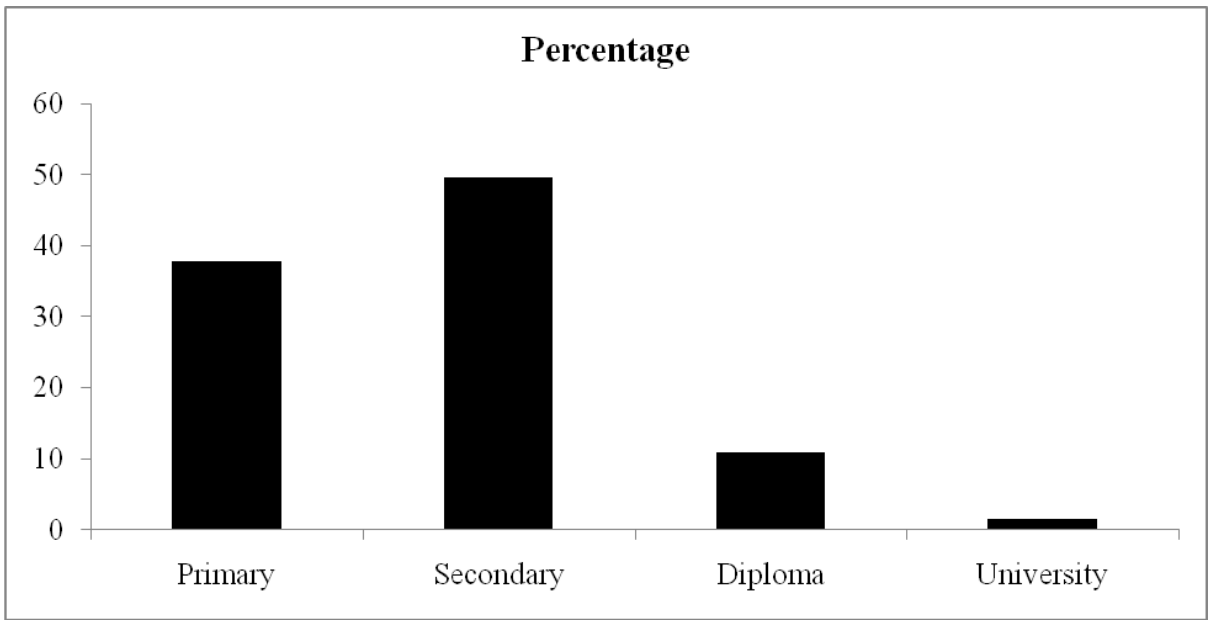

Figure 4.2: Formal education level of respondent's

4.4.2 Formal Technical Training

The results of this study reveal that 45.6% of the mechanics were products of apprenticeship, while the remaining 54.4% had undertaken some formal training and attained various qualifications as presented in Table 4.3. Technology diffusion involves the dissemination of technical information and know-how and the subsequent adoption of new technologies and techniques by users. Formal training is a learning activity intended to impart specific knowledge, skills and attitudes necessary to effectively and efficiently perform related tasks. Training Increases human capital and expertise to understand, absorb, operate, and improve technology within MSEs (Gagel, 2015). It is normally undertaken after some form of formal education. However in the automobile repair sub sector, informal training is in most cases disseminated as 'on-the-job' training or apprenticeship. Interestingly, apart from the craft certificate which 18.8% of the mechanics had attained, the rest of the qualifications had an inverse relationship with the number of mechanics. Only 7 (10.2%) mechanics had attained a higher national diploma while the majority had acquired a government trade test III 16 (23.2%). The influence of training on the perceived technology adoption attributes is further assessed in the subsequent sections.

Table 4.3: Qualifications of the mechanics

Qualification	Frequency	Percentage
Craft certificate	13	18.8
Trade test III	16	23.2
Trade test II	13	18.8
Trade test I	11	15.9
Diploma	9	13.1
Higher National Diploma	7	10.2
Total	**69**	**100.0**

4.4.3 Area of Specialization for the Mechanics

Out of a total of 127, the mechanics who responded to the survey were composed of five categories but majority were auto-body vehicle and general vehicle mechanics at 38.6% and 29.9%, respectively (Figure 4.3). A person with good manual dexterity and a desire to figure out problems often has what it takes to become an auto mechanic, also known as an automotive service technician. An automobile mechanic provides maintenance and repairs for cars and trucks. This requires an ability to stay current with automotive technologies. Auto mechanics perform maintenance and repairs on all different types of vehicles, from small passenger cars to diesel trucks and buses Parr (2014). Many mechanics specialize in certain types of repair jobs, such as engine work, auto body repair, and electronic systems. Many auto mechanics work in independent garages following different career paths, depending on their training and experience. The major distinction is mechanics that service and repair a vehicle's mechanical and electrical components and those who repair vehicle body parts (Gagel, 2015).

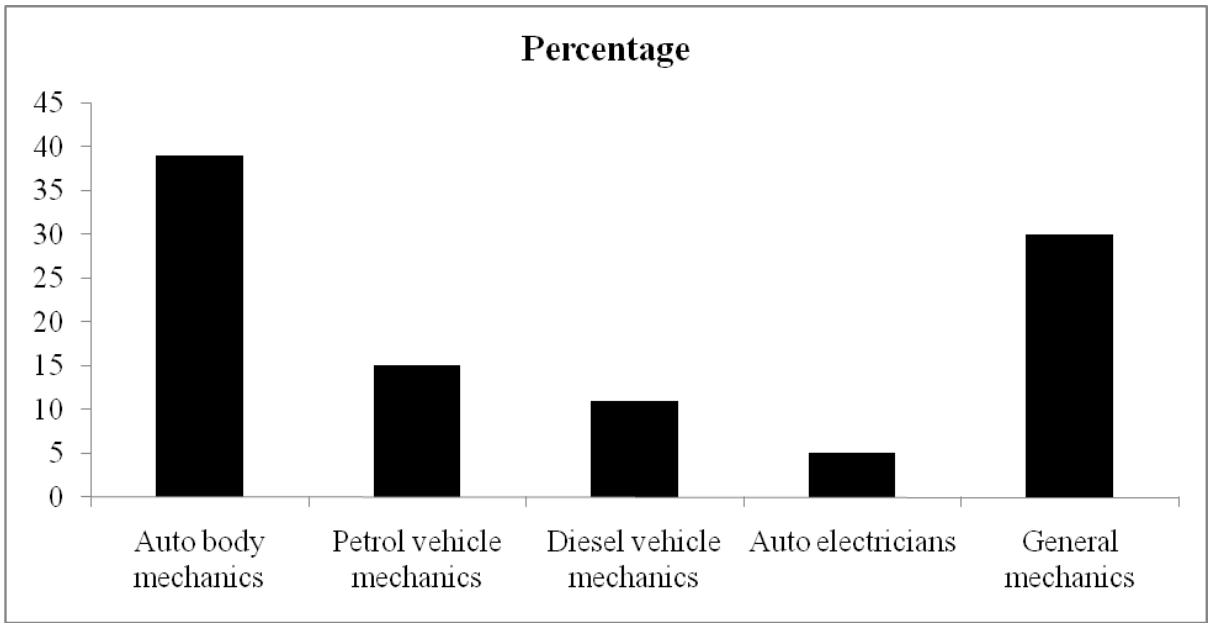

Figure 4.3: Distribution of the mechanics as per their areas of specialization

4.4.4 Experience of the Mechanics

Majority of the mechanics (33.1%) investigated had operated their businesses for at least 11-15 years. They were followed by those who had operated between 6-10 and 16-20 years, both at 22.0% each. Those who had an experience of 2-5 years were 12.6% and those who had operated for over 20 years were 10.2% as shown in Figure 4.2. Gagel (2015) asserts that experience is the best predictor of business success, especially when the new business is related to earlier business experiences. Entrepreneurs with vast experiences in managing business are more capable of finding ways to cope with business challenges. The importance of experience for MSEs success is also underscored by other experts for instance Haswell et al. (in Iztok & Krsto 2014) who note that among other reasons behind business failures are managerial and lack of experience.

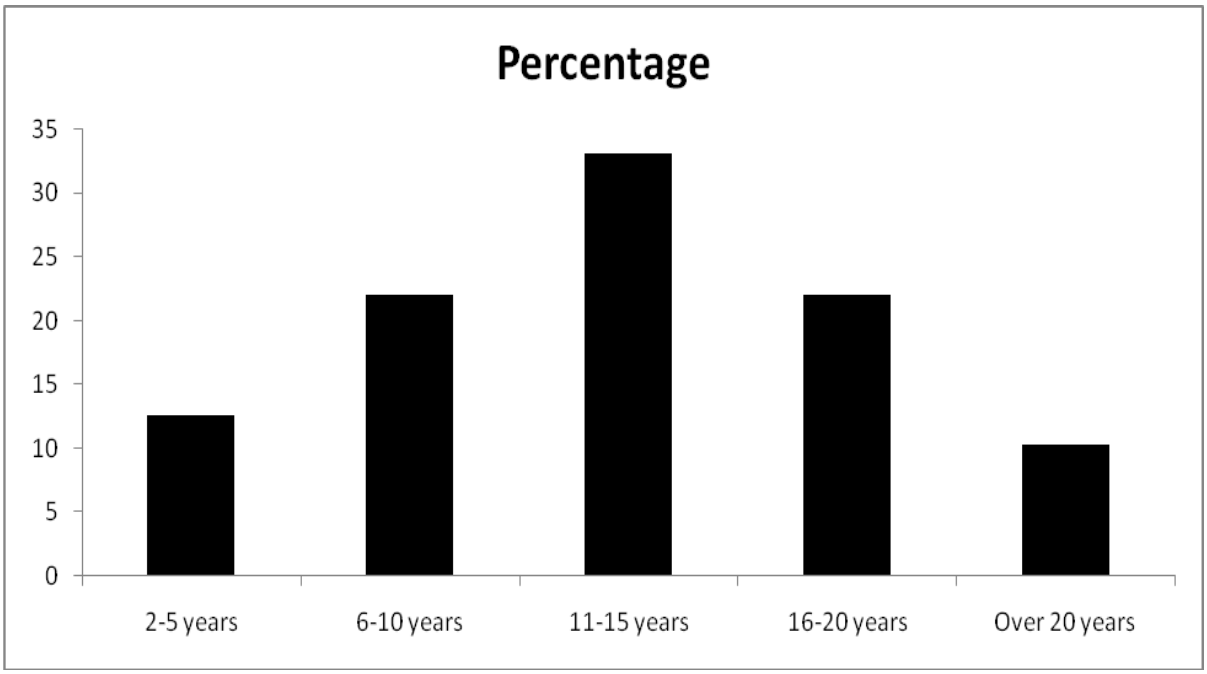

Figure 4.4: Experience of the mechanics.

4.5 The Influence of Relative Advantage on Adoption of Modern Automobile Technology

Rogers, (in Narayanan, 2000) suggests that there are five steps involved in the decision making process of innovation adoption: knowledge/awareness, attitude

formation, decision, implementation, and confirmation. Knowledge or awareness of basic technical concepts is; in most cases, learnt during formal schooling. Attitude formation or perception may be influenced by the level of knowledge one has on a particular innovation. The very basic distinguishing features of old and modern motor vehicles are illustrated in Table 4.4.

Table 4.4: Salient features between old and modern automobiles

Category	Old Model Vehicles	New Model Vehicles
Auto body	Oil-based paints, Lacquer paints, Standard thinners, Mild steel body panels	Water based enamel paints (e.g., Spice hecker), Fibre-glass, Aluminum and Plastic body panels
Engine and Transmission	Carburetor, Manual transmission system	Variable Valve Timing injection (VVTi), Electronic Fuel Injection (EFI) systems, Turbo charger, Automatic Transmission systems
Electricals	Manual locking system, Manual windows and side mirrors	Central locking system, Power windows and side mirrors, ABS, Air bags

Given their various levels of formal education, the mechanics were asked to respond whether modern automobile technology is relatively more advantageous than the traditional. The responses are shown in Table 4.5. Overall, 81.1% of the mechanics concurred that modern automobiles have more advantages than the older models. Of these, 37.8% were secondary school leavers, 31.5% primary school leavers, 11% diploma holders and 1.6% university graduates. The low scores by university and diploma graduates collaborates with a study by Riddell and Song (2014) whose study found out that highly educated workers tend to adopt new technologies faster than

those with less education but such positive correlations between the level of education and the rate of technology adoption do not necessarily reflect the true causal effect of education on technology adoption. The advantages they cited included: fuel efficiency in case of EFI systems, ease to drive in the case of automatic transmission systems, more user-friendly electronically operated accessories like power windows, power side mirrors, and central locking systems among others.

Table 4.5: Formal education in relation to relative advantage

Level of education	**Relative advantage**	
	No advantages	Advantageous
Primary	6.3%	31.5%
Secondary	11.8%	37.8%
Diploma	0.8%	11%
University	0%	1.6%
Total	**18.9%**	**81.1%**

The study also related the training status of the mechanics and their perception on relative advantage as shown in Table 4.6. A large proportion of the mechanics (81.1%) indicated that modern vehicles have more advantages over older models. This included 44.1% of the mechanics who had undertaken formal training. Parr (2014) asserted that training in the supporting skills and emerging technologies is important in the preparation of motor vehicle mechanics.

Table 4.6: Relation of training of the mechanics and relative advantage perception

Formal Technical Training Status	Relative advantage	
	No advantages	Advantageous
No formal training	8.7%	37 %
Formally trained	10.2%	44.1%
Total	**18.9%**	**81.1%**

A breakdown of the responses based on the technical qualifications of the mechanics is illustrated in Table 4.7. A significant number (20.3%) of mechanics with government trade test III agreed that modern vehicles have more relative advantages than older models. They were followed by those with craft certificate, 17.4%, trade test II holders 13%, diploma holders 11.6%, trade test I and higher national diploma graduates with 10.1% and 8.7% respectively. Grossman (2012) and Oreopoulos and Salvanes (2011) found that training increases technology use and adoption. In addition, the private and social benefits of training may be understated by standard outcome measures (e.g., individual earnings). This will especially be the case if an individual's training and the associated technology use also influence employer and coworker outcomes.

Table 4.7: Technical training of the mechanics and relative advantage perception

Technical Training Qualification	Relative advantage	
	No advantages	Advantageous
Craft certificate	1.5%	17.4%
Trade test III	2.8%	20.3%
Trade test II	5.8%	13.0%
Trade test I	5.8%	10.1%
Diploma	1.5%	11.6%
Higher National Diploma	1.5%	8.7%
Total	**18.9%**	**81.1%**

When asked to make a technical comparison between modern and old model motor vehicles, mechanics drawn from the five areas of specialization responded as shown in Table 4.8 where; 33.1% of the auto-body mechanics, 24.4% of the general vehicle mechanics, 11.0% of the petrol vehicle mechanics 7.9% of the diesel vehicle mechanics and 4.7% of the auto electricians, indicated that modern vehicles have more relative advantages over older models. Parr (2014) asserts that digital literacy is less about tools and more about thinking, also skills and standards based on tools and platforms have proven to be somewhat ephemeral. But specialization breeds better appreciation of certain innovations and leads to adoption and assimilation of those innovations. The mechanics cited several operational benefits, for instance; of a fuel-injected vehicle including: smoother and more dependable engine response during quick throttle transitions, easier and more dependable engine starting, better operation at extremely high or low ambient temperatures, smoother engine idle and running, increased maintenance intervals, and increased fuel efficiency.

Table 4.8: Area of specialization of the mechanics as related to relative advantage

Area of Specialization	Relative advantage	
	No advantages	Advantageous
Auto-body mechanics	5.5%	33.1%
Petrol vehicle mechanics	4.0%	11.0%
Diesel vehicle mechanics	3.1%	7.9%
Auto electricians	0.8%	4.7%
General vehicle mechanics	5.5%	24.4%
Total	**18.9%**	**81.1%**

The survey examined the influence of experience of the mechanics on their perception of modern versus old model automobiles in the context of relative advantage as revealed in Table 4.9. A good number of mechanics (26.8%) who had worked for a period of between 11-5 years indicated a favor of modern auto technologies. They were followed by those who had worked between 6-10 years at 17.3%. Notably, only 7.1%% of the mechanics with the longest experience, over 20 years, indicated in favor of new auto models. This may be attributed to the fact that new or modern vehicle technologies are radical innovations where prior experience may not be significantly useful. A study by Kim (in Xuanting, Jian, Yun & Jun 2015) found that 30% of successful entrepreneurs had no work experiences. This implies that although prior experience is important, it is not critical for business success. In the case of this study, emerging automobile inventions and innovations may not necessarily require prior experience as incompatibility and complexity issues may require the mechanics to re-train.

Table 4.9: Experience of the mechanics and their relative advantage perception

Experience of the Mechanics	Relative advantage	
	No advantages	Advantageous
2-5 years	0.8%	11.8%
6-10 years	4.7%	17.3%
11-15 years	6.3%	26.8%
16-20 years	4.0%	18.1%
Over 20 years	3.1%	7.1%
Total	**18.9%**	**81.1%**

4.6 Influence of Compatibility in Adoption of Automobile Technology

According to Innova (2012), compatibility is the degree of innovation perceived consistent with existing value or previous experience and need to the potential adopter. In this study, it includes the assessment of similarity of the equipment, tools, and skills required to diagnose, repair and service either new or old model motor vehicles. With this definition in mind, the mechanics were asked to express their opinion on whether modern and old motor vehicle models are compatible. The responses are shown in Figure 4.5.

In total, 70.9% mechanics did not agree that modern and old model vehicles are compatible. This implies that these mechanics are not comfortable in adopting modern automobile technology due to the computer-based integrated systems. They cited various technical innovations including: the automatic transmission systems, VVTi, EFI, central locking system, air bags, ABS among others incorporated in modern automobiles that require special equipment to diagnose and repair. According to Autor, Frank and Richard (2003) many empirical studies find strong correlation between adoption of computer-based technologies and increased use of more educated workers. Highly educated workers have a comparative advantage in dealing with economic change and in implementing new technology. On the auto-body area, fibre-glass and plastic panels are not compatible with mild steel. However, 29.1% of the mechanics investigated indicated that the two models are

compatible. They argued that, although there have been radical innovations on motor vehicles; the basic mechanism pertaining to the operation of internal combustion engine remained the same. Furthermore, hand tools like spanners or wrenches, screwdrivers etc are still same

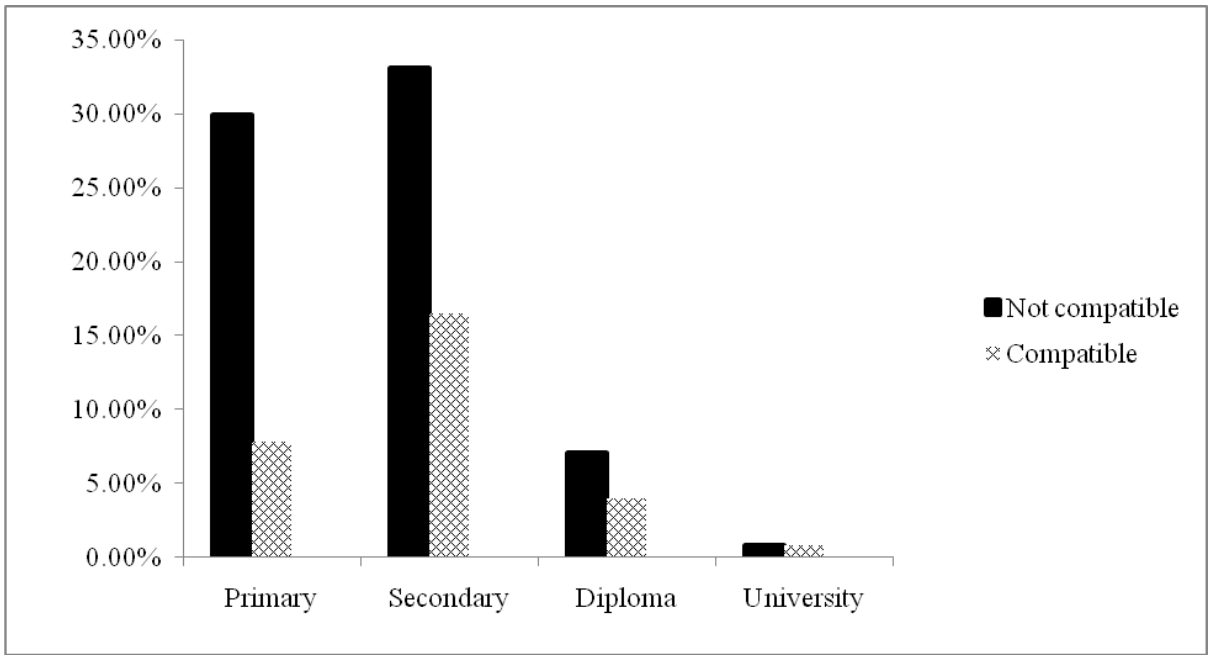

Figure 4.5: Education level of the mechanics in relation to compatibility

Based on formal technical training, 37.8% of the formally trained mechanics indicated that there is no compatibility between modern and old model motor vehicle technology (Figure 4.6). In addition, 33.1% of their counter parts who had not undertaken any formal training asserted that there is no compatibility between modern and old model motor vehicle technology. This means that 70.9% of the mechanics may not readily adopt modern vehicle technology as it is not compatible to what they are used to. To a larger extent training increases technology use and adoption, the private and social benefits of training may be understated by standard outcome measures (e.g., individual earnings). This will especially be the case if an individual's training and the associated technology use also influence employer and coworker outcomes (Oreopoulos & Salvanes, 2011).

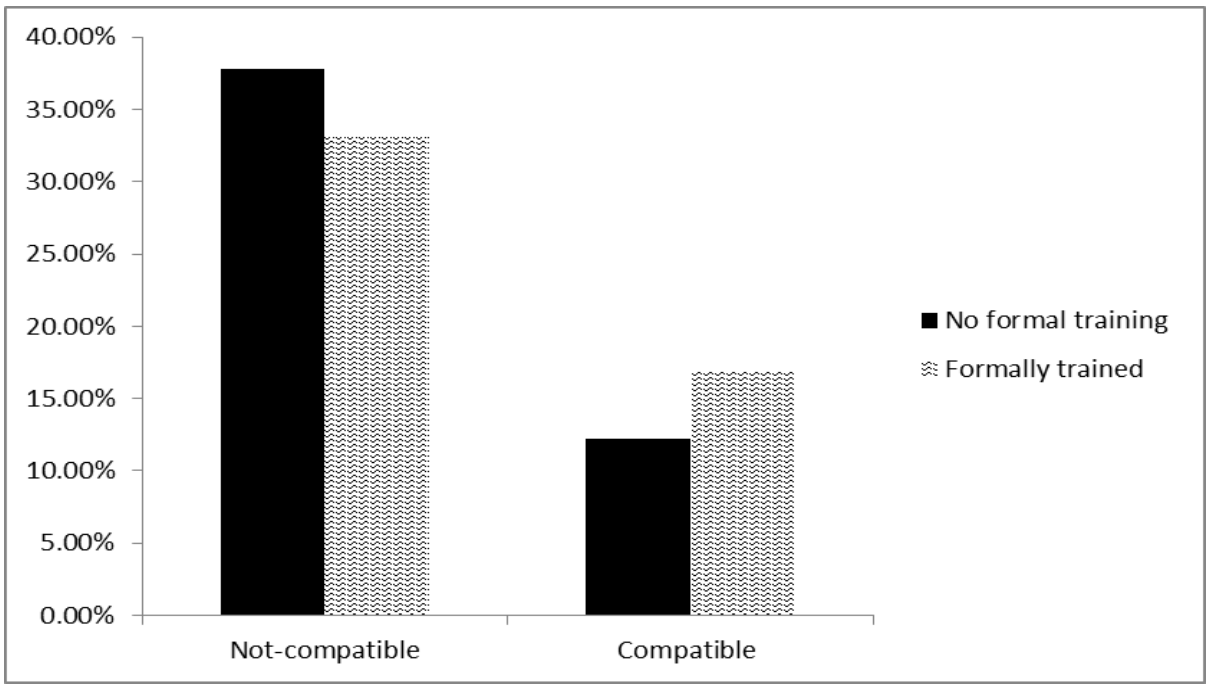

Figure 4.6: Training status of the mechanics as related to compatibility perception

There were mixed reactions from mechanics with various formal technical training qualifications as far as compatibility of new and old model vehicles is concerned. Their perception was as indicated in Figure 4.7. More than one half of the mechanics disagreed that old and new model vehicles are compatible. Mechanics who indicated otherwise comprised of: 8.7% in the trade test I cohort, and 2.9% diploma holders among others. Overall, 30.4% of the formally trained mechanics were in agreement that there is compatibility between the two models. This means that the remaining 69.6% who indicated non compatibility may not be ready to adopt modern vehicle technologies. This is collaborated by Nomsa (2013) who asserted that individuals perceive that the technology they want to adopt is consistent with their beliefs, culture and values and there is no resistance to change from the staff, they will adopt that technology The greater the compatibility with the felt needs, the greater the diffusion rate. If previous technological ideas were introduced and were not accepted then the new ideas will be judged based on the performance of the previous ideas. Attributes of compatibility can impact on the decision to use new technology because

technology often requires establishments to change their existing business practices and operations in order to increase the benefits of using the technology.

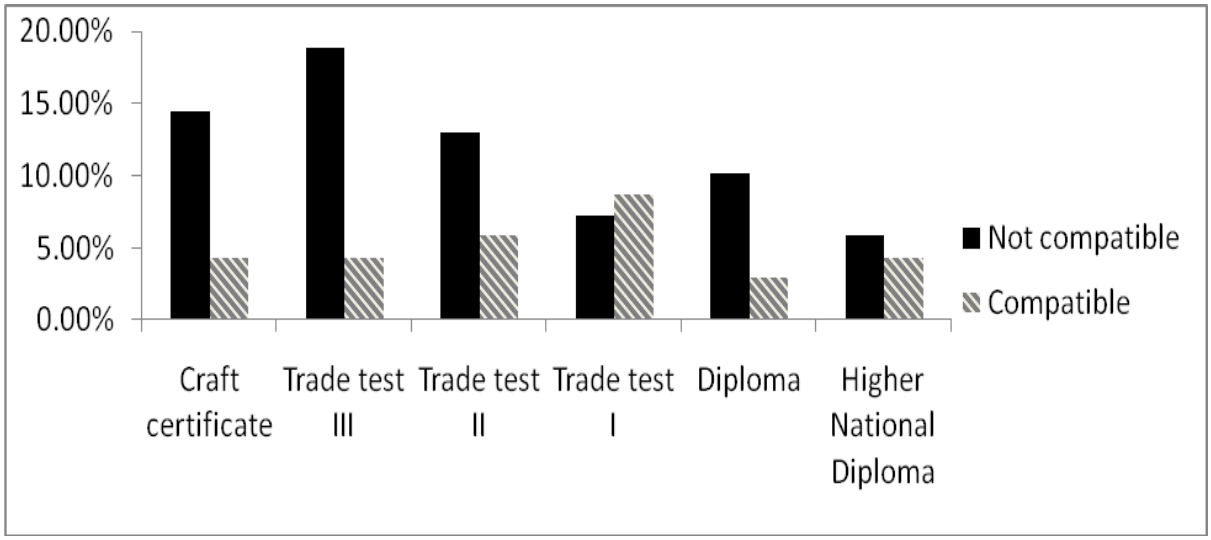

Figure 4.7: Specific technical qualifications of the mechanics as related to compatibility

Rationally, mechanics from specific areas of specialization are in a better position to judge whether or not, modern automobile technology is compatible with the traditional technology. Asked to give their view on the same, the mechanics responded as recorded in Figure 4.8. A greater proportion of mechanics asserted that modern and older model motor vehicle technology is not compatible. However, 29.1% argued that, apart from the electronic fuel injection (EFI) which is incorporated with the cylinder head and the wiring from the input sensors to the output actuators via the central processing unit (CPU) in modern vehicles, all other engine parts are as in older models. The auto electricians further argued that apart from a few additional electronic components and switches to facilitate the operation of central locking system, power windows and side mirrors, for instance; major systems like: charging, lighting, starting ignition remain basically same. This is collaborated by Growse (2012) who asserts that; the fundamental mechanism of an internal combustion engine, are still same. Nevertheless, 70.9% of all respondents indicated that technologically, the two models are not compatible. They argued that modern auto-body paints and panels, antilock braking system (ABS), air bags and the automatic transmission systems among others are more radical than incremental innovations.

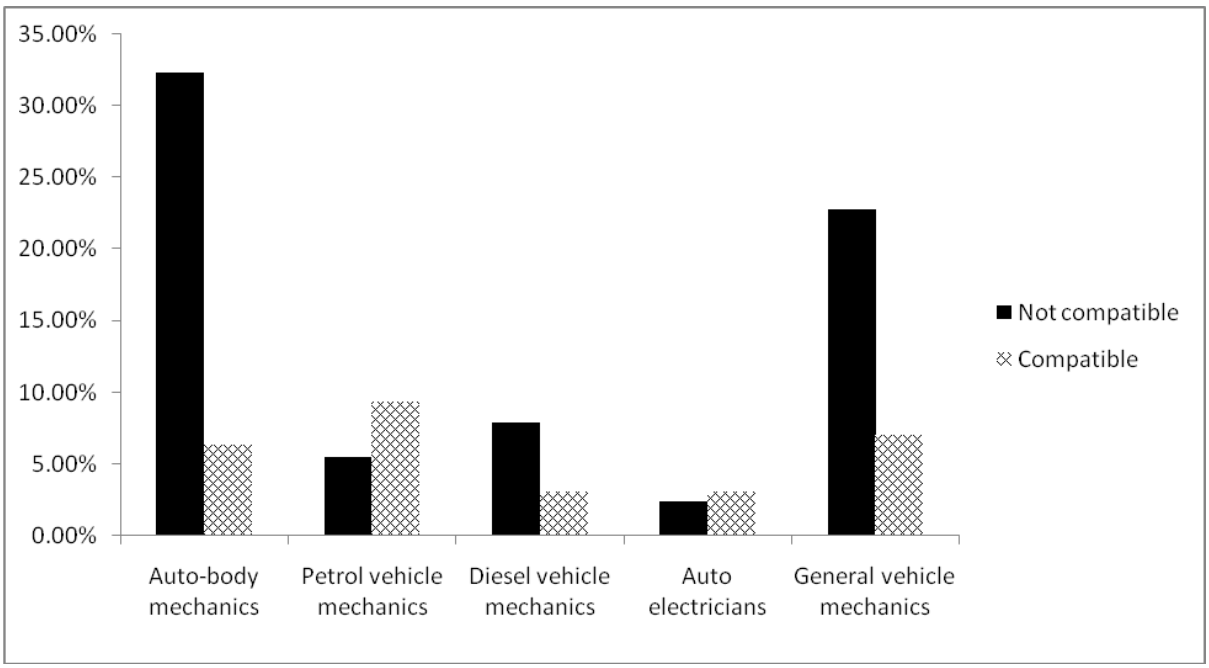

Figure 4.8: Areas of specialization for the mechanics as related to compatibility

The study further sought to determine the perception of mechanics with varying work experience as far as compatibility of new and old model vehicle technology is concerned. Figure 4.9 shows how their responses. Although a significant number of the mechanics who had worked for relatively shorter periods expressed their views in negation as far as compatibility between modern and conventional automobiles is concerned, a good number confessed not to have worked on or even seen older model operating technology. In their study, Bartel & Lichtenberg (2014) found out that; even if everyone is provided with tools and equipment necessary to perform certain tasks, there will still be issues related to experience and training. This is particularly an issue among mechanics in MSEs who lack modern vehicle diagnostic gear. Systems like the carburetor and contact breaker points which were replaced by EFI and electronic ignition respectively were history to some of the youthful mechanics. Mechanics who had worked for over 15 years were in a better position to judge on this particular variable.

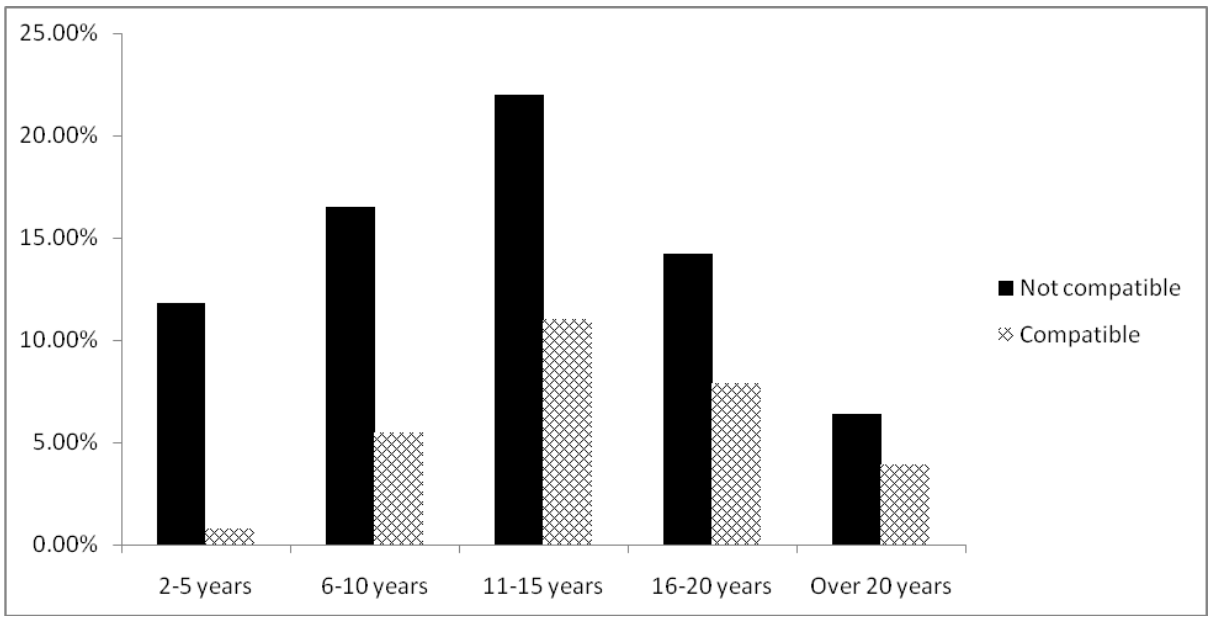

Figure 4.9: Experience of the mechanics as related to compatibility

4.7 Influence of Perceived Complexity on Adoption of Automobile Technology

According to Jolly (2011), complexity is the degree an innovation perceived as difficult to be comprehended or utilized. In the context of this study, the mechanics were asked to express how easy or difficult it is to work on modern as compared to older model vehicles. The relationship between the formal level of education of the mechanics and perceived complexity is presented in Figure 4.10. Overall, 74.8% of the mechanics indicated that modern automobile technology is relatively more complex compared to the traditional technology. This may be attributed not only inadequate formal education within the Jua Kali mechanics but also lack of a comprehensive curriculum that addresses all industry trends. The physics behind the operation of EFI and transmission systems, understanding the integration of electronic components into the wiring schematic diagrams and the chemistry behind automotive paints and re-finishers among the many technological concepts and principles can best be acquired in formal education institutions. In Kenya, these subjects are introduced to students at secondary school level.

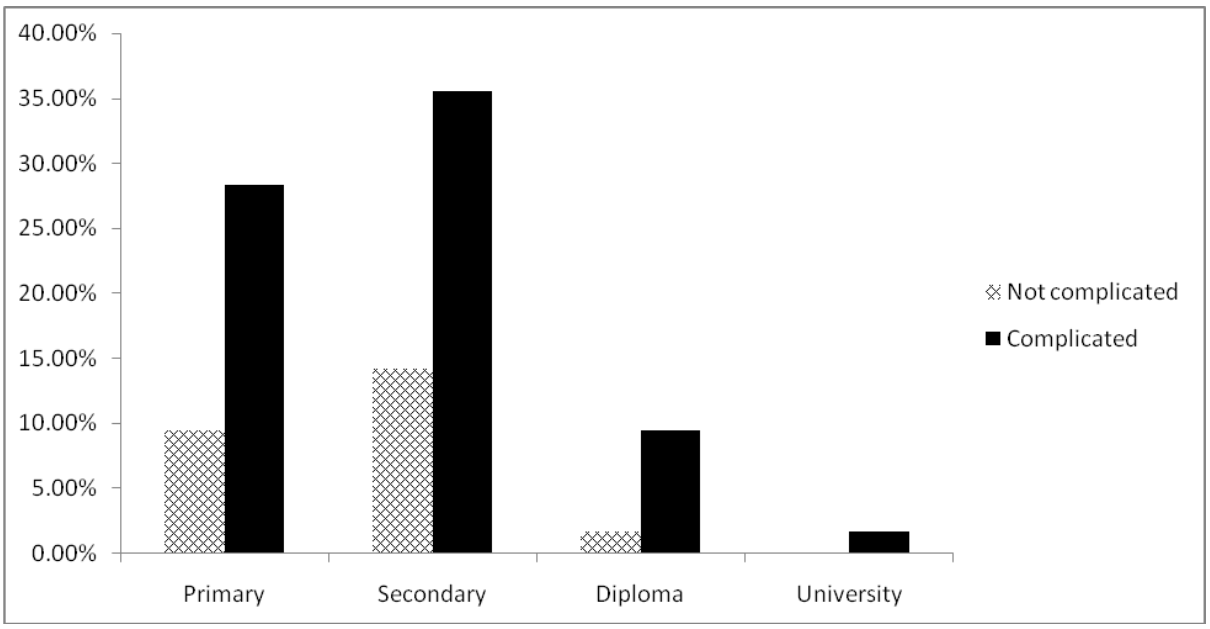

Figure 4.10: Perceived complexity as affected by education level of the mechanics

The study further investigated the technical training status of the respondents as regards to complexity and the findings are as shown in Figure 4.11. Although of having undergone some formal technical training, 40.9% of the mechanics asserted that modern automobile technology is more complex than old model vehicle technology. They argued that, the technology used in automobiles changes very rapidly and mechanics must be prepared to learn these new technologies and systems. This is corroborated by the U.S. Bureau of Labor Statistics; that, innovations such as hybrid engines and alternative automobile energy technologies mean that mechanics must update their skills constantly (BLS, 2010). In spite of these 25.2% of the respondents argued that modern automobile technology is not complex *perse* and laid the blame on an inappropriate formal education and insufficient technical training.

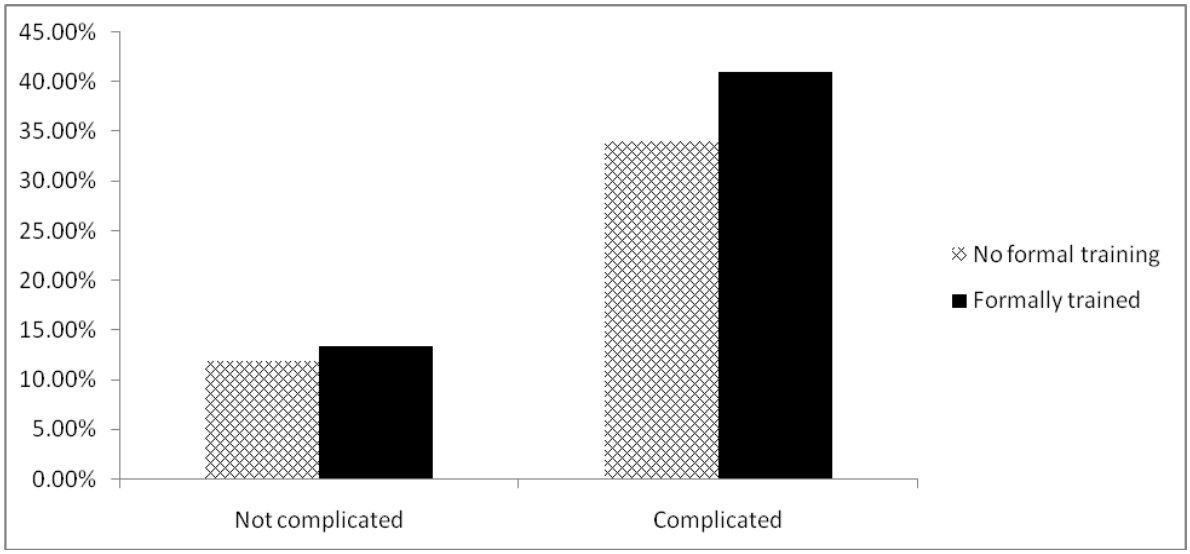

Figure 4.11: Technical training status of the mechanics as related to complexity

Responses from the formally trained mechanics based on their specific qualifications were as shown in Figure 4.12. Out of the most highly trained respondents; those with a higher national diploma, 8.80% indicated that modern automobiles are more complicated to work on. Those with low levels of technical training; craft certificate and trade test III who indicated complexity issues were 13.10% and 18.80% respectively. This implies that relatively highly technically trained mechanics can easily handle modern vehicles than their counterparts with low levels of technical training. This findings are in agreement with Riddell and Song (2014) who also found out that formal technical training increases the use of technologies that require or enable workers to carry out higher order tasks,

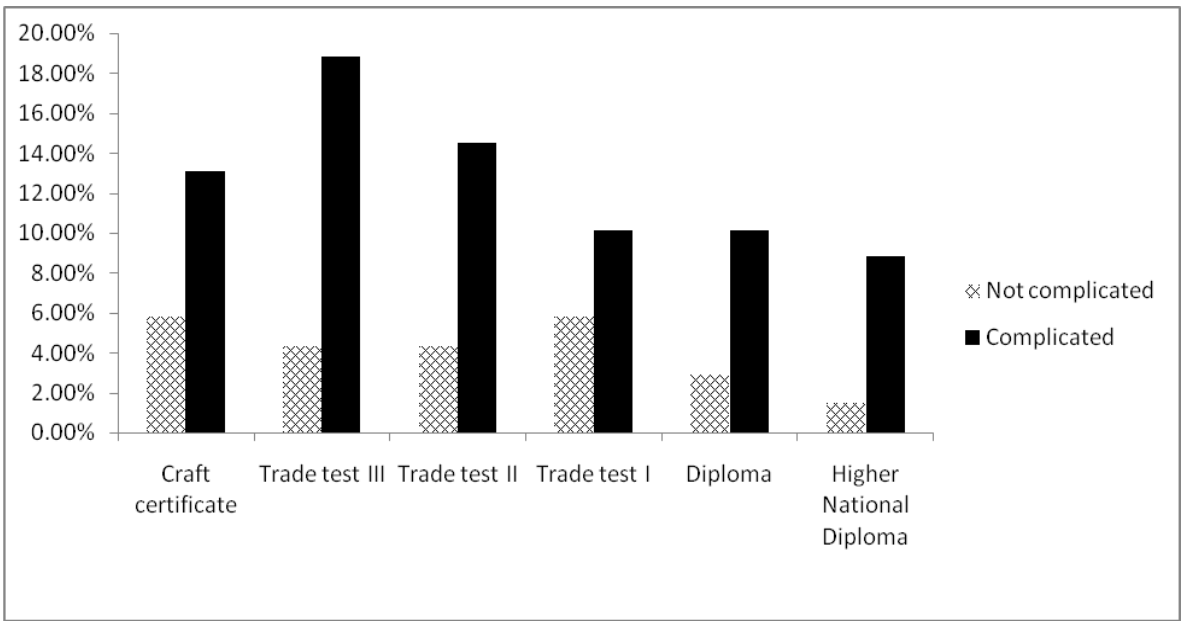

Figure 4.12: Technical qualification of the mechanics as related to complexity perception

Figure 4.13 depicts specific category responses. Mechanics who agreed that modern automobile technology is more complicated than older models were 75.4% while 24.6% expressed different views arguing that modern automobile technology is not complicated. They rather asserted that it was lack of appropriate diagnostic tools and equipment that was the main constraint. This is corroborated by Jarvis& Rennie (2011) who said that "due to the increasingly labyrinthine nature of the technology that is now incorporated into automobiles, most automobile dealerships and independent workshops now provide sophisticated diagnostic computers to each technician, without which they would be unable to diagnose or repair a vehicle". Another study by Kithyo et al. (2004) showed that Jua Kali mechanics have problems in handling modern vehicles. Furthermore, mechanics in the informal sector perform the bulk of the repairs yet most of them do not have the right equipment. This lack of proper tools indicates that the quality of work done by the Jua Kali mechanics in the areas where these tools are supposed to be used is below standard.

The development in the automobile technology cuts across all areas of specialization. From the aero-dynamically designed auto bodies, EFI and automatic transmission

systems to electronically controlled accessories for both petrol and diesel motor vehicles. Majority of the mechanics in these categories were in agreement that the technology employed in these systems is more complicated than the one they were used to in older models. Auto body mechanics recorded the highest percentage (29.2%) of those who perceived modern technology as complex. They argued that modern vehicle panels require special equipment to facilitate their repair. They further added that paint work needs a dust free environment, thus, the necessity of 'spray booths.' Paintwork defects such as scratches, swirls and holograms are all removable by machine polishing. They were followed by the general mechanics that attributed their perception to the fact that electronics is the basis of most technological development.

Modern vehicles require mechanics who can take readings, using a laptop or hand-held device connected to an engine's electronic control unit (found in newer vehicles) and research faults, using manufacturers' circuit diagrams and specification manuals among other tasks. This is challenging to a number of the informal mechanics in Nakuru given their levels of formal education and training. This is corroborated Wanyeki (2014) who, in their study found out that most of them do not have the right equipment and many have had no formal education in repairs of motor vehicles. With changes in motor vehicle technology, the mechanics have not kept up with the changes and this has had a negative impact on the quality of the repairs they undertake on motor vehicles. When asked why they preferred not to specialize in any specific area, one mechanic responded: "With the rapid advancement in technology, the mechanic's job has evolved from purely mechanical, to include electronic technology. Because vehicles today possess complex computer and electronic systems, mechanics need to have a broader base of knowledge than in the past". The notion of having abroad knowledge base is the main motivation of their lack of specialization.

Also in agreement were diesel vehicle mechanics who indicated that modern automobile technology is relatively complicated. They cited the diesel electronic fuel injection and turbo chargers as very complex to repair. This is corroborated by Fair,

Weaver, and Walsh (2011) who asserted that most modern diesel engines are equipped with several electronic components and computer processors. Therefore, it is very beneficial for a diesel mechanic to be proficient with computers and have a strong understanding of electronics. There is need to often use diagnostic machines and computer software to ensure all electronic parts are working correctly. Among the petrol vehicle mechanics, 10.2% said that modern automobile technology is complex. Like their diesel counterparts, they cited the electronic fuel injection (EFI) as a very complicated system. They also mentioned the multi-valve mechanisms like VVTi, Valvematix and the various automatic transmission systems as being relatively complicated for the Jua Kali mechanic. In support of this is a survey conducted by the Vanguard newspaper in Nigeria that found that auto mechanics need computer training to repair modern vehicles**.** The findings revealed that, following the influx of sophisticated cars into the African continent from different parts of the world, auto mechanics in not only Nigeria, but in Africa as a whole; require for special training on the use of computers to repair faulty vehicles. One mechanic said the lack of knowledge and skills among artisans was a major obstacle to their work. "We do repair old generation cars using simple technologies. In most cases, we go to established auto firms in Kano or Lagos for the repair of such exotic cars built with brain box and remote sensors," he said (Vanguard, 2013).

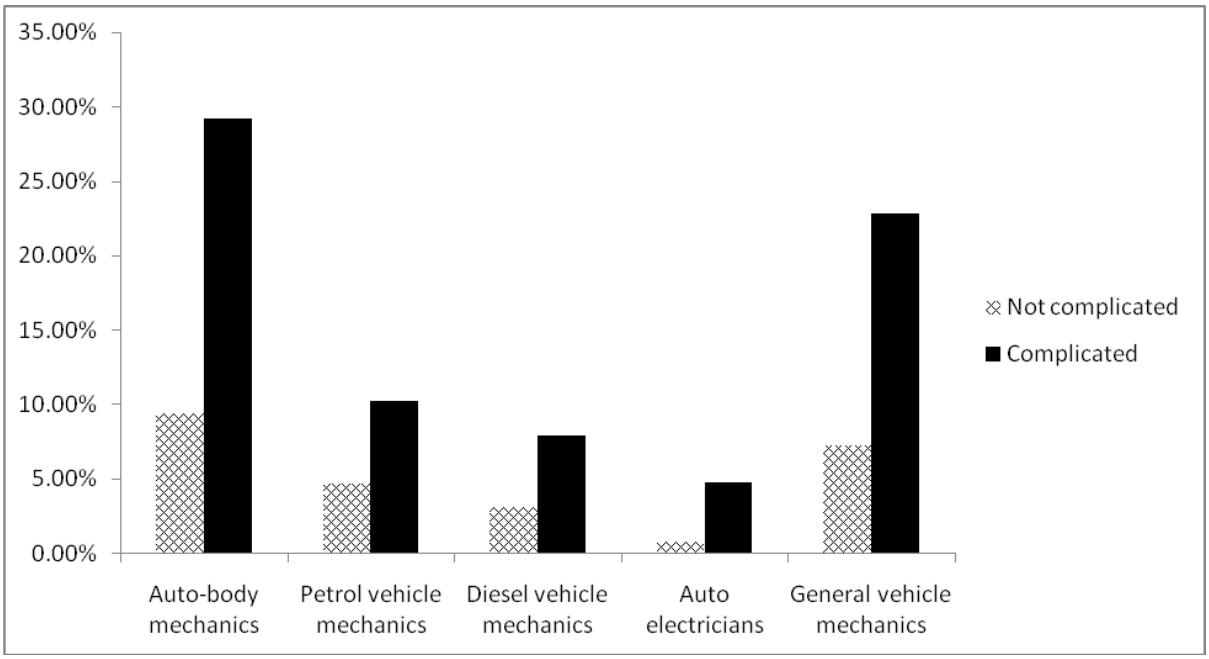

Figure 4.13: Relation between the various categories of mechanics complexity perception

Experience contributed to the mechanics' perception on complexity as Table 4.14 illustrates.

However, the technology used in automobiles changes very rapidly and mechanics must be prepared to continuously learn these new technologies and systems. From the finding, 23.6% of the mechanics who had worked for a period 11-15 years and more than one half of those who had a working experience of more than 20 years said that modern auto technology is relatively more complicated. Notably, those with an experience of 2-5 years may not have had a chance to work on older model technology like the fuel carburetor and ignition "contact breaker points" as these had been faced out to a larger extent more than fifteen years ago. According to Growse (2011), automotive technology is consistently updated, employers in developed economies are more and more sending their experienced mechanics and technicians to training programs and centers in order for to remain abreast of current industry trends, including alternative energy engines, green air conditioning systems and electronic fuel injection. In the past, the profession was available to those with mechanical aptitude and a willingness to learn on the job. But because modern machines are more complex, employers now require more advanced educational requirements for mechanics (Growse, 2011).

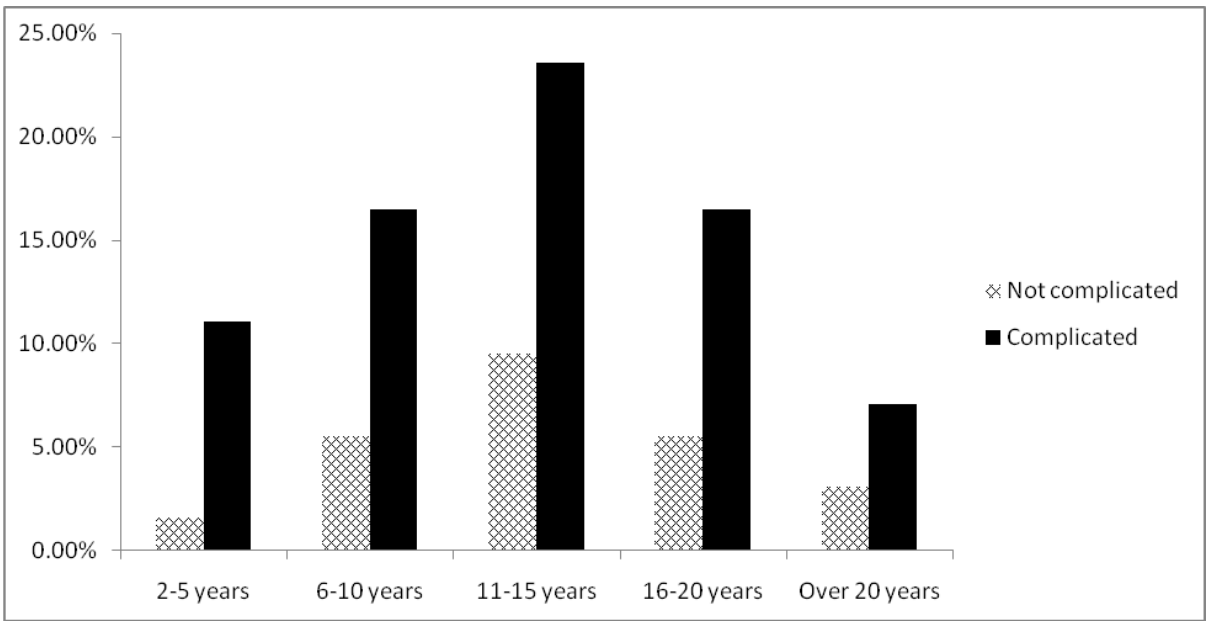

Figure 4.14: Experience of the mechanics as relates to complexity

4.8 Influence of Observability on Adoption of Automobile Technology

According to Jolly (2011), observability is defined as the result of an innovation being available for others to see. He further adds that, this attribute is related to risk. Adopters will not adopt an innovation if its benefits are hard to observe. These characteristic increase uncertainty level on the value of the innovation and therefore increase the risk of its adoption. Although the performance of an innovation to meet the technical features and price requirements can influence this factor, at the end, it is the perception of the adopters which is the determining factor. Observability in this study included the availability of modern vehicle diagnostic tools and equipment in as many garages as possible for other mechanics to see and emulate. Selected tools and equipment necessary to repair modern automobiles as recommended by vehicle manufacturers were included in the observation check list displayed in Table 4.10.

Table 4.10: Observation check list

S. No	Requirement	User mechanics	Available	Not available	Total
1	EFI auto data	Electric, Petrol, Diesel, General	13	65	78
2	EFI scanner	Electric, Petrol, Diesel, General	2	76	78
3	EFI code reader	Electric, Petrol, Diesel, General	11	67	78
4	Fuel pump gauge	Petrol, Diesel, General	3	68	71
5	Oil pressure gauge	Petrol, Diesel, General	6	65	71
6	Cooling system analyzer	Petrol, Diesel, General	5	66	71
7	Engine analyzer	Petrol, Diesel, General	0	71	71
8	Repair manual	Petrol, Diesel, General	8	63	71
9	Diode-transistor tester	Electric, General	5	40	45
10	Digital multi-meter	Electric, General	31	14	45
11	Wiring schematic diagrams	Electric, General	0	45	45
12	Paint spray booth	Auto-body, General	4	83	87
13	Paint depth gauge	Auto-body, General	0	87	87
14	MIG welder	Auto-body, General	3	84	87
15	TIG welder	Auto-body, General	2	85	87
16	Fibre-glass molder	Auto-body, General	7	80	87

Chi-square analysis was used as the general frame work for evaluating whether there were significant differences between tools and equipment of the Jua Kali garages and those recognized by the manufacturers of the vehicles. The expected conditions are the availability of tools and equipment recommended by vehicle manufacturers and the observed responses to the questionnaire (i.e., from the mechanics). The results are shown in Table 4.11.

Table 4.11: Chi-square analysis of garage equipment

S.No	Requirement (Equipment)	YES		No		Total	df	χ^2	significance
		f_o	f_e	f_o	f_e				
1	EFI auto data	13	39	65	39	78	1	34.666	0.0000
2	EFI scanner	2	39	76	39	78	1	70.205	0.0000
3	EFI code reader	11	39	67	39	78	1	90.205	0.0000
4	Fuel pump gauge	3	35.5	68	35.5	71	1	59.507	0.0000
5	Oil pressure gauge	6	35.5	65	35.5	71	1	49.028	0.0000
6	Cooling system analyzer	5	35.5	66	35.5	71	1	52.408	0.0000
7	Engine analyzer	0	35.5	71	35.5	71	1	71.000	0.0000
8	Repair manual	8	35.5	63	35.5	71	1	42.605	0.0000
9	Diode-transistor tester	5	22.5	40	22.5	45	1	27.222	0.0000
10	Digital multi-meter	31	22.5	14	22.5	45	1	6.422	0.2370
11	Wiring schematic diagrams	0	22.5	45	22.5	45	1	45.000	0.0000
12	Paint spray booth	4	43.5	83	43.5	87	1	71.735	0.0000
13	Paint depth gauge	0	43.5	87	43.5	87	1	87.000	0.0000
14	MIG welder	3	43.5	84	43.5	87	1	75.513	0.0000
15	TIG welder	2	43.5	85	43.5	87	1	79.184	0.0000
16	Fibre-glass molder	7	43.5	80	43.5	87	1	61.253	0.0000

The results show the typical observed frequencies (f_o) and expected frequencies (f_e) for presence of selected garage equipment used by mechanics in their various areas of specialization. ('Yes' means that the hand tool is present and 'No' means it is not

available). It is assumed that statistically these two events are equally likely. Except for the digital multi-meter, Jua Kali mechanics do not have the tools recommended by vehicle manufacturers.

4.9 Logistic Regression Analysis and Testing of the Hypotheses

4.9.1 Logistic Regression Analysis

A logistic regression analysis using the 'enter' method was conducted to generate relevant statistical information and produced the following tables. A test of the full model is presented in Table 4.12. All variables against a constant only model were statistically significant (Chi-square = 35.634, $p < 0.000$ with df = 11) indicating that the predictors as a set reliably distinguished between adopters and non-adopters and there is adequate fit of data to the model. This means that at least one or all of the predictors is significantly related to the response variable. Results in Table 4.12 shows that the -2 log likelihood chi-square distribution for the logistic regression has a p value of .000. Hence the study concludes that the four variables are statistically significant. According to Trammer and Elliot (2007), -2 log likelihood is a measure of how well the model explains the variations in the outcome of interest thus the significance of the variables imply they collectively explain variations in technology adoption among automobile mechanics operating in micro and small enterprises.

Table 4.12 Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	35.634	4	.000
	Block	35.634	4	.000
	Model	35.634	4	.000

The Hosmer and Lemeshow test of goodness fit was also generated as shown in Table 4.13. A non-significance ($p = 0.682$) implies that the model adequately fits the data.

Table 4.13: Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	3.963	6	.682

Table 4.14 illustrates the summary of the model. Nagelkerke's R^2 of 0.765 indicates that there exist a moderately strong relationship between prediction and grouping.

Table 4.14: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	105.527	.245	.765

Overall the success of prediction was 82.7% (93.8% for non-adopters and 48.4% for adopters) as illustrated in Table 4.15.

Table 4.15: Classification Table

			Predicted	
		Adoption		
	Observed	0	1	Percentage Correct
Step 1	Adoption 0	90	6	93.8
	1	16	15	48.4
	Overall Percentage			82.7

To establish the effect of the hypothesized independent variables on the dependent, the odds ratio (OR), which estimates the change in the odds of membership in the target group for a one unit increase in the predictor was generated. It was calculated using the regression coefficients of the predictors as exponents or exp. SPSS calculated this value of the ln (odds ratio) and presents it as Exp (B) in the results printout in the 'Variables in the Equation' as shown in Table 4.16. In addition; to

determine which particular independent variables had effects on the dependent variable, the wald statistics significant levels were also generated.

Table 4.16: Independent variables

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Relative advantage	-1.191	.528	5.091	1	.024	.306
Compatibility	2.555	.662	14.905	1	.000	12.868
Complexity	-2.080	.662	9.879	1	.002	.125
Observability	1.535	.621	6.108	1	.013	4.642
Constant	-1.846	.503	13.461	1	.000	.158

4.9.2 Relative advantage

The odds ratio for the relative advantage independent variable ‘’ was .306. This means that a one decrease in the variable decreases the chances of the mechanics to adopt a technology when all other variables are held constant. The wald statistics criterion demonstrated that relative advantage made a significant contribution to technology adoption at 0.01 level of significance (p=0.024).This leads to the conclusion that relative advantage influences technology adoption. Therefore, the null hypothesis that informal mechanics in Kenya do not perceive modern automobile technology as providing any relative advantage is rejected and the alternative accepted. The relative advantage of one technology over another is a key determinant of the adoption of new technology. The issue of relative advantage has been shown to have a positive relationship with adoption of innovation (Tornatzky & Klein, 2012; Anderson & Harris, 2010; Grover, & Güttler, 2013). Mechanics need to be shown that modern automobile technology offers considerable benefit compared to traditional offering. A large number of researchers have highlighted some of the key benefits that modern vehicles offer, these include: better combustion leading to fuel efficiency, less harmful emissions, less frequent tune-ups among others.

4.9.3 Compatibility

Compatibility attribute is related to benefit costs in the innovation for the adopters. Individuals or organizations would likely adopt the innovation if it does not drastically disturb the life style of the existing pattern. The odds ratio for compatibility was 12.868 implying that a one unit increase in this variable will increase the chances of a technology to be adopted 12.87 times when all other variables are held constant. The wald statistics criterion demonstrated that compatibility made a significant contribution to technology adoption at 0.01 level of significance (p=0.000).The null hypothesis that compatibility has no influence on adoption of technology within the informal automobile mechanics in Kenya is therefore rejected and the alternative one accepted. Therefore, compatibility plays a significant role as far as adoption of a technology is concerned. Compatibility of the innovation needs to align with individual's current values and experiences. The more compatible a technology is, the less a change of working procedure and tools is required, therefore, allowing for faster adoption of automobile technology into the informal setting. If the innovation requires the mechanics to adjust their existing way of doing work, or is in contrast to their attitudes the more unlikely they are to adopt (Zaltman & Lin, 1971).

4.9.4 Complexity

The odds ratio for complexity was found to be 0.125 indicating that a one unit increase in complexity will result to a decrease in chances for the mechanics to adopt a technology by 0.125 times holding all other variables constant. A negative b coefficient indicates that as a technology is perceived as more complicated the odds of its adoption increases. The wald statistics criterion demonstrated that complexity made a significant contribution to technology adoption at 0.01 level of significance (p=0.002). Based on the results, the null hypothesis that complexity or 'ease to use' does not affect adoption of technology within the informal automobile mechanics in Kenya is rejected and the alternative one accepted. Meaning that the more complicated a technology, the less the chances of it being adopted.

As Nathan Rosenberg (1972) argued, the skill level of workers and the state of the capital goods sector are two of the important determinants of diffusion of a technology to individual firms, because workers, in this case mechanics and capital goods; in this case modern vehicle diagnostic equipments are crucial for successful implementation and operation of a new invention. If a successful implementation of a technology requires complex new skills, and if it is time-consuming or costly to acquire the required level of competence, then adoption might be slow. As a consequence, the overall levels of skills available to the enterprise as well as the manner in which the necessary skills are acquired are important determinants of diffusion. If the initial idea is too advanced relative to the understanding capacity of the informal mechanics, then it will take longer for the idea to be implemented.

According to the U.S. Bureau of Labor Statistics (2010), to become a mechanic, a person is usually required to be at least 18 years of age and possess a high school diploma. Course work typically involves both classroom studies and hands-on experience, with instruction in engine design, engine theory, torque conversion, cooling systems, transmission systems, lubrication systems, and power train theory and design. In addition, Holder, William; Kunz, Phil (2010) asserts that, one will be a more attractive mechanic if in possession; not just mechanical skills, but computer and mathematics skills as well. After formal education, additional training in the field, whether in the form of high school courses or advanced mechanic courses at a technical institute, will make mechanics more competitive. The bulk of training for a mechanics is on the job. However, candidates who have formal training tend to advance to the journey level more quickly than those who pursue on-the-job training. In modern auto body refinishing techniques; for example, Machine polishing is the recommended method of paint correction for professionals and a growing number of amateur enthusiasts are also taking up the handle. However, according to Craig Kelly (2009), very little is known about the process behind paint correction and the science behind paint application technology. Furthermore, prior to tackling any blemishes, it is vital to take multiple readings of the paint thickness using a paint depth gauge. This allows you to determine the combined thickness of primer, paint and clear coat and, using a rough guide as to the general thicknesses of these individual layers you

will be able to ascertain how much clear coat is available to make the correction (Craig, 2009).

4.9.5 Observability

The odds ratio for the observability independent variable was 4.642 implying that a one unit increase in the variable increases the chances of a technology to be adopted by 4.6 times when all other variables are controlled. The wald statistics criterion demonstrated that observability made a significant contribution to technology adoption at 0.01 level of significance (p=0.013). This also leads to the rejection of the null hypothesis that observability does not play any role in the adoption of technology within the informal automobile mechanics in Kenya. The lack of these tools may be attributed to their prices because they are relatively expensive compared to most common hand tools. This lack of proper tools indicates that the quality of work done by the Jua Kali mechanics in the areas where these tools are supposed to be used is below standard. In addition, there are high chances that the diagnosis made by Jua Kali mechanics is wrong and may cause more problems to the vehicle in the long run.

4.10 Revised Conceptual Framework

From the analysis, the study established that all the four variables: relative advantage, compatibility, complexity and Observability have a significant influence in the adoption of modern automobile technology among the mechanics operating in micro and small enterprises in Kenya. The revised model is illustrated in Figure 4.15.

Y = –1.846+ 2.555compatibility +1.535 observability –1.191 relative advantage– 2.080 complexity

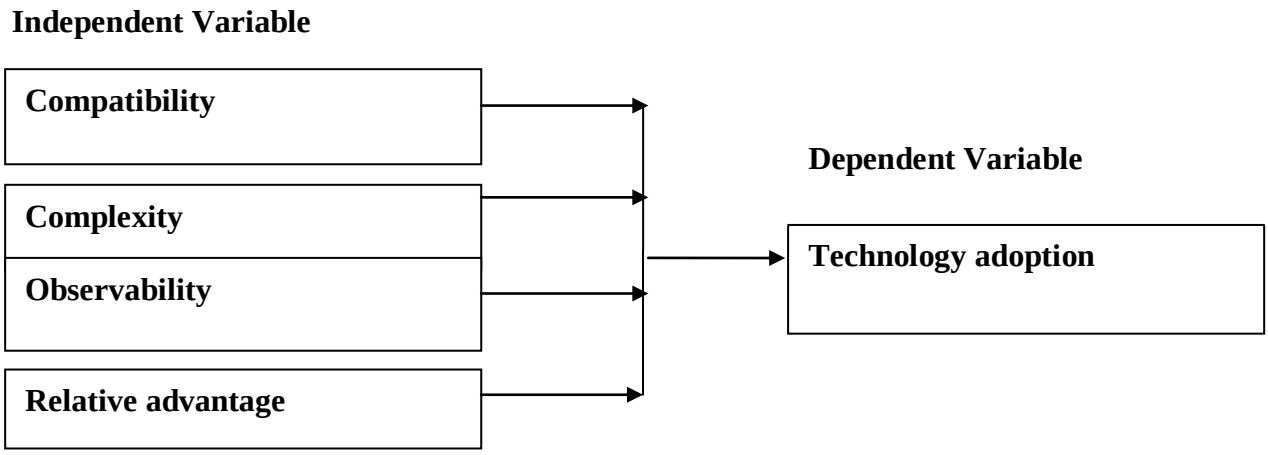

Figure 4.15: Revised Conceptual Framework

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter discusses the summary of the major findings, conclusion and recommendations. The summary of the major findings are organized as per the study objectives: To establish the influence of relative advantage, compatibility, complexity and observability in the adoption of automobile technology among mechanics operating in micro and small enterprises in Kenya.

5.2 Summary of Major Findings

This study sought to assess the determinants of technology adoption among the informal automobile mechanics in Kenya. Guided by the theoretical framework advanced by Rogers (2003): perceived attributes theory of technology adoption; the research used a descriptive cross sectional survey design and employed both probability and non probability sampling techniques to collect quantitative and qualitative data using a self administered questionnaire along with direct observation. Data was analyzed using two statistical softwares: Statistical Package for Social Sciences (SPSS) and MiniTab version 16. Quantitative data enabled associational analysis, mainly; binary logistic regression, Chi-square, and correlation statistics. Qualitative data was used for content analysis. From the findings, the perceived attributes: relative advantage, compatibility, complexity and observability; have a significant influence on the adoption of technology within the informal automobile mechanics.

5.2.1 Relative Advantage

The study sought to establish the influence of relative advantage in the adoption of technology among mechanics operating in MSEs in Kenya. The relative advantage of one technology over another was found to be a key determinant of the adoption of new technology. The odds ratio for the relative advantage independent variable ‘’ was .306. This means that a one decrease in the variable decreases the chances of the mechanics to adopt a technology when all other variables are held constant. The wald

statistics criterion demonstrated that relative advantage made a significant contribution to technology adoption at 0.01 level of significance (p=0.024).This leads to the conclusion that relative advantage influences technology adoption. Taking the electronic fuel injection (EFI) system as an example, some of these advantages include: Uniform air/fuel mixture distribution, highly accurate air/fuel ratio control throughout all engine operating conditions, superior throttle response and power, improved emissions control, Improved cold engine start ability and operation and simpler mechanics, reduced adjustment sensitivity.

5.2.2 Compatibility

This study unveiled that compatibility plays a role in the adoption of technology. The odds ratio for compatibility was 12.868 implying that a one unit increase in this variable will increase the chances of a technology to be adopted 12.87 times when all other variables are held constant. The wald statistics criterion demonstrated that compatibility made a significant contribution to technology adoption at 0.01 level of significance (p=0.000). If the mechanics require adjusting their existing routine and or the innovation or invention is in contrast to their attitudes, the more unlikely they are to adopt it. This study found that, the diagnosis, service or repair of electronic fuel injection and automatic transmission systems is quite different from the traditional carburetor and manual gearbox systems. In the case of auto-body mechanics' tasks; the introduction and use of fibre glass, aluminium, and hard plastics as auto-body panels has necessitated the development of newer paints like spike hecker, metallics and sadocrylls. The repair of these panels may require complete replacement or advanced welding equipment like the tig and mig welders unlike the conventional arc and oxy-acetylene welders used in the traditional mild steel panels. It is inevitable for the mechanics to adopt these innovations if they are to remain competitive in the industry.

5.2.3 Complexity

This study found out that complexity or ease to use a particular innovation plays a major role in the adoption of modern vehicle technology. The odds ratio for complexity was found to be 0.125 indicating that a one unit increase in complexity

will result to a decrease in chances for the mechanics to adopt a technology by 0.125 times holding all other variables constant. A negative b coefficient indicates that as a technology is perceived as more complicated the odds of its adoption increases. The wald statistics criterion demonstrated that complexity made a significant contribution to technology adoption at 0.01 level of significance (p=0.002). Jua Kali mechanics face the challenge of servicing, diagnosing and repairing modern automobiles due to the dynamic technological innovations in the industry; for example, VVTi and EFI), automatic transmission systems and water based paints. This study found out for instance, that, most automatic transmission problems can't be fixed by an average mechanic. There are just too many specialized tools and pieces of equipment needed before attempting any repair. In addition, the mechanics cited airbag systems in modern vehicles as highly complex with a number of components requiring an exact replacement and testing procedures which require expensive equipment. To avoid early exit, stagnation or obsolescence and improper diagnosis or repair; the Jua Kali mechanics need to learn and acquaint themselves in these technologies.

5.2.4 Observability

Observability is where by an innovation use and effects must be visible by others. The odds ratio for the observability as a independent variable was 4.642 implying that a one unit increase in the variable increases the chances of a technology to be adopted by 4.6 times when all other variables are controlled. The wald statistics criterion demonstrated that observability made a significant contribution to technology adoption at 0.01 level of significance (p=0.013). According to the Society of Automobile Engineers (SAE), all vehicles manufactured after the year 1996 must be OBD II compliant. And with the government of Kenya policy that all vehicles imported into the country must be less than 8 years old since manufacture, it then means that vehicles in the country incorporate EFI systems. In the case of gear shifting mechanisms, 85% of automobiles manufactured globally use automatic or semi-automatic transmission systems; commonly known in Kenya as “automatic gearbox”. For this reason, a large number of automobiles in Kenya, including heavy commercial vehicles use automatic transmission systems. In this regard, the informal auto mechanics have no choice but to adopt these technologies if they are to remain

in business. Overall for a technology to be adopted into the Jua Kali context, it needs to show relative advantage, compatibility and lack of complexity. In addition users, especially mechanics need to see a technology in action and be given a chance to try out this technology themselves.

5.3 Conclusions

After a detailed analysis, adoption of various modern motor vehicle technologies was found to be influenced by perceived relative advantage of modern automobile technology compared to older models, the degree of a particular technology or innovation perceived to be consistent with the existing value or previous experience and need to the mechanics (compatibility), the degree the mechanics perceive a particular technology or innovation to be easy or difficult to comprehend or use (complexity) and the result or benefits of the new technology or innovation being available for other mechanics to see and also the availability of the necessary tools and equipment that service diagnose and repair the technology for to make it sustainable (observability).

5.4 Recommendations

Kenya is working towards becoming a middle income economy and eventually a knowledge society by implementing Vision 2030. Adoption of technology and innovation is indisputably a major driving force towards this goal. Education and training institutions can play a central role in creating a human resource base to enhance science and technology industrialization, and thus aid the development of a knowledge economy. In order to realize a profitable and sustainable informal sector, the Government should commits itself to facilitate the identification, acquisition, transfer, diffusion and application of relevant science, technology and innovation knowledge in all sectors of the economy. Identifying and closing skills deficiencies is vital to long-term economic prospects in order to sustain sectors like the informal motor vehicle mechanics that are at risk of disappearing, not being developed or leaving their main tasks to be taken up by formal dealership garages. The only prudent option is to achieve a high skill, high knowledge based economy in order to build a significant future in the local and international marketplace.

Kenya needs to address the dual challenge of skill deficiencies and skill shortages. Skill deficiencies address future needs. Skill shortages replicate the past and are focused on immediate needs. The government should provide mechanics with appropriate training to improve their knowledge and sensitize them on the use of modern tools and also assist in the acquisition of modern vehicle diagnostic and repair equipment to ensure efficiency and effectiveness in their work.

The country should start by integrating Information and Communication Technologies (ICT) in education because technological innovations and developments in industry today are ICT biased and demand persons competent in the use of ICT. Specialized ICT skills are required in the work place for automobile mechanics, and are seen as an essential complement to traditional content knowledge, in courses such as engineering, electronics, and accounting. There is also a need for a comprehensive, holistic and realistic strategy to be developed with all key stakeholders of the technology transfer process. Such a strategy should address issues of informal automobile mechanics' competencies; training curriculum, assessment; content development and delivery; approaches and linkage to industry for relevance, effectiveness and efficiency. Continuous monitoring, evaluation, and utilization of appropriate technologies are strongly recommended.

5.4.1 Recommendation for Future Research

The government should fund institutions of higher learning and all other stake holders in order to encourage and enable further research on the fundamentals of the technology transfer process: technology transfer, technology promotion, technology deployment, technology innovation, technology development, technology research, technology assessment, technology information and communication, technology investment, technology collaboration and technology commercialization.

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APPENDICES

Appendix i: Letter of Introduction

Kennedy Ojucku Mairura
P.O. Box 13118-20100
Nakuru.
Cell: +254 723 219 303
Mail: osats 2009@gmail.com
March 2013

Re; Automobile Mechanics in Kenya

I am a student of Jomo Kenyatta University of Agriculture and Technology pursuing a PhD in entrepreneurship. Part of my requirement to complete the program is to undertake a research project. I chose the Jua Kali motor vehicle sub-sector to carry out my study titled: Determinants of Technology adoption among Automobile Mechanics in Micro and Small Enterprises in Kenya. This questionnaire is strictly for academic purposes and the response therein will be kept strictly confidential.

Sincerely

Mairura, M.K

Appendix ii : Questionnaire

TECHNOLOGY ADOPTION WITHIN INFORMAL MECHANICS

Introduction

This questionnaire aims to obtain information on technology adoption within the mechanics operating in the informal sector in Kenya. Your participation and cooperation in this study will be of great value to the researcher and your cooperation is appreciated. Your responses will be kept confidential and used only for the purposes of this study.

Instructions to the mechanics

Please respond to all questions put to you by the researcher. If there is any question that you do not understand or you wish to seek clarification, please feel free to ask. The researcher will **FILL** in and **TICK** your responses where appropriate, as the interview proceeds.

SECTION A: BACKGROUND INFORMATION

1. Name (optional)----------
2. Age A) 18-25 B) 25-35 C) 35-45 D) 45-55 E) Over 55
3. Formal education
   A) Primary
   B) Secondary
   C) Diploma
   D) University
   E) Other
4. Have you undertaken any technical training? A) Yes B) NO
5. If yes, what qualifications do you posses?
   A) Higher National diploma
   B) Diploma
   C) Craft certificate
   D) Government trade test I
   E) Government trade test II
   F) Government trade test III
   G) Other

6. What is your area of specialization?

   A) Auto body B) Petrol vehicles C) Diesel vehicles D) Auto electrician E) General Mechanic

7. What is your experience?

   A) 2-5 B) 5-10 C) 10-15 D) 15-20 E) over 20 years

8. Given a chance, will you go for further training? A) Yes B) NO
9. If yes, which skill would you wish to learn? ----------

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10. Do you experience any challenges while working on modern vehicles?
11. If yes, what challenges? ----------

SECTION B: TECHNICAL INFORMATION

Please circle the number that best describes your opinion and experience about modern vehicles.

I. RELATIVE ADVANTAGE

How would you rate modern vehicles:

a) In terms of fuel consumption?

1.Very inefficient 2. Inefficient 3. Efficient 4. Very efficient

b) In terms of power output?

1. Very low 2. Low 3. High 4. Very high

c) In terms of service cost?

1.Very low 2. Low 3. High 4. Very high

d) In terms of durability

1. Not durable 2. Slightly durable 3. Durable 4. Very durable

II. COMPATIBILITY

While repairing or servicing and modern old model vehicles, how would you compare:

a)Service tools and equipment used?

1. Very different 2. Different 3. Similar 4. Very similar

b) Service procedures?

1.Very different 2.Somehow different 3. Similar 4. Very similar

c) Fuel types used?

1.Very different 2.Somehow different 3. Similar 4. Very similar

d) Service parts?

1.Very different 2.Somehow different 3. Similar 4. Very similar

COMPLEXITY

What is your view of modern vehicles:

a) In terms of diagnostic procedures

1. Very complicated 2.Complicated 3. Easy 4. Very easy

b) Service procedures

1. Very complicated 2.Complicated 3. Easy 4. Very easy

c) Repair procedures

1. Very complicated 2.Complicated 3. Easy 4. Very easy

d) There is need for further training in order to work on modern vehicles

1. Strongly disagree 2. Disagree 3. Agree 4. Strongly agree

IV. OBSERVABILITY

a) How frequent do you perform repeat jobs concerning modern vehicles

1. Very frequent **2.** Frequent **3**. Rare **4**. Very rare

How do you consider modern vehicles in terms of:

b) Availability of diagnostic tools and equipment?

1. Most of them are hardly available due to their high prices 2. Most of them are hardly available because I don't know how they work 3. Readily available

c) Availability of service parts?

1. Most are hardly available 2. Most are readily available 3.Some are available

d) Availability of repair parts?

1. Most are hardly available 2. Few are available 3, Readily available

V. **<u>Adoption Level</u>**

a) Between old and new model motor vehicles, which ones do you prefer working on?----------. Please give reasons for your answer---------

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b) Do you use an OBD II scanner in your diagnoses?

1. Never **2**. Rarely **3**. Most times **4**. Always **5.** Its not available

c) What type of auto-body paints do you normally apply?

d) Do you often receive complaints of paint reactions?

1. Never **2**. Rarely **3**. Most times **4**. Always

e) How do you diagnose EFI system malfunctions (problems)?

EFI scanner [ ] EFI Code reader [ ]

Multimeter [ ] Engine Analyzer [ ]

f) How do you diagnose dash board warning (eg "Check Engine") lights?

EFI scanner [ ] EFI Code reader [ ]

Multimeter [ ] Engine Analyzer [ ]

g) Once you have repaired an automatic gearbox, does the same problem re-occur after some time?

1. Never **2**.At times, a few cases **3.** Yes, in most cases **4.** We don't repair them

Thank you **for your cooperation.**

Appendix iii: Observation Check List

S/no	Requirement	User mechanics	Available	Not available	Total
1	EFI auto data	Electric, Petrol, Diesel, General			
2	EFI scanner	Electric, Petrol, Diesel, General			
3	EFI code reader	Electric, Petrol, Diesel, General			
4	Fuel pump gauge	Petrol, Diesel, General			
5	Oil pressure gauge	Petrol, Diesel, General			
6	Cooling system analyzer	Petrol, Diesel, General			
7	Engine analyzer	Petrol, Diesel, General			
8	Repair manual	Petrol, Diesel, General			
9	Diode-transistor tester	Electric, General			
10	Digital multi-meter	Electric, General			
11	Wiring schematic diagrams	Electric, General			
12	Paint spray booth	Auto-body, General			
13	Paint depth gauge	Auto-body, General			
14	MIG welder	Auto-body, General			
15	TIG welder	Auto-body, General			
16	Fibre-glass molder	Auto-body, General			