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The Role of Kaizen concept on quality improvement in motor vehicle assembly plants in Kenya

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THE ROLE OF KAIZEN CONCEPT ON QUALITY IMPROVEMENT IN MOTOR VEHICLE ASSEMBLY PLANTS IN KENYA

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DECLARATION

I wish to state that this work has not been hitherto submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and conviction, the thesis has no material previously published or written by another person except where due reference is made in the thesis itself

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Approval

This dissertation of Charles O. Motieri was reviewed and approved for examination by the university supervisor.

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ABSTRACT

Kaizen is a well-recognized concept and highly revered in the manufacturing cycles all over the world because it stands for continuous improvements at the workplace with the participation, support of all employees and commitment of top management. Quality sits at the highest level in most organizations that value customers and the experience that comes with their products and services. The manufacturing pillar is one of the BIG 4 agendas that form the strategic plans of the government in pursuit of economic growth. Interestingly, auto industry is one on the key players in the manufacturing sector. The research was carried out to establish the impact of 5S KAIZEN on quality improvement in the motor vehicle assembly plants. Kenya, being the only country in the region that assembles motor vehicles for domestic and export market, it was deemed important to understand how quality improvement is enhanced by practicing Kaizen, one of the most famous and basic Japanese industrial practices and methodology. The target population of this study was 230 from 3 motor vehicle assembly plants from which a sample size of 146 employees was drawn through both simple random and stratified sampling. These employees were drawn from the technicians in production shop floor including the supervisory team of production managers, quality control managers and the Kaizen champions who are in charge of technical operations in the assembly plants. From the study, the response rate was 93.2% representing 136 of the 146. The study employed multiple regression analysis to study the relationship between quality improvement in the motor vehicle plants and the 5S kaizen. The study findings indicated that set in order was the most impactful on the quality improvement of motor vehicle with a beta coefficient of 0.866 in which it accounts for 61.0% variability in quality improvement. From the multiple regression the study established that the 5S kaizen significantly contribute to the quality improvement in the motor vehicle plants. However, these may prove to be of challenge owing to lack of financial resources, lack of support by the top management, lack of motivation from the employees and lack of skilled manpower.

Key words: *Quality improvement, 5S Kaizen, Sort, Set in Order, Shine, Standardize, and Sustainability*

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LIST OF ABRREVIATIONS AND ACRONYMS

AVA - Associated Vehicle Assemblers

DPV - Defects per Vehicle

IEA - Isuzu East Africa

KAM - Kenya Association of Manufacturers

KEBS - Kenya Bureau of Standards

LSHS - Labh Singh Harnam Singh

NPCC - National Productivity and Competitive Centre

OTD - On Time Delivery

QC - Quality Control

QM - Quality Management

QMR - Quality Management Representative

SOP - Standard Operating Procedures

TOC - Theory of Constraints

TPS - Toyota Production System

DEFINITION OF TERMS

Customer satisfaction: is a measure of how products and services offered by the organization meet or surpass customer expectations

Gemba: is a Japanese term that's symbolizes physical site / the actual workplace in which the main activity of value addition takes place like the factory floor in a manufacturing set up.

KS372:2019: is a legally approved Kenyan safety standard for bus body building guideline that outlines the requirements and materials to use when building or assembling buses

Lean Manufacturing: is a methodology that focuses on minimizing waste in manufacturing setups while at the same maximizing productivity

Lead Time: total time required to complete one unit of a product or service

PDCA Cycle: also known as the Deming Cycle is a continuous quality improvement model

Quality Products: is incorporating features that have capacity to meet customer needs and give customer satisfaction

5S KAIZEN: a Japanese business philosophy that advocates for small and incremental continuous steps by workers to improve operations

Seiri: means sorting and it involves removing unnecessary items from what is needed

Seiton: stands for setting in order and involves arranging items in order for ease of access

Seiso: stands for shining and it involves keeping things tidy and clean at the workplace

Seiketsu: means standardization and is concerned with establishing standards and guidelines to keep workplace clean and safe

Shitsuke: it means to sustain and involves making habits and commitments as a way of life

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Background of the study

Increasing competition is challenging organizations to harness better strategic initiatives to better serve customers through production of high-quality products and services (Duh et al., 2012). Therefore, the required conversion process of converting raw material inputs into finished goods through value addition at every stage is attained via the production process, (Shankar, 2007); (Attri & Grover, 2012). Simply put, production system is a transformation method of converting inputs into outputs (Bellgran & Säfsten, 2010).

The community of nations emulates Japan for its embedded culture of Kaizen, innovation and the successful rebuilding of its economy having risen from the brink of extinction after the twin bombings and the devastating effects of world war two (Waheed et al., 2010). It has two words Kai and Zen that stand for good change or what is commonly known as continuous improvement Kaizen is famous and stands for a popular technique of eliminating waste by continuous improvement in all processes and work operations in order to remain lean (Vamsi Krishna Jasti & Kodali, 2014).

Kaizen originated in the industries during the manufacturing process (Fujimoto, 1999);Imai, 1986);Sua´rez-Barraza, 2007) and its success in discovering problems, identifying root causes and eradicating them was paramount to the growth of manufacturing sector in countries like Japan and Korea. Kaizen is a Japanese concept that was initiated after the devastating effects of the Second World War (Proši, 2011). Kaizen is widely practiced in most Japanese companies and affiliated entities as a way of improving productivity, eliminating waste, enhancing quality and increasing customer satisfaction. It advocates taking small steps to achieve economic results.

After its global outreach in the USA, the application of Kaizen and TQM turned towards the services sector (Sua´rez-Barraza & Ramis-Pujol, 2010) owing to waste (Muda) which can manifest itself in processes that generate services as an output. After the Second World War and

during the economic reconstruction era, Japanese products were viewed as being inferior, cheap and of poor quality. This led to an industry wide move to improve quality and productivity directed by Union of Japanese Scientist and Engineers (JUSE) to remedy the situation and salvage Japanese reputation by implementing 5S and Muda Dori (waste elimination), cost reduction, reduction of defects, improvement of work safety management and production facilities (JICA, 2018).

On the global stage, sustainable development is gaining momentum and manufacturing entities are now shifting from traditional production methods which focused on operational and financial performance to sustainable manufacturing practices (Dubey, Gunasekaran, & Ali, 2015). The concept of Kaizen and environmental sustainability is anchored on waste reduction, process centered focus and extraordinary level of employee involvement and participation (Martínez-Jurado & Moyano-Fuentes, 2014).

Kaizen supports scaling down raw material waste and environmental degradation like pollution by guaranteeing a safe and healthy workplace for employees (Fliedner, 2008;Pampanelli et al., 2014;Vinodh et al., 2010). Similarly, 5S Kaizen being part and parcel of Lean practices boosts neat and structured workplaces which motivate employees to rationally discard unwanted items from production areas in the form of rejects (Vinodh & Rathod, 2011).

1.1.1 Kaizen concept

Different organizations across the world have adopted a managerial approach of Kaizen to improve operations and work processes (Ortiz, 2010 ; Suarez-Barraza et al., 2012). The Kaizen concept is known as a strategic method which increases productivity, quality, efficiency and safety (Titu et al., 2010). The word Kaizen stands for Kai (change) and Zen (good) for the better or continuous improvement (Maarof & Mahmud, 2016). According to Suárez-Barraza and Smith (2014), Kaizen refers to constant improvement in Japanese.

Kaizen comprises many features unique to Japanese industrial experience. Firstly it focuses on small incremental changes under existing set ups and secondly it revolves around human elements and champions people's process oriented efforts for perfections, (JPC, 2019). Surprisingly, Kaizen doesn't call for huge capital for firsthand machines, equipment's or hiring of technocrats

and experts as compared to innovation which demands vast investments and introduction of new technology. Instead, Kaizen entails constant effort and commitment at all cadres of the employees to recommend and practice the use of existing human and capital resources to enhance productivity and quality. Kaizen and innovation are like two wheels of a cart for productivity and quality improvement, (JPC, 2019). Some of the most effective Kaizen implementation tools for advancing productivity and quality in the workplace are 5S, QC, TQM, TPM, and JIT among others (JPC, 2019).

Considering the present global phenomenon in the car industry where products and services are comparable, its noticeable that product life cycles is becoming shorter whereas service intervals are more and more extended. This has necessitated the increase in service quality offered to customer under the prevailing conditions and organizations therefore have to adopt Kaizen to improve their performance levels (Titu et al., 2010).

This study assessed how 5S philosophy improved quality in motor vehicle industry, with focus being on motor vehicle assembly plants. Further, the study looked at making recommendations on how best these practices can be applied to other manufacturing sectors to become efficient, especially those that form part of the downstream segment of the automotive industry's value chain in support of the Kenyan Governments ''Big Four'' agenda.

The prerequisite for Kaizen implementation is adopting the 5S philosophy mainly to organize, clean, maintain a safe discipline work place for sustainable perfections in efficiency, productivity, waste reduction and cost containment (Osada, 1989; Marasinghe, 2012). Lean means the elimination of unnecessary and non-value adding waste and Kaizen is small continuous improvements steps.

Figure 1. 1: 5S Concept (Source: Internet 2020)

Hiroyuki Hirano was credited with initiating 5S which was based on the five Japanese terms that convey the principles of industrial housekeeping. 5S is an abbreviation that symbolize five Japanese words Seiri (Sort), Seiton (Set in order, Systemize or Simplify), Seiso (sweep or shine), Seiketsu (standardize or sanitize), and Shitsuke (sustain or self-discipline). 5S was used for the first time around 1950's after World War Two in the Japanese manufacturing industry (Korkut et al., 2009). It's one of the greatest resourcefully applied apparatus for lean manufacturing. 5S is the basis for all developments and its foundation entails the application of visual management.

It is a Japanese philosophy of practicing good and hygiene house- keeping practices and is mostly used in tandem with Kaizen as part of the Lean manufacturing tools. The 5S principles was pioneered by the Toyota Motor Corporation to advance quality and safety at the workplace. In the early 1980's a Japanese by the name Takashi Osada formalized the framework of applying 5S at work (Randhawa & Ahuja, 2017). Teamwork was vital in 5S Kaizen implementation and the approach was not only restricted to the shop floor /production or sales and marketing areas but the entire organization. Every employee from the top management to the bottom is encouraged to improve his area of work and it's important when Teamwork is encouraged since Kaizen is easily realized.

Table 1.1 Summary translation of 5S Concept

Japanese	English meaning	Meaning	Typical examples
Seiri	Sort	Clearly separate necessary things from unnecessary one	Discarding old and obsolete items
Seiton	Set in order	Neatly arrange and identify items for use	Arranging in shelves, racks and cabinets
Seiso	Shine	Always clean workplace to maintain tidiness and cleanliness	Establishing individual responsibility for daily cleaning
Seiketsu	Standardize	Maintaining the first 3S and individual well-being and personal hygiene	Settings SOP's and maintenance plans
Shitsuke	Self- discipline/ Sustain	Making a habit of conforming to the rules	Executing the standards in a disciplined way

Source: Researcher (2020)

The 5S concept was executed in a progressive way beginning with the first step Seiri (Sort) which refers to removal of all undesirable, unnecessary and discrete material from the workplace to reduce confusion and clear space. This was done to by attaching red flags on unwanted items and deciding if to move or discard these items and by "green flagging" items that are in use (Gombrii & Solhkonan, 2010). The next step is Seiton (Set in order) entails putting things in the right place for ease of access. This can be done by labelling or painting with reflective paint or tape the floor plan layout. The location of inventory, tools, equipment and files should be easily and conspicuously identifiable (Chapman, 2015)

The third step is Seiso (Shine) which means to clean and make it shine. It involved cleaning the shop floor and issuing instruction to clean machines (Avari et al., 2011; Becker, 2001). Step four of the process is Seiketsu (Standardize) which involved setting up centralized locations or stations with inventories, consumables and materials alongside a checklist of responsibilities and schedules (Chapman, 2015). Upholding hygiene and safe working environment are important in this stage. The last and final step is Shitsuke (Sustain) which calls for inculcating self- discipline and a culture of consciousness and re-training. To sustain 5S, Chapman (2015), recommends that management staff conduct periodic and regular audits of the 5S principles and "post check sheets that communicate what to clean and inspect and how to do it and who is responsible and the frequency of the checks". Adhering to these five principles ensured a clean workplace and an

organized workflow that allowed supervisors to establish when production is lagging, or something is out of order and needs attention. 5S was the foundation and implementing it well is vital because a lack of 5S system will render the other lean tools ineffective (Chapman, 2015)

1.1.2 Quality improvement

Many organizations in the world have fully adopted total quality management (TQM) principles and practices to achieve advantages by investing substantial resources in their operations (Sweis et al., 2014). Evidence from available literature review showed that TQM has helped firms in upgrading their products and services by availing superior products and enhancing their performance levels (Refaie & Hanayneh, 2014). Organizations have recognized that quality is inevitable and a competitive strategy for improving products and services and continuous quality improvement plays an integral role in the success and survival of the motor vehicle enterprises. Learning from past mistakes expressly from customer feedback could lead to tremendous success for automotive factories that convert mistakes into opportunities for improvement. Quality activities at the level of six sigma help auto industries reduce failure frequency and acquire competitive strategy. Majority of automakers are experiencing soaring warranty costs and customer complaints that trigger quality improvement practice activities. Chinese auto factories prioritized quality improvement practices based on a failure frequency (R/1000) (Zhou et al., 2016).

Quality systems in a company can be considered to play a major role in successful implementation and sustaining of Lean manufacturing since quality practices are seen to compliment Lean systems (Garza-Reyes, 2015). Part of the product quality aspects or principles used in the motor industry comprise of product design, functionalities and safety (Jahanshahi et al., 2011).Widespread evidence suggests the effectiveness of Lean Manufacturing (LM) in helping firms/ organizations to be more competitive through the improvement of their business operations (Belekoukias et al., 2014; Al-Najem et al., 2013).

Nicholas (2016), established that quality and lean practices can be applied well in isolation although, their combination greatly improves plant performance. Lately, continuous improvement of product and processes is precisely significant in having an edge over others in the competitive

manufacturing marketplace and that has become more commanding in highly competitive industries like automotive (Drohomeretski et al., 2014). Inopportunely, continuous quality improvement has not been successfully realized in small scale manufacturing industries, where it remains an idea endeavored for Quality Improvement (Doshi & Desai, 2017).

The proceeds of quality emanate from the overall organizations culture that strives to continuously improve all facets of the organization (Gharakhani et al., 2013). Quality is usually measured on the number of customer complaints, reworks, returns per month, number of defects and lastly the On-Time Delivery (OTD) which is the percentage of units/vehicles delivered within the (promised period) OTD window. Quality Management (QM) focuses on continuous improvement of all processes within the organization with the sole aim of meeting, exceeding and enriching the customer expectation. This customer expectation has loosely translated to a new concept of providing a whole new level of customer experience as the organizations interact with the customers. Studies show existence of a relationship between employee performance, quality management practices and organizations performance. According to Sadikoglu and Zehir, (2010), QM is not only a function on its own but it's more of an integrated approach encompassing the entire organization.

According to Al-Tahat (2010), standards must be maintained to safeguard quality and it's upon the management to ensure that every aspect of the functional processes undertaken by the firm are embedding quality. Quality Control tools like checklists, the fishbone/ Ishikawa diagram and Pareto principle and 5 WHY are ideal for problem solving and maintaining high quality standards at work. They have proven over to time to offer immense results when applied meticulously. Product quality is the main motivation in customer satisfaction in acquiring an automobile (Johnson et al., 1997). Generally productivity involves anything that concerns a business entity and it includes measures of job satisfaction, customer satisfaction and employee morale (Abraham, 2012).

According to GOST R ISO 9000-2015 2.2.1, the quality of products and services of the organization depends on the capability to meet consumers' purposeful or unpremeditated influence on pertinent stakeholders. Indeed, the quality is largely determined by the consumer and therefore, the manufacturer must monitor the quality of work. Quality management is defined

by a synchronized activity on all matters of organization management manual. Remember quality management principles: Customer focus, defining the interests and desires of buyers; Leadership that provides unity of purpose and direction of the state; The collaboration of employees, ensuring the involvement and expertise in manufacturing processes; Process approach, implying the accomplishment of the goal through the relationship of all the elements; Continuous improvement, suggesting success; Decision making based on facts, helps achieve the desired result; Management relations, which is the link between suppliers and the organization. All these dynamics shall be met to achieve the anticipated, and most significantly - quality products and services at the end of the process. Multidimensional concept of quality and consequently the features of objects are different. This aspect, usually takes into account the functional characteristics, reliability, durability, defect-free (free from defects), safety, design, sustainability (National Standards Authority, 2015)

Wiengarten et al. (2013) emphasized the significance of investments in quality practices in positive enactment of lean practices. To understand and relate well with the criteria and selection of QI in the motor industry, the study reviewed a couple of references based on three dimensions against their measures. The Cost dimension (warranty cost, number of warranty claims, number of defects) Customer voice (VOC) dimension (customer complaints and customer satisfaction) and lastly the Failure dimension (occurrence and detection) (Zhou et al., 2016). Reducing the risk of failure in the process is vital and may improve the product and process quality and the metrics of the same would be reduction in customer return goods, reduction in rejections and cost of poor quality. Failure Mode and Effects Analysis (FMEA) is one of the tools used in quality improvement. It aids in pinpointing measures necessary for improving product and processes by focusing on failure modes and its impacts (Xiao et al., 2011).

1.1.3 Motor Vehicle Assembly Plants in Kenya

The automotive trade is a key sector in the economy of Kenya. The industry has three sub sectors namely: the auto vehicle production/assembly, motor cycles production and Assembly, and Automotive component parts manufacturers (KAM, 2018). The Vehicle assembly plants are manufacturing plants where value addition takes place by assembling (CKDs) completely knocked down kits. Currently Kenya has three vehicle assembly plants with an additional fourth

having been licensed to start operations later this year. The installed capacity of the three plants is 34, 000 units per year against a demand of EAC region of 15,000 units per year (KAM, 2018). Ferdows and Thurnheer (2011) coined the term factory fitness within the context of assembly lines that become leaner and exclude waste and non-value adding activities and fitter when it multiplies and develops its core capabilities. The automotive market in Kenya is mainly focused on retail, distribution, spare parts sales & after sales support. Assembly of motor vehicles is done on a small-scale level by three assembly plants, Isuzu East Africa (IEA) Ltd in Nairobi, formerly General Motors East Africa (GMEA), the Associated Vehicle Assemblers (AVA) in Mombasa and Kenya Vehicle Manufactures (KVM) in Thika. Sadly, all the three plants are operating below their installed capacity (Deloitte, 2018).

In a bid to lobby the government with one voice and advance their investment and stakeholder interests, majority of the bus body builders came together in 2016/17 and formed an association known as Kenya Association of Bus Manufacturers (KABM) under the umbrella body of KAM. This was after a sustained outcry and onslaught from the public about the tragic road accidents and quality of buses operating on Kenyan roads. The realization of this association was to lobby the Government to allow for self-regulation with the supervision of National Transport and Safety Authority (NTSA) a government agency mandated with ensuring compliance and setting safety standards.

With the collaboration from both the private and public sector, the Kenya Standard of Body Building KS 372:2014 was developed by Kenya Bureau of Standards (KEBS) and published in the Kenya gazette notice as Law and was recently reviewed to KS372:2019. These progressive amendments are in line with the changes in government policy in the transport industry and with international safety standards. The use of Tensile steel (Q355) has been adopted on all bus bodies in Kenya and the region due to good quality, lighter and stronger properties in the event of a deadly collision or accident. The state department for Industrialization is tasked with the enactment and development of the National Automotive Policy as guided by the constitution of Kenya 2010 in the fourth schedule. The vision 2030 framework affords direction for the policy development which aims to transform Kenya into a newly industrialized middle-income country providing high quality life to its citizens.

In Kenya the government wants the manufacturing sector to increase its GDP contribution from 9.5% to 15% by 2022 as part of the big four Agenda and the auto industry has a huge role play to bridge the gap. Parliament is in the process of enacting the National Productivity and Competitiveness Council Bill 2019. It will provide the necessary administrative framework to foster productivity and competitiveness improvement. The bill calls for establishment of a council, establishment of Technical committees, publication of annual productivity, quality and competitiveness reports, provision of training and consultancy and initiation of research activities (G.O.K, 2019).

1.2 Problem Statement

The two biggest problems affecting vehicle assemblers is low quality and lack of skilled labor, (Manufacturers, 2018). Several manufacturing units are faced with a lot of challenges in responding to swift changes in customer demands, quality and competitiveness. This study was motivated by one of the gaps in the literature review indicating an over reliance by large corporations on SME's by Zhou (2016) which are under sustained pressure to guarantee product quality. Most Vehicle assembly plants are functioning below their production capability and affordability of Kenya's manufacturing entities still lags behind China and India although she is ahead of her neighbors (World Bank, KIPPRA and CSAE , 2004).

There is a mismatch in training being provided in Technical & higher institutions of learning and the industry skills requirements. This huge gap coupled with low interest in Research and Development (R&D) has led to an outcry from the industry, (G.O.K, 2019). For the body builders the biggest setback is low quality or workmanship within their facilities, prolonged lead-times and reworks and defectives of their products which does not meet the customer expectations (Okatch et al., 2011).

1.3 Research Objectives

General Objective

To assess the role of 5S Kaizen on quality in the motor vehicle assembly plants with specific focus on bus body building segment.

Specific Objectives

i. To determine the influence of Sorting on quality improvement in the vehicle assembly plants in Kenya
ii. To determine the influence of Set in order on quality improvement in the vehicle assembly plants in Kenya
iii. To determine the influence of Shining on quality improvement in the vehicle assembly plants in Kenya
iv. To establish the influence of standardization on quality improvement in vehicle assembly plants in Kenya
v. To determine the influence of Sustainability on quality improvement in the vehicle assembly plants in Kenya

1.4 Research Questions

i. What is the influence of Sorting on quality improvement in the vehicle assembly plants in Kenya?
ii. What is the influence of Set in order on quality improvement in the vehicle assembly plants in Kenya?
iii. What is the influence of Shining on quality improvement in vehicle assembly plants in Kenya?
iv. What is the influence of Standardization on quality improvement in vehicle assembly plants Kenya?
v. What is the influence of Sustainability on quality improvement in vehicle assembly plants in Kenya?

1.5 Significance of the study

The findings from the study will be published in an international peer review journal and the management of assembly plants will fine tune work plans, processes and strategies to continuously improve quality by eliminating the gaps identified during the study. Thus, assembly plants will be more competitive and efficient in resource utilization with sustainability at the core. Results can be shared with their suppliers to streamline their operations and value chains since they play a big role in supporting assembly lines.

This study will be utilized as a source of reference guide in related fields of research for students and researchers in the future. From the research gaps, scholars can find the study useful in identifying further areas of research. It will be useful for academicians who undertake the same topic in their studies and in adding to the body of knowledge.

The Government of Kenya through the National Productivity and Competitiveness Centre (NPCC) will receive valuable information that will be used to formulate policies that will guide them in allocating training resources in support of Micro, Small and Medium Enterprises (MSME's) in manufacturing sector to foster productivity and quality. This will be done by empowering employees in these sectors with skills and knowledge which will translate to quality improvement and sustained growth.

1.6 The scope of study

This study tries to examine the impact of 5S concept in enhancing quality improvement in the motor vehicle assembly plants in Kenya. This is as a result of vehicle assembly & body building assembly processes and areas have several intricate procedures and undertakings that require precise timely interventions to produce high quality products. The motor vehicle assembly & bus body building plants fall under manufacturing pillar of Kenya Government's Big 4 Agenda as enshrined in Vision 2030 for Kenya to become an industrial powerhouse. Geographically, the research scope of the study will be on the motor vehicle assembly plants in Kenya. The theoretical scope of the research will be restricted to the theory of constraints and Lean Manufacturing. Further, the study will be majorly a quantitative methodology with limited

additional single open-ended question per questionnaire. The questionnaires were issued to employees and managers in the production lines in all the factories since they do similar jobs and are conversant with the assembly and quality improvement processes and initiatives.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

In this chapter pertinent literature was reviewed plus the theoretical foundation of the study and its empirical review of the literature is discussed in length. The literature incorporates the major areas of the historical development of 5S concept in the manufacturing industry, the 5S tools effective for productivity and quality improvement in the workplace, why 5S is an ideal concept to adopt and the benefits of applying 5S concept to the organization. Information in the form of correspondence's including emails, letters, bulletins, notices, technical and financial reports and company newsletters may be an area of interest to the researcher and this includes public records and therefore they will be utilized as well (Saunders et al., 2009). Secondary data in any form on Kaizen and quality related improvements was reviewed.

2.2 Theoretical Review

This section laid bare the theoretical substance that formed the basis of this study. The dominant theory examined in detail is the Theory of Constraints supported by Lean Management. The TOC has two major components, first is the philosophy determines the workings principles and steps of TOC and secondly the generic approach that revolves around investigation, analysis and complex problem solving. In simple terms the TOC acknowledges that manufacturing processes cannot be devoid of bottlenecks and the key for success is unlocking and overcoming the constraints to create a seamless production flow.

2.2.1 The Theory of Constraints

The Theory of Constraint (TOC) was first formulated in the US by an Israel physicist known as Dr. Eliyahu Goldratt in his 1984 book ''The Goal'' (Goldratt, 1984). The TOC is also commonly referred as Management by Constraints (MBC) and is interesting to analyze since it focuses on the weakest links in the process chain. According to Goldratt (1984), the TOC approach recognizes an organization as a system with a goal and every action taken must be judged on its impact to the entire organization's goal. The theory suggests that improvements in universal performance of business establishments can be realized by focusing on leverage points of its system. Nowadays the TOC is closely seen as a general theory for running the organization

(Panizzolo, 2016). It distinguishes that every system must have at least one constraint otherwise commercial entities would make unlimited profits. Eden and Ronen (2007, p.69) describe a constraint as ‘‘any significant element that hinders an organization from achieving its goal.’’ The TOC views constraints as opportunities for improvements and not as something negative. An employee would get sick or a machine could break down and pose a challenge in the efficient running of a production operations and thus the entire process gets constrained from achieving its intended objectives. The decision whether to elevate a constraint or not is a strategic one for the business entity and its optional(Ronen & Pass, 2007). The use of TOC assists in the management of inventory in assembly lines by focusing on the constraint therefore alleviating competing requirement of various departments (Chou et al., 2012).

Pass and Ronen (2003) recommend adoption of TOC in the automotive hi-tech industries to manage tactical and strategic constraints. This study adopted the Theory of Constraints because within the assembly processes there are so many activities that take place i.e. to transporting, unpacking, sorting and assembling components parts to make a product. This can present some challenges during assembly and a single constraint like wrong shipment, short shipment or loss of a part can impede the entire production process. Goldratt (1999) summarized the five key steps as: identifying the problem/bottleneck in the process or area of operation and this could be people, machine or lack of materials. The second part is to decide how to overcome the bottlenecks by effective use of other non-constraint resources to match desired output. The third step is to synchronize the available resource with constraints for optimal utilization and fourthly aim at breaking (elevating) the constraint to render it ineffective. Lastly, repeat the process and ensure that inertial doesn’t become the next constraint and this is important since TOC is a continuous problem that recognizes that there is no single solution for every scenario. Ren et al. (2013) observed a reduction in lead time, patient satisfaction and increased number of surgeries when the five TOC stages are applied in hospitals.

Tsitsakis (2010) used the TOC to solve long waiting time, capacity issues and low occupancy rates at five public hospitals in Greece. Most automotive companies that try to implement 5S concept encounter a lot of challenges on the last two steps; on standardization due to changes in regulations and customer preferences and on sustainability of the 5S culture which is primarily

a constraint that is inherent in most people due to lack of self-discipline and resistance to change. Implementation of TOC might vary between Eastern and Western countries owing to differing nationalist cultures (Kull & Wacker, 2010).

Bernardi and Pires (2010) observed that constraints hindering production can range from policy or behavioural aspects to physical resources like lack of enough raw materials and equipment capacity. Şimşit et al., (2014) affirms that TOC is now viewed by managers as a problem structuring and problem-solving technique for decision making that influences their thinking approach. From the literature reviewed, TOC has been found to be useful in many sectors like marketing, services, process industries and project management (Tulasi & Rao, 2012). It was observed that TOC philosophies aid manufacturing entities including SME's in enhancing production capacity and exploiting returns and support in refining production efficiency (Bai et al., 2018). For an organization to speedily and entirely meet its potential customer needs, progressive levels of efficiency with maximum production flexibility shall be adopted (Jagodziński & Ostrowski, 2016). This is not outright easy due to variability of manufacturing requirements in assembly lines, inadequate resources like skilled employees and new technology could contain bottlenecks which restrict the output of production setups (Lei & Li, 2017).

2.2.3 Lean Manufacturing model

In 1988, John Krafcik introduced Lean Production System to the world and later on Womack in his book "The Machine that Changed the World' 'promoted Lean Manufacturing (LM) or Lean Production (LP) in the early 1990's. Customer driven demand and competitiveness as a result of globalization has led to complex production planning control systems to optimize mass production in the auto industry. Toyota Motor Corporation is one the global giants that embraced this idea by produced vehicles with less defects, less inventory and minimum human effort with tremendous success. LM is response customer demands by focusing on waste elimination and cost reduction (Bhamu & Singh, 2014).

According to Taj & Morosan (2011), LM is a multifaceted methodology that incorporates waste elimination during manufacturing, establishing and entrenching quality culture and systems (TQM), proper machine and equipment maintenance (TPM) and an empowered workforce that

works towards improving quality, faster responses, flexible and cost competitiveness. The slogan manufacturing without waste is gaining momentum lately and Lean manufacturing is now considered to be a robust means of achieving continuous improvement in any system (So & Sun, 2011). Lean Production is evinced as a model where employees and management are thinkers and their full involvement in organizational issues promotes (Kaizen) the culture of continuous improvement. This will enable the organization to be agile and firmly confront market challenges/demands and environmental obligations of today and tomorrow (Taj & Morosan, 2011). The evolution of lean production process was the brainchild of two ambitious engineers (Taiichi Ohno and Kiichiro Toyoda) which culminated in the Toyota Production System (TPS) famous for mass production of automobiles.

In the manufacturing business, Lean practices are key to remaining successful. Globally, manufacturing entities are shifting focus from the traditional operations and financial focus to sustainable lean manufacturing practices (Dubey, Gunasekaran, & Chakrabarty, 2015). According to Wang, Subramanian, Gunasekaran, Abdulrahman, & Liu, (2015), sustainability is a key competitive parameter for most futuristic manufacturing entities going forward for them to remain competitive. In the motor industry, majority of the Original Equipment Manufacturers (OEM) are innovating products that are of high quality, user friendly to consumers and the ecosystem. With the recent upsurge by most organization to adopt LM, many entities have started to reap the benefits while other have not realized the importance or gains that come with LM. The reason is that Lean Manufacturing implementation is not fully understood well within those organizations (Anand & Kodali, 2010). This is because no standard process or framework is in place and it's desirable that both the management and employees work together for full realization of LM. Resources must be allocated and relentless devotion by management is necessary.

2.3 Empirical Review

The empirical review involved examination of the available and relevant empirical literature that relate to Kaizen and applicable tools effective for productivity and quality improvement at the workplace. The sections were arranged sequentially and in tandem with the research objectives.

2.3.1 Sorting and quality improvement

Kumar et al. (2018) studied a road map for identifying opportunities for continuous improvement in small and medium sized enterprises in India. The study adopted a case study of SME's located in non-capital part of India. They found out that Lean Kaizen tools contribute to the continuous progress in improvement of quality of product and productivity in the organization. The study focused on Value Streaming Method (VSM) while the current study incorporates 5S concept.

According to Moriones et al.(2010) their study in 203 Spanish manufacturing plants, it was established that 5S was positively related to operational performances related to productivity and quality. The research design adopted was questionnaire survey. Ho et al., (2015) wanted to test a TQM model developed from the previous study using Standards and Industrial Research Institute of Malaysia (SIRIM) who later renamed it SIRIM 5S Green model for business sustainability organizational development. The results of the research indicated that there is a strong correlation between 5S and Lean 5S in quality improvement and indeed 5S and Lean 5S are effective tools to use. The research employed a questionnaire on 81 firms across different industries in Malaysia with two in depth interviews on 5D and Lean management. Their study cut across industries while this study was restricted to the motor vehicle (assembly plants) industry.

Jaeger and Adair (2016) studied the perceived TQM paybacks, practices and hurdles in Kuwait's ISO 9001:2000 certified industrial organizations. From their findings there was a huge disparity between the Project Managers (PMs) and Quality Management Representatives (QMRs) regarding TQM. Whilst both agreed on perceptions related to practices and obstacles, they held a divergent view on their perception of the most important TQM benefit. The PMs held the view that TQM benefits quality of products and services more while the QMRs felt it was productivity.

2.3.2 Set in order and quality improvement

Some studies in the republic of South Africa and Ghana adopting Kaizen approach, reported improvement of scientific operations, work efficiency, reduction of queuing time and overcrowding (Moriones et al., 2010). According to Moriones et al., (2010), findings reveal that the introduction of 5S is linked to better performance in terms of productivity and quality. This research considers this conclusion widely accepted in the academic and professional literature to

be very relevant. Firm managers considered trying to keep order and tidiness in the plant in a rigorous and systematic way and led to improvement in quality and productivity and consequently in competitiveness.

Prashar (2014), studied the systematic adoption of Lean Kaizen in process improvement in the assembly line of one of the largest steering manufactures in India that was facing severe liquidity and surging bank interest rates & cost of raw materials a bid to survive and curb internal inefficiencies. The study adopted the use of value stream mapping (VSM) to target kaizen improvement areas at the same time identified Nonvalue adding processes and activities. The firm kept inventory for 61 days and long distances travel of 294 meters in assembly lines and large defective parts of 879 parts per million. After using lean strategies to modify the assembly process, a reduction rate of 32% on defective parts with inventory levels down by 66% was achieved alongside a reduced production headcount, storage space and equipment. This helped the company manage its working capital and improved its profitability as a going concern. The focus was on an organization facing bankruptcy while this study focused on going concern entities.

According to Bacoup et al. (2018), it's possible for manufacturing companies to attain ISO certification without creating more documentation by adopting lean management which induces lower costs and less lead times. The findings of the research concluded that an organization can possibly keep one manual, ten records and have zero nonconformity and no customer complaints for a period of two years by putting in place lean management principles. According to Randhawa and Ahuja (2018), a study carried out in Indian manufacturing entities in 2016, it was established 5S contributes immensely to competitive dimensions in the overall organization. Some of the areas with great impact were in quality and continuous improvement, cost optimization, effective workplace utilization and safety enhancements and employee related success. The research design adopted was an empirical study.

According to Goshime et al. (2019), articles and secondary data were reviewed and existing gaps identified. The notable and conspicuous gaps were space waste, material waste, waste in knowledge and talent and energy waste among others. This study added safety as the sixth in addition to the 5S in the kaizen strategies. Conflicts between human resource waste and

unemployment due to fragmented implementation of lean manufacturing were reconciled by this study. A model for improving productivity and customer satisfaction was developed and solutions to alleviate problems and speed up development were forwarded for adoption. This study confined itself to quality improvement whilst their study included the element of productivity.

2.3.3 Shining and quality improvement

Ishijima et al., (2014) and Srinivasan et al., (2016) conducted a pre-test and post-test case study in a job shop facility to examine the effect of implementing 5S on climate safety of factory workers classified into two (case and non-control) groups. The two sets of employees completed a safety climate questionnaire a month after and two months after 5S events. The cycle time to assemble one-unit part impressively decreased by 4.5 minutes and from the anecdotal evidence from talks held with workers, they felt safer and in control of their work surrounding and majority of workers reported and eliminated hazards during the 5S activities. Employees were more involved and participated in decision making and took more responsibilities in cleanliness and work orderliness.

Ma et al., (2018) identified crucial factors for adoption in shop floor management and quality control cycles for Kaizen support. It was noted from the analysis conducted, that not all shop floor tools could help identify opportunities and areas for improvement. Whilst QCCs are effective for solving larger problems in organizations, they have less impact on individual learning and growth. The study employed qualitative method and used questionnaires to obtain data from 371 respondents in Sino - Japanese automotive ventures. According to Chiarini et al., (2018), the results of the research carried out exhibited many theoretical similarities or parallelisms alongside lessons for practitioner's specifically regarding principles of JIT, Jidoka, Genchi Genbutsu , challenge, team work , respect for people , waste elimination and Kaizen. The research methodology was the review of Taiichi Ohno's book dedicated to TPS, the Toyota way 2001 together with other relevant literature. The literature regarding Zen philosophy was analyzed and categorized using content analysis.

2.3.4 Standardization on quality improvement

According to Ablanedo-Rosas et al., (2010), in their research study conducted in the state of Hilgado Mexico, it was observed from the empirical evidence gathered that the first 3S are easy to implement. However, Standardization is never put into practice, or it's almost forgotten left unconcluded. On all the three cases after two months things started to slacken, and old habits started to find their way back. This study looked at the impact of standardization where no failure cases were reported and how it is entrenched in the organization.

Alonso-Almeida et al., (2012), steered a research study in the hotel industry in Spain from a sample of 186 tourist accommodation facilities. This companies were certified with the Q mark for tourist quality standard using a questionnaire based on quality practices. Exploratory and confirmatory factorial analysis methodology was used to validate the scales of reliability and validity. It was observed that quality practices that have the most influence on key results are quality policy and quality plans supported with good leadership. This study revolved around standards in the manufacturing auto industry sector.

Römkens et al. (2011), from their research study, a data base of 750 selected paired samples of cadmium soil and paddy rice was used to calibrate plant transfer models using soil metal content. The models were validated against a set of 2300 data points not used in calibration. These models were used inversely to derive soil quality standards for rice. To account for model uncertainty soil quality standards were derived considering a maximum probability that rice exceeds the food quality standards equal to 10 or 5%. It was observed that for both Japonica and Indicia-type cultivars, the soil quality standard must be reduced by a factor of 2 to 3 to achieve stringent standards. The strong impact of PH and CEC on soil quality standards implies that it's vital to remedy for soil type when deriving national or local standards. However, this research study concentrated on business entities with a commercial inclination and not agricultural as was with their study.

Münstermann et al., (2010) from their study wanted to know if business process standardization (BPS) had an impact on process performance. Their methodology was based on an empirical data from 156 firms to evaluate the hypothesis that process standardization positively impacts business process time, cost and quality. From the results, it was noted that empirical analysis showed BPS

has a decisive impact on process performance (R^2=61.9 percent. The paper is among the first to empirically show the vital impact of process standardization on performance. Whilst their study emphasized the value of standardization on business and process performance, this study delved into the impact of standardization on quality only in respect to 5S.

2.3.5 Sustaining 5S & quality improvement

Ishijima et al., (2014), noted that establishment of continued patronage of leaders and healthcare workers, promoting learning, and encouraging sharing of skills and capabilities are key to scaling up. Parand's study opines that response is particularly significant when circulating information back to the superiors to motivate executive senior management and to expand understanding of the program within the hospital (Parand et al., 2012). Sajan et al. (2017), noted on a study based on a survey conducted in 252 manufacturing Indian SME's, there is uninterrupted link between Lean manufacturing and sustainability. Economic and social sustainability performances are as a result of entrenching one of the Kaizen principles of Lean Manufacturing. Their study was done on many organizations whilst this study was based on three motor vehicle assembly plants.

Suarez-Barraza and Ramis-Pujol, (2012) observed from their studies that for Kaizen implementation and sustainability to succeed in an organization there shall be a strategic link or direction that lays emphasis on embedding or institutionalization of 5S; systemization and standardization accompanied with self-discipline. The research design was an exploratory case study of three MNC's of which two were from automotive and the third one was from a manufacturer of hygiene products. Whilst their study included a manufacturing organization dealing with hygiene products, this study won't include entities from outside the auto industry.

Ishijima et al. (2014) conducted a study in Tanzanian Public hospitals on 5S implementation, it was established that involvement and commitment, clear team roles and responsibilities availability and use of 5S guidelines, feedback and information sharing were significantly present. Their finding echoed those of Gilson et al. (2010) that the establishment of assistance to managers and healthcare workers, boosting education and sharing of work skills is crucial to scaling up the Kaizen culture within the organization. A questionnaire item with 14 instructive variables was used.

Suarez-Barraza and Ramis-Pujol (2012) conducted a study in three MNC's in Mexico regarding Lean Kaizen and observed that lack of a balanced implementation of philosophy and technique and the failure to apply the PDCA cycle advocated by Deming, may hinder the full realization of Kaizen benefits to the organization. The data collection method was through observation and semi structured interviews and documentary analysis. Jaeger and Adair (2016) studied the perceived TQM benefits, practices and obstacles in Kuwait's ISO 9001:2000 certified industrial organizations. From their findings there was a huge disparity between the Project Managers (PMs) and Quality Management Representatives (QMRs) regarding TQM. Both groups agreed on their reflection that implemented management system is the most important practice and a lack of employee involvement as the biggest obstacle.

From the paper that was presented during the 7th International Economics and Business Management conference proceedings held on 5th and 6th October 2015 in Malaysia by Maarof and Mahmud (2016), some factors contributing to successful Kaizen implementation and challenges were reviewed. It was noted that good communication, clear corporate strategy, employee empowerment and presence of a Kaizen champion counted for successful implementation. The review also established lack of employee motivation, not understanding the organization strategic goals, resistance to change and difficulties implementing continuous improvement posed challenges in implementing Kaizen. The paper provided insights beneficial to SMEs and other industry players formulating their Kaizen strategies.

2.4 Research Gaps

The following section outlined the knowledge, contextual and methodological gaps identified that the research intended to fulfill.

Table 2.1 Research Gaps

Author	Title	Findings of the study	Research Gaps
Manuel F. Suárez-Barraza, Juan Ramis-Pujol (2012)	An exploratory study of 5S: a multiple case study of multinational organizations in Mexico	Drivers and Inhibitors of 5S were identified and from a strategic viewpoint 5S is embedded in the organization	Impact of 5S on Lean Kaizen program and performance of the organization was not evaluated directly
Hisahiro Ishijima, Shizu Takahashi, Noriyuki Miyamoto, Eliudi Eliakimu (2014)	Factors influencing national rollout of quality improvement approaches to public hospitals in Tanzania	Sustained top leadership and management support across the entire organization is needed for Kaizen to work. Follow up activities like coaching and mentoring after implementation were also necessary	Reporting bias since the PRM data was self -generated at the hospitals thus calling for caution in extrapolating study results
Siddarth Srinivasa, Laura Hughes Ikuma, Mahmoud Shakouri, Isabelina Nahmens and Craig Harvey (2015)	5S impact on safety climate of manufacturing workers	5S implemented in this study improved the safety climate of the workers, floor area utilization and cycle times and inventory management therefore confirming 5S met its original objective	The outcome of the study cannot be generalized in the entire manufacturing industry since 5S was conducted in one section of a job shop facility specialising in highly customized products

Source: Researcher (2020)

Studies have been conducted on Kaizen and very limited literature is available which specifically focuses on the bus body builders who form part of the downstream segment of supply chain of the motor vehicle industry. In addition to that, the Jua kali (informal) industry which is an integral sector of the economy that provides employment opportunities to our youths has largely been ignored too. Kaizen is an important concept that can help turn around the fortunes of this small businesses.

According to NTSA (2019), there were around sixteen (16) body builders who are legally licensed to fabricate bus bodies in the country and this are the ones that have complied with the stringent regulatory requirements. Most of this bus body building facilities are old and even the few ones that are relatively new or refurbished have outdated processes, flawed layout designs and are not ISO 9001:2015 certified. So, embracing 5S concept as one of Kaizen tools was deemed to be helpful in improving their systems and processes for efficient utilization of economic resources.

2.5 Conceptual framework

From the literature review, conceptual framework is a conjectured model that depicts the variables in the study as well as the correlation amongst the dependent, intervening (moderating) and independent variables (Kothari, 2014). This study postulated the interaction between setbacks or challenges experienced in the production line (independent variables) and efficiency- the possible outcomes/results as (Dependent variable) after the effective application of Kaizen at the workplace. The conceptual framework has block A as the independent Variable (IV) and block B as the Dependent Variable (DV) as depicted below.

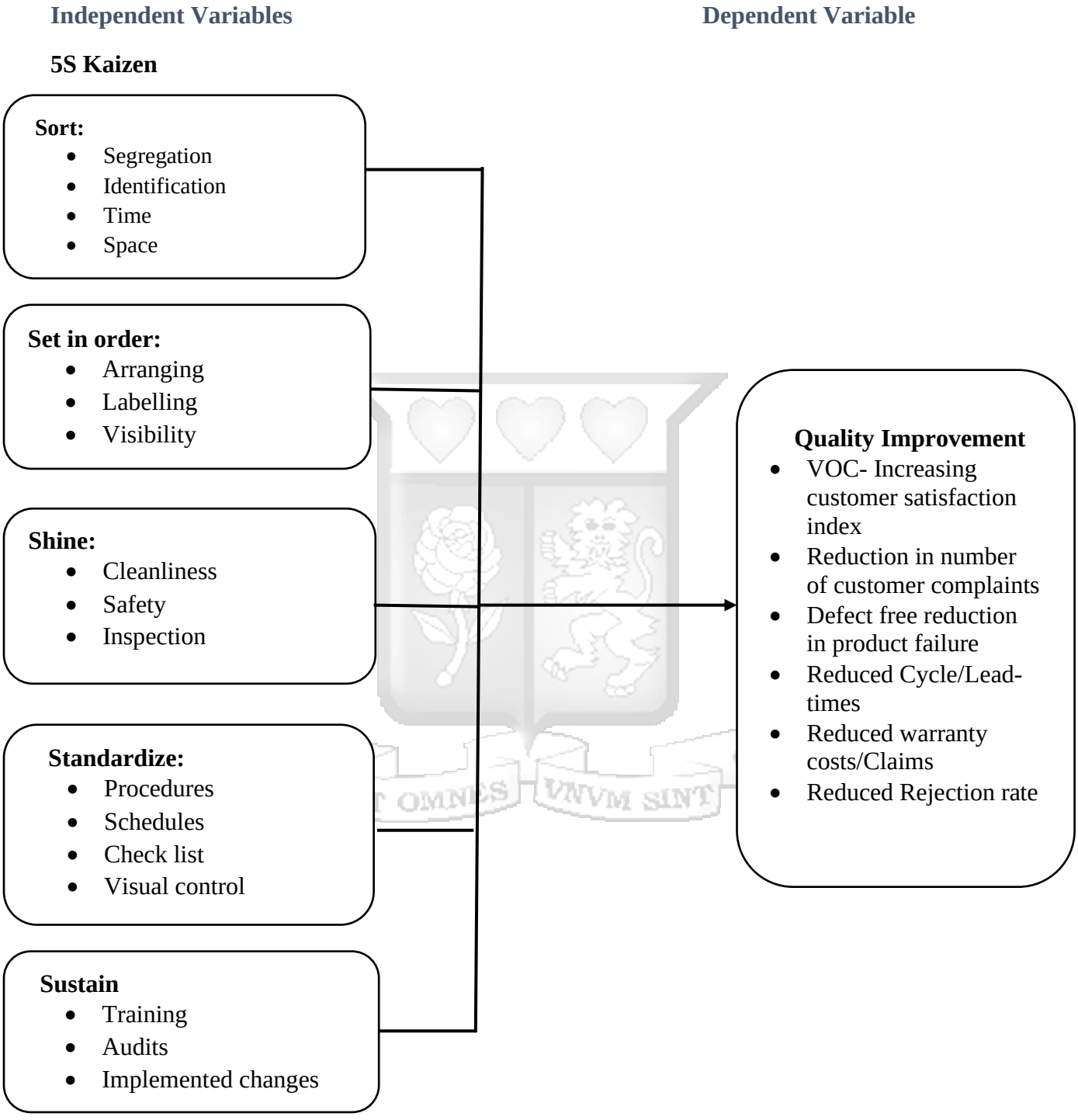

Figure 2.1 Conceptual framework (*Source: Researcher, 2020)*

Operationalization of Variables

The various variables under study were measured as indicated below:

Table 2.2 Operationalization of Variables

Objective	Variable	Measurement	Data collection instrument	Data Analysis
To investigate the influence of Sorting on quality in motor vehicle assembly plants in Kenya	Segregation Identification Searching /waiting time	Quantitative data 5-point Likert scale	Semi structured questionnaire	Descriptive & correlation analysis
To investigate the influence of Set in Order on quality of motor vehicle assembly plants in Kenya	Arranging Labelling Visual aids	Quantitative data 5-point Likert scale	Semi structured questionnaire	Descriptive & correlation analysis
To investigate the influence of Shining on quality of motor vehicle plants in Kenya	Cleanliness Safety Inspections	Quantitative data 5-point Likert scale	Semi structured questionnaire	Descriptive & correlation analysis
To determine the influence of Standardization on quality of vehicle assembly plants in Kenya	Procedures Schedules Checklist Visual aids	Quantitative data 5-point Likert scale	Semi structured questionnaire	Descriptive & correlation analysis
To determine the influence of Sustain on quality of vehicle in assembly plants in Kenya	Training Audits Number of Implemented changes	Quantitative data 5-point Likert scale	Semi structured questionnaire	Descriptive & correlation analysis

Source: Researcher (2020)

2.6 Summary

In this chapter, the study appraised the relevant theoretical and empirical literature that formed the basis of this research work. The study focused on key elements of adopting the Kaizen philosophy/concept and the tools to boost productivity and quality in assembly plants and bus body building plants. A lot of emphasis was placed on production line of bus building plants since they have complex operations that's heavily customized given the tastes and preferences of the customers of those products.

It's evident that whilst most of the studies have covered the concept of 5S to spur productivity and quality in the automotive sector, not much has been done on local bus body building facilities to enable them achieve world class standards in production planning and management. There was need for Multi-National Corporations (MNC's) that engage this body builders as their suppliers of bus body solutions, to step up efforts to re-invigorate this facilities by providing them with the much needed technical and expert support to upscale their production and business processes.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methods used to collect and analyze data for the research study. To be precise, it examined the research design, the population of the study, the sampling design and sample size to be used, the data collection techniques/methods and in addition to data analysis and issues to do with ethical considerations.

3.2 Research Design

Research design is a method that provides a framework through which the researcher gathers and presents data. This study employed a cross sectional and descriptive survey research design (Kothari, 2014). According to Mugenda and Mugenda (2003), descriptive survey design focuses on objectives formulation, data collection tools, design, data collection, data processing, analysis and reporting of findings (Cooper & Schindler, 2008; Mugenda & Mugenda, 2003) . A descriptive survey involved administering questionnaires to individuals. This research study adopted a quantitative emphasis to find correlational relationships between variables and was facilitated by use of primary data.

3.3 Population of Study

Population is the unit of study and refers to the total group of elements about which a researcher desires to make some inference (Cooper & Schindler, 2008). For this study the target population was ostensibly drawn from three assembly plants namely; AVA with a population of 100, ISUZU E. Africa whose population was 85 and LSHS with a population of 45. The latter two are based in Nairobi while the first one is in Mombasa Kenya. The total population from these three assembly plants was 230.

3.4 Sample size and sampling Technique

The sample size and sampling procedure that were used in the study are as discussed below:

3.4.1 Sample size

The methodology for determining the sample size of the study borrowed from previous studies, published formulas and census for small populations. According to Mugenda and Mugenda (2003), a quality research must be characterized by affordability in terms of finances, time sensitive and enough human resource. Sample sizes should not be too large or too small to be within the confidence levels of a study outcome. The sample size for the study therefore was calculated using Yamane formula given by:

$$n = \frac{N}{1 + N(e^2)}$$

Where: n = the desired sample size.

N = the target population of the study

e= the level of statistical significance set (this will be 0.05, implying the 95% confidence level)

Thus, based on the total population, the sample required for this study was given as

$$n = \frac{230}{1 + 230 * 0.05^2} = 146$$

The desired sample size for each plant (stratum) was obtained through proportional allocation and summarized in Table 3.1.

Table 3. 1: Sampling Frame

Plant	Population	Sample
AVA	100	63
ISUZU E. Africa Ltd	85	54
LSHS Ltd	45	29
Total population	**230**	**146**

Source: Researcher (2020)

3.4.2. Sampling

Based on Cooper and Schindler (2008), sampling design is the progression for obtaining a sample from a population under study in addition to the sample being precise. It's normally preferred when it's not possible to investigate every single element of a population. Considering research is expensive, time consuming and requires effort to collect information, it was deemed ideal.

3.4.3 Sampling Technique

The study used probability sampling techniques, mainly stratified sampling and simple random sampling. To collect data, stratified sampling procedure was used since the population could be grouped in three plants (strata). Simple random sampling was used within the strata to randomly pick the respondents for questionnaires administration. According to Kerry and Bland (1998), stratified random sampling is ideal when the population is in heterogeneous groups. Since these groups were homogeneous, applying any new sampling technique would have been a challenging task. The merit of using stratified sampling include, fast application, simplicity in use, time and cost saving, ease in bias checks in successive choices of samples, often smaller variances than other unconventional sampling techniques and suitable when the researcher has a list of the elements in the population.

3.5 Research Instruments

In the study, research instrument used was mainly questionnaires (**appendix 1**) to collect primary data. The questionnaire had sections consisting of questions on demographic characteristics, Sorting, Set in order, Shinning, Standardization, Sustain and Quality Improvement in the motor

vehicle assembly plants. The constructs for the questionnaire were mainly obtained from recommendations by JICA Study Team (UNICO/JPC) for Research Study on Standardizing KAIZEN Approaches in Africa in the (JICA, 2018).

3.6 Data collection Procedures

Data was collected through administration of questionnaires for the respondents. The researcher sought an introductory letter from the Strathmore University and authorization from the National Commission for Science and Technology and Innovation to undertake the study. An explanation on the aims of the study was done by the researcher to offer guidance to the respondents on how the questionnaire should be filled. The researcher also enlisted three research assistants who were trained on the data collection procedures, ethical considerations among other topics. Respondents were at liberty to participate or decline to take part in the study and it was absolutely at their own resolve. The research assistants explicitly conveyed to them that it was purely voluntary for them to spare time and fill in the questionnaire. The questionnaires were issued to the production managers, quality control managers, production shop floor employees and Kaizen champions to fill. This was done during lunch hour breaks to ensure minimal work disruptions. Some respondents finished filling and returned on same day while others took at most 2 days to complete the exercise. Research assistants from each plant consolidated and accounted for their collected data and relayed the same to the researcher to analyze and compile the final study findings.

3.7 Research Quality

In this study, the internal reliability and validity determined the design of the questions, the construction of the questionnaire and pilot testing (Saunders, Thornhill, et al., 2019).

3.7.1 Reliability

Saunders et al. (2019) opines that reliability is the level at which the research instruments presents uniformity of results even after numerous trials. Reliability narrates the consistency of a measure (Heale & Twycross, 2015). The Cronbach's alpha was used as a measure of internal consistency and examined multiple Likert questions in this study. To ensure reliability, the researcher employed self-administered questionnaire approach. Reliability was enhanced through a pilot

study of a sample of 30 respondents from the targeted respondents. The respondents were conveniently selected since the statistical conditions were not necessary (Cooper & Schindler, 2008). The data obtained from the pilot study was not included in the actual study. During reliability testing, the Cronbach's Alpha coefficient (α) was computed to measure the reliability of the data. This coefficient is between 0.00 (no reliability) and +1.00 (positive reliability. The Cronbach's α result is a number between 0 and 1 and an acceptable reliability score is one that is 0.7 and higher (Heale & Twycross, 2015). Computation of Cronbach's Alpha was done using SPSS version 25.0 and established to be 0.813. Correlation coefficient varies on a scale of 0.00 (indicating total unreliability) and 1.00 (indicating perfect reliability). Values ranging from 0.8 and above indicate high reliability, 0.6 to 0.8 will indicate adequate reliability, while values below 0.5 are deemed unacceptable.

3.7.2 Internal validity

Validity is the degree to which an instrument measures what it claims to measure (Golafshani, 2013). The validity of instruments depends on the ability and willingness of respondents to avail the information required (Sekaran & Bougie, 2009). The research study used content and construct validity. Content validity strived to assess the quality of all measurements instruments which are established prior to any hypothetical (Golafshani, 2013). The technical supervisory staff at the assembly plants were enlisted to help develop the research instrument to make sure all variables were captured into the research instrument. An important aspect of validity is content validity, which is defined as the ability of research instrument giving adequate results with characteristics to be measured. The results were given to technocrats within the industry to cross check the format, relevance, reliability and content to ensure research instrument collected appropriate data. This facilitated the necessary revision and modification of the research instruments thereby enhancing validity. Upon cross checking, the final research instrument was reviewed.

3.7.3 Piloting

Crowther and Lancaster (2009) recommend that's its vital to ensure the questionnaire instruments are precisely and preventatively inspected before they are issued and or used. This ensured validity and reliability of the questionnaire instrument and that it fulfils its purpose as a valid and

reliable data collection instrument. To validate the questionnaire instrument, Robson and McCartan (2016) advised conducting a small-scale pilot study prior to its distribution and use. According to Mugenda and Mugenda (2003) a pretest with a sample representing 10% of the total sample with homogeneous characteristics is encouraged. Pretesting of the research instruments gives the researcher an opportunity to refine the tool further. During pretesting, efficiency and flow of the questions in the questionnaires were fine-tuned to get better responses. Pretesting was done to determine the reliability and validity of the study tools as well as the structure, sequence of questions and wording. This delivers consistency and accuracy to the data collected (Saunders et al., 2015).

3.8 Data analysis

Data analysis from the questionnaires was through simple descriptive statistics using SPSS software for the five objectives. The descriptive statistics were the mean and standard deviations. In addition, content analysis was used in the analysis and interpretation of open-ended items.

Upon completion of data collection, questionnaires were checked for errors and data entered in Statistical Package for Social Scientists (SPSS V.25) software for analysis. The software was used because of its flexibility and added capabilities for analyzing diverse models. After cleaning data, it was coded where responses were put in categories and numbers to allow for analysis. Quantitative techniques of data analysis using the Statistical Package for Social Scientists (SPSS V.25) software were used and presented through percentages, means, standard deviations and frequencies. During analysis both descriptive and inferential statistics which included frequency tables and cross tabulation were executed. The analyzed data was presented using charts and tables. The researcher employed multiple regression model to study the relationship between quality improvement, Sort, Set in order, Shinning, Standardization and Sustain. Regression was suitable for its knack to accurately and precisely test the nature and association of influence of independent variables on a dependent variable. Regression analysis could estimate the coefficients of the linear model which best predicted the value of the dependent variable. Furthermore, correlation analysis was used to illustrate the direction and strength of relationship between two variables.

The multiple regression model that was used is given by

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where:

Y= Quality improvement,

β_0 = constant term, $\beta_1, \beta_2, \beta_3, \beta_4$ and β_5 are coefficients of
Sorting (X_1),
Set in order (X_2),
Shinning (X_3),
Standardization (X_4), and
Sustain (X_5),

ε is the error term. The results of the study will be published in an international peer review journal

3.9 Ethical Issues

This study safeguarded all ethical considerations during the research study period. The researcher sought and obtained clearance and approval from Strathmore University Ethics Review office before commencing with this research. The researcher further applied for and secured a research license from National Commission for Science Technology and Innovation (NACOSTI). The researcher ensured that data obtained was solely used for academic purposes. The anonymity of respondents was certain in the sequence of this research and respondent's permission was obtained beforehand by the researcher as he carried out the research study. Written consent was sought from the management authorities of the respective motor vehicle assembly plants. The ethical considerations that guided the research included voluntary or willingness to take part in the study, informed consent, confidentiality, guaranteed protection of information and privacy. The researcher and research assistants explained the objectives of the study and provided room for respondents who willingly consented to the study to fill the questionnaire.

CHAPTER FOUR
DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter entails the data analysis, the presentation and interpretation of the results. This study aimed to assess the role of 5S Kaizen on Quality Improvement in the motor vehicle assembly plants with specific focus on bus body building section. The present data was collected by means of questionnaires and aimed to answer the question communicated in the problem statement. This chapter starts by giving the response rate and demographic profile of the subjects under study.

4.2 Demographic profile

The study targeted 146 respondents but managed to get the views of 29 from LSHS, 57 from AVA and 50 from ISUZU summing up to 136 respondents as shown in Figure 4.1. This translated to a study response rate of 93.2%.

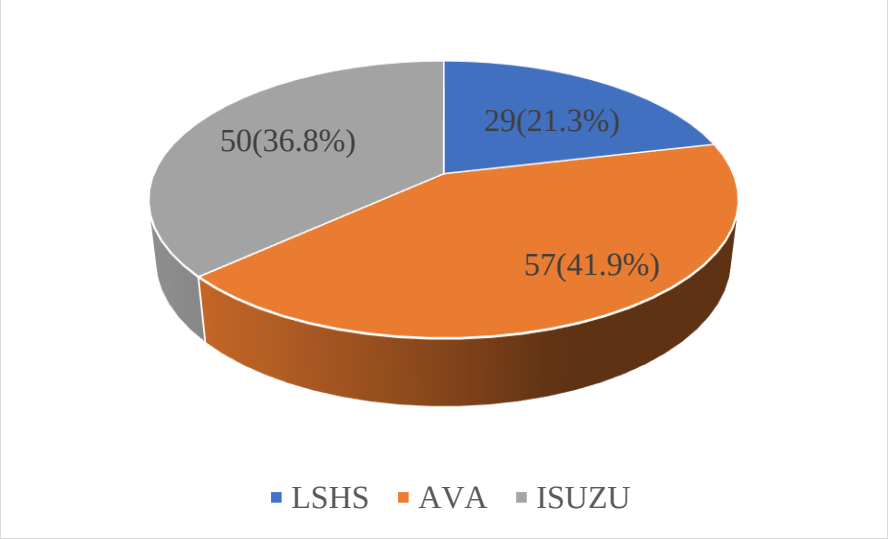

Figure 4.1: Response rate

From Table 4.1, out of the 136 who responded to the study, 107 (78.7%) were male and the other 29 (21.3%) were female. This shows that there was no equal representation of male and female respondents clearly showing that this is a male dominated sector. According to Kothari (2014) a response rate of 50% is satisfactory for data analysis and reporting; 60% rate is good and 70% response rate and over is excellent; hence this response rate was satisfactory for analysis. Majority

of the respondents were aged between 31 years and 40 years, 67 (49.3%). A total of 36 (26.5%) respondents said that they were aged between 41 years and 50 years while 32 (23.5%) were aged between 20 years and 30 years. These clearly indicate that most of the respondents are youthful aged under 40 years.

Table 4. 1: Gender and age of the respondents

Gender	**Frequency**	**Percent**
Male	107	78.7%
Female	29	21.3%
Total	**136**	**100.0%**
Age of the respondents		
20-30	32	23.5%
31-40	67	49.3%
41-50	36	26.5%
51-60	1	0.7%
Total	**136**	**100.0%**

The study results in Table 4.2 indicate that most of the respondents, 74 (54.4%) have college diploma, 31 (22.8%) have secondary education, 27 (19.9%) have undergraduate degree while 4 (2.9%) have post-graduate degree. The study also shows that 26 (19.1%) of the respondents had been working for a period ranging between 1 and 3 years, 33 (24.3%) had been in their respective organisations for 4-6 years, 19 (14.0%) had been in their organizations between 7 and 10 years and 58 (42.6%) had stayed in the organization for more than 10 years. From these findings, most respondents had been in their respective organizations for a long time to adequately respond about the role of 5S Kaizen on quality in the motor vehicle assembly plants with specific focus on bus body building segment.

Table 4. 2: Education level and years of experience of the respondents

Level of education	Frequency	Percent
Secondary school	31	22.8%
College diploma	74	54.4%
Undergraduate degree	27	19.9%
Post graduate degree	4	2.9%
Total	**136**	**100.0%**
Years of experience		
1-3 years	26	19.1%
4-6 years	33	24.3%
7-9 years	19	14.0%
Over 10 years	58	42.6%
Total	**136**	**100.0%**

4.3 The influence of Sorting on Quality Improvement in the vehicle assembly plants

In this section, the researcher provided the descriptive statistics results on the influence of sorting on the quality improvement of motor vehicle assembly plants as well as the relationship between sorting and quality improvement of the motor vehicle assembly plants starting with descriptive statistics.

4.3.1 Descriptive statistics of Sorting on Quality improvement

The first objective of the study was to determine the influence of Sorting on the quality improvement in the vehicle assembly plants. The study first sought to know from the respondents whether removal of unwanted and unnecessary items from the workplace and their eventual disposal created space within the assembly plants. This was done on a Likert scale of 1-5, where 5= strongly agree, 4= Agree, 3= Moderately Agreed, 2= Disagree and 1= Strongly Disagree. The mean and standard deviations (std) are as illustrated in Table 4.3.

Table 4. 3: Sorting on the Quality Improvement in vehicle assembly plants

	LSHS		AVA		ISUZU		All 3 plants	
Statements	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**
Through Sorting, the organization has improved Quality of its products and services	4.66	0.484	4.53	0.702	4.11	0.799	4.36	0.747
Relevant staff are involved in identification process of materials and parts used in the plant	4.41	1.053	4.40	0.979	4.02	0.745	4.22	0.908
All unnecessary items are always segregated and removed from the racks and storage areas	4.48	0.509	4.63	0.536	3.95	0.844	4.28	0.757
The time for searching and waiting for issuance of parts and materials to the production line has reduced	4.10	1.01	4.26	0.790	4.016	0.787	4.11	0.840
Discarding of unwanted materials and items is done as per laid down guidelines	4.45	0.736	4.37	0.757	3.72	0.745	4.08	0.817
Records of disposed items and materials are kept safely	4.07	1.067	4.44	0.666	3.69	0.852	4.01	0.907

From the study findings in Table 4.3, the majority of the respondents agreed that; through Sorting, the organizations have improved quality of their products and services (mean=4.36, std=0.747), relevant staff were involved in identification process of materials and parts used in the plant (mean=4.22, std=0.908), all unnecessary items are always segregated and removed from the racks and storage areas (mean=4.28, std=0.757), the time for searching and waiting for issuance of parts and materials to the production line had reduced (mean=4.11, std=0.840), discarding of unwanted materials and items was done as per laid down guidelines (mean=4.08, 0.817) and records of disposed items and materials are kept safely (mean=4.01, std=0.907). Similar responses are seen across the three assembly plants.

The study also sought to find out what could be done to improve the Sorting process and how often it should be done. The respondents were asked to give their opinions through an open-ended item and their varied responses and similarities were summarized and analyzed as shown on table 4.4.

Table 4. 4: Improvement of Sorting and frequency of the activity

Responses	Frequency	Percent
By labelling parts and materials.	11	9.6%
Constant supply of materials	4	3.5%
Distinguish between resalable, scrap and buffer	8	7.0%
Improved recording of unwanted tools before disposal	5	4.4%
Increase manpower and create more storage space	7	6.1%
Materials to be kept appropriately	8	7.0%
Requires manpower since it is tedious	11	9.6%
Separate usable and unusable materials	3	2.6%
Team training and enlighten on subject	21	18.4%
Standardizing products	8	7.0%
Team meetings	2	1.8%
On daily basis	7	6.1%
Monthly	8	7.0%
Weekly	6	5.3%
Every fortnight	5	4.4%
Total	**114**	**100.0%**

From the results in Table 4.4 most of the respondents indicated team training and awareness on subject matter 18.4% (n=21) and 9.6% (n=11) indicated that labelling of the parts and materials greatly improved sorting in the plants. On the other hand, most of the respondents indicated that these activities be done on a monthly basis (7.0%) while others indicated that having these activities done on daily basis improved the sorting process a great deal (6.1%).

4.3.2 Relationship between Sorting and Quality improvement in the vehicle assembly plants

The relationship between Sorting and quality improvement was assessed through a simple regression model and the results are presented in Table 4.5.

Table 4. 5 Model summary showing the relationship between Sorting and Quality improvement in the vehicle assembly

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.693	0.481	0.477	0.4264			
ANOVA						
Model	Sum of Squares	df	Mean Square	F	Sig.	
Regression	22.559	1	22.559	124.057	0.000	
Residual	24.367	134	0.182			
Total	46.926	135				
Coefficients						
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
(Constant)	1.412	.264		5.354	0.000	
Sorting	0.697	.063	0.693	11.138	0.000	

From the findings in Table 4.5, the value of R=0.693 represents the simple correlation between quality improvement (dependent variable) and sorting (independent variable). It indicates that there exists a high degree of correlation between quality improvement (dependent variable) and sorting (independent variable). The value of R square = 0.481 indicates how much of the total variation in the quality improvement (dependent variable) are explained by sorting (independent variable). In this case, 48.1% of the variation in the quality improvement (dependent variable) are accounted for by sorting (independent variables). The value of adjusted R square =0.477 represent the total variation in quality improvement (dependent variable) as explained by sorting (independent variable) if population data were to be used. Furthermore, the study findings indicated that the regression model predicts the dependent variable (quality improvement) significantly well given that p-value (sig) =0.000<0.05 (5% significance level). This indicates that the regression model was a good fit for the data, since it significantly predicted the outcome variable (quality improvement). The coefficients of the regression model provided the necessary information to predict quality improvement from sorting. Moreover, the results also provided information showing that sorting contributed statistically significantly to the model. The coefficients of the model are obtained from the unstandardized coefficient column (B) and given as:

Quality improvement = 1.412+ 0.697Sorting.

It can be seen that sorting contributes statistically significantly to the model given the p-values 0.000 less that 0.05 (5% significance level).

4.4 The influence of Set in order on Quality improvement in the vehicle assembly plants

In this section, the researcher provides the descriptive statistics results on the influence of set in order on the quality improvement of motor vehicle assembly plants as well as the relationship between set in order and quality improvement of the motor vehicle assembly plants.

4.4.1 Descriptive statistics of Set in order on Quality improvement

The second objective of the study was to determine the influence of Set in order on the quality improvement in the vehicle assembly plants. This was done on a Likert scale of 1-5, where 5= strongly agree, 4= Agree, 3= Moderately Agreed, 2= Disagree and 1= Strongly Disagree. The mean and standard deviations (std) are as illustrated in Table 4.6.

Table 4. 6: Influence of Set in order on quality improvement in vehicle assembly plants

	LSHS		AVA		ISUZU		All 3 plants	
Statements	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**
Through Set in Order the organization has improved quality of its products by reducing damages	4.48	0.508	4.58	0.545	4.08	0.841	4.32	0.729
Arranging of parts and materials is a daily exercise conducted as part of continuous improvement	4.34	0.857	4.53	0.592	4.09	0.729	4.29	0.739
Parts and materials for use in the plant are well labelled and marked for all to see and retrieve easily	4.55	0.632	4.67	0.566	4.03	0.854	4.35	0.783
Visibility in the plant has improved and by extension reducing chances of making errors/passing on defects	4.41	0.568	4.53	0.631	3.89	0.758	4.21	0.742
Pathways & aisles are clearly painted and unhindered for staff and visiting customers to walk through	4.28	0.702	4.60	0.623	3.83	0.827	4.17	0.812
By proper arrangement fast moving parts are placed next to counter to reduce serving time	4.45	0.572	4.53	0.592	3.78	0.934	4.16	0.845
The storage area has been well utilized to enhance movement and improved space management	4.31	0.604	4.26	0.790	4.30	0.790	4.29	0.749

The study findings indicate that the majority of the respondents agreed that through Set in order the organizations have improved quality of their products by reducing damages (mean=4.32, std=0.729), arranging of parts and materials is a daily exercise conducted as part of continuous improvement (mean=4.29, std=0.739), parts and materials for use in the plant are well labelled and marked for all to see and easily retrieve (mean=4.35, std=0.783), visibility in the plant had improved and by extension reduced chances of making errors/passing on defects (mean=4.21, std=0.742), pathways and aisles are clearly painted and un hindered for staff and visiting customers to walk through (mean=4.17, std=0.812), by proper arrangement, fast moving parts are placed next to counter to reduce serving time (mean=4.16, std=0.845) and the storage area has

been well utilized to enhance movement and improved space management (mean=4.29, std=0.749).

The study also sought to establish how excess inventory affected Set in order process and by extension quality. The respondents were asked to give their opinions through an open-ended item and their varied responses and similarities were summarized and analyzed in table 4.7. The findings in Table 4.7 indicate that majority of the respondents 15.4%, (n=14) felt that excess inventory consumed production time while 11% (n=10) felt that it consumes space and causes congestion.

Table 4. 7: Effect of excess inventory on Set in order process and quality

Responses	**Frequency**	**Percent**
Challenging to identify and pick parts needed	4	4.4%
Consumes space and causes congestions	10	11.0%
Consumes time for production	14	15.4%
Excess inventory affects movement	7	7.7%
Excess of one type of material	3	3.3%
Excess stock consumes a lot of space	4	4.4%
Improved quality	9	9.9%
Increases reliability	3	3.3%
Leads to delays and damages to storage	2	2.2%
Leads to non-compliance	4	4.4%
Leads to reduced profits	3	3.3%
Misuse of materials	2	2.2%
Negatively affect quality	6	6.6%
Ordering materials in time	3	3.3%
Quick identification of production	4	4.4%
Standard qualities achieved	2	2.2%
Track of non-used parts	3	3.3%
Unwanted damages	8	8.8%
Total	**91**	**100.0%**

On the other hand, 9.9% (n=9) felt that excess inventory led to improved quality of motor vehicle assembly plants.

4.4.2 Relationship between Set in order and Quality improvement in the vehicle assembly plants

The relationship between set in order and quality improvement was assessed through a simple regression model and the results are presented in Table 4.8.

Table 4. 8:Model summary showing the relationship between set in order and quality improvement in the vehicle assembly

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0.781	0.610	0.608	0.369367073

ANOVA					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	28.644	1	28.644	209.952	0.000
Residual	18.282	134	0.136		
Total	46.926	135			

Coefficients				
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.637	0.256		2.488	0.014
Set in order	0.866	0.060	0.781	14.490	0.000

From the findings in Table 4.8, the value of R=0.781 represents the simple correlation between quality improvement (dependent variable) and set in order (independent variable). It indicates that there exists a high degree of correlation between quality improvement (dependent variable) and set in order (independent variable). The value of R square = 0.610 indicates how much of the total variation in the quality improvement (dependent variable) are explained by set in order (independent variable). In this case, 61.0% of the variation in the quality improvement (dependent variable) are accounted for by set in order (independent variables). The value of adjusted R square =0.608 represent the total variation in quality improvement (dependent variable) as explained by set in order (independent variable) if population data were to be used. Furthermore, the study findings indicate that the regression model predicts the dependent variable (quality improvement)

significantly well given that p-value (sig) =0.000<0.05 (5% significance level). This indicates that the regression model is a good fit for the data, that is, it significantly predicts the outcome variable (quality improvement). The coefficients of the regression model provide the necessary information to predict quality improvement from set in order. Moreover, the results also provide information showing whether set in order contribute statistically significantly to the model. The coefficients of the model are obtained from the unstandardized coefficient column (B) and given as:

Quality improvement = 0.637+ 0.866 Set in order

It can be seen that Set in order contributed statistically significantly to the model given the p-values 0.000 less that 0.05 (5% significance level).

4.5 The influence of Shining on Quality Improvement in the vehicle assembly plants

Here, the researcher provides the descriptive statistics results on the influence of shining on the quality improvement of motor vehicle assembly plants as well as the relationship between shining and quality improvement of the motor vehicle assembly plants.

4.5.1 Descriptive statistics of Shining on Quality improvement

The third objective of the study was to determine the influence of shining on quality improvement in the vehicle assembly plants. This was done on a Likert scale of 1-5, where 5= strongly agree, 4= Agree, 3= Moderately Agreed, 2= Disagree and 1= Strongly Disagree. The mean and standard deviations (std) are as illustrated in Table 4.9.

Table 4. 9: Influence of Shining on Quality Improvement in vehicle assembly plants

	LSHS		AVA		ISUZU		All 3 plants	
Statements	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**
Shining plays a big role in quality of products and materials under storage for long periods	4.41	0.907	4.40	0.791	3.91	0.849	4.17	0.874
Daily cleaning of the shop floor is done before and after work a safe and healthy workplace	4.59	0.628	4.63	0.578	3.88	0.934	4.26	0.854
Machines and equipment are cleaned everyday by the users to ensure longevity & uptime	4.48	0.634	4.42	0.663	4.06	0.774	4.26	0.733
The inspection reports of Shining activities are well maintained for reference and analysis	3.97	0.823	4.21	0.709	3.73	0.740	3.93	0.772
Vehicles collected from the plant are thoroughly washed and cleaned before delivery to customers	4.52	0.688	4.56	0.700	3.94	0.833	4.26	0.816
Shining ensures that machines and equipment don't aid in generating defects and accidents during assembly	4.38	0.775	4.47	0.735	3.94	0.871	4.20	0.842

The study findings indicate that most of the respondents agreed that shining plays a big role in quality of products and materials under storage for long periods (mean 4.17, std=0.874), daily cleaning of the shop floor is done before and after work a safe and healthy work place (mean=4.26, std=0.854), machines and equipment are cleaned everyday by the users to ensure longevity and uptime (mean=4.26, std=0.733), the inspection reports of shining activities are well maintained for reference and analysis (mean=3.93, std=0.772), vehicles collected from the plant are thoroughly washed and cleaned before delivery to customers (mean=4.26, std=0.816) and shining ensures that machines and equipment don't aid in generating defects and accidents during assembly (mean=4.20, std=0.842).

Furthermore, the study sought to establish the measures put in place in the event water is not available for cleaning. The respondents were asked to give their opinions through an open-ended

item and their varied responses and similarities were summarized and analyzed as shown on table 4.10. The results in Table 4.10 show that 18.5% (n=17) of the respondents either make local arrangement with private sector to supply water for cleaning or use dusting for cleaning. 13.0% (n=12) indicated that they use spirit and vacuum cleaning while 10.9% (n=10) indicated that there are enough water storage tanks that collect adequate water for cleaning.

Table 4. 10: Measures put in place for cleaning

Responses	Frequency	Percent
Air pressure are used for cleaning	2	2.2%
Back up reservoirs in place	3	3.3%
Brooms and cotton rags	7	7.6%
Dusting	17	18.5%
Enough water storage tanks	10	10.9%
Industrial spirits and detergents	8	8.7%
Keep water in buckets	2	2.2%
Local arrangement is done with private sector to supply water	17	18.5%
Use spirit and vacuum cleaning	12	13.0%
The factory invested in heavy water storage facilities	8	8.7%
Use compressed air as alternative	2	2.2%
Water boozers are contracted to supply water	4	4.3%
Total	**92**	**100.0%**

4.5.2 Relationship between Shining and Quality improvement in the vehicle assembly plants

The relationship between shining and quality improvement was assessed through a simple regression model and the results are presented in Table 4.11.

Table 4. 11: Overall relationship between shining and quality improvement

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0.744	0.553	0.550	0.395523085

ANOVA					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	25.963	1	25.963	165.965	0.000
Residual	20.963	134	0.156		
Total	46.926	135			

Coefficients					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.063	0.255		4.165	0.000
Shinning	0.779	0.060	0.744	12.883	0.000

From the findings in Table 4.11, the value of R=0.744 represents the simple correlation between quality improvement (dependent variable) and shining (independent variable). It indicates that there exists a high degree of correlation between quality improvement (dependent variable) and shining (independent variable). The value of R square = 0.553 indicates how much of the total variation in the quality improvement (dependent variable) are explained by shining (independent variable). In this case, 55.3% of the variation in the quality improvement (dependent variable) are accounted for by shining (independent variables). The value of adjusted R square =0.550 represent the total variation in quality improvement (dependent variable) as explained by shining (independent variable) if population data were to be used.

Furthermore, the study findings indicate that the regression model predicts the dependent variable (quality improvement) significantly well given that p-value (sig) =0.000<0.05 (5% significance level). This indicates that the regression model is a good fit for the data, that is, it significantly predicts the outcome variable (quality improvement). The coefficients of the regression model provide the necessary information to predict quality improvement from shining. Moreover, the results also provide information showing whether shining contribute statistically

significantly to the model. The coefficients of the model are obtained from the unstandardized coefficient column (B) and given as:

Quality improvement = 1.063+ 0.779 shining.

It was observed that shining contributes statistically significantly to the model given the p-values 0.000 less that 0.05 (5% significance level).

4.6 The influence of Standardization on Quality Improvement in the vehicle assembly plants

In this section, the descriptive statistics results on the influence of standardization on the quality improvement of motor vehicle assembly plants as well as the relationship between standardization and quality improvement of the motor vehicle assembly plants were outlined.

4.6.1 Descriptive statistics of Standardization on Quality improvement

The fourth objective of the study was to determine the influence of standardization on quality improvement in the vehicle assembly plants. This was done on a Likert scale of 1-5, where 5= strongly agree, 4= Agree, 3= Moderately Agreed, 2= Disagree and 1= Strongly Disagree. The mean and standard deviations (std) are as illustrated in Table 4.12.

Table 4. 12: Influence of Standardization Quality improvement in vehicle assembly plants

	LSHS		AVA		ISUZU		All 3 plants	
Statements	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**
Standardization plays a big role in embedding the quality culture in the assembly plant	4.72	0.591	4.65	0.650	4.06	0.753	4.39	0.752
Work procedures and work instructions are strictly adhered to and followed by all staff	4.45	0.632	4.47	0.592	3.84	0.801	4.17	0.766
Schedules are prepared on time and all activities are tracked and monitored	4.45	0.686	4.53	0.631	3.83	0.788	4.18	0.791
Visual aid and boards are conspicuously displayed at designated places to cascade and share quality tips	4.52	0.688	4.63	0.536	3.72	0.826	4.18	0.833
Manufacturers guidelines and assembly processes are well articulated and shared to all shop floor staff	4.48	0.688	4.49	0.703	3.69	0.889	4.11	0.883
Vehicle quality checklist are uniformly used across the production processes	4.52	0.688	4.51	0.631	3.95	0.844	4.26	0.791
Standardization enhances uniformity of product designs, final product quality and services	4.86	0.351	4.67	0.606	3.80	0.760	4.30	0.801

The study findings indicated that majority of the respondents agreed that standardization plays a big role in embedding the quality culture in the assembly plant (mean=4.39, std=0.752), work procedures and work instructions are strictly adhered to and followed by all staff (mean=4.17, std=0.766), schedules are prepared on time and all activities are tracked and monitored (mean=4.18, std=0.791), visual aid and boards are conspicuously displayed at designated places to cascade and share quality tips (mean=4.18, std=0.833), manufacturers guidelines and assembly processes are well articulated and shared to all shop floor staff (mean=4.11, std=0.883), vehicle quality checklist are uniformly used across the production processes (mean=4.26,std=0.791) and standardization enhances uniformity of product designs, final product quality and services (mean=4.30, std=0.801).

The study also sought to establish how often standards were reviewed and what it entailed. The respondents were asked to give their opinions through an open-ended item and their varied responses and similarities were summarized and analyzed as shown on table 4.13. The study findings in Table 4.13 showed that 25.0% (n=23) indicated that the standards are usually reviewed annually and it entails strict rules and regulations while 16.3% (n=15) indicated that the standards are reviewed annually and it entails procedures of operations. On the other hand, 18.5% (n=17) indicated that reviewing of the standards is usually a continuous process and entails quality feedback loops and product audit while 15.2% (n=14) indicated that standards are reviewed monthly and is usually accompanied by quality meetings.

Table 4. 13: Frequency of reviewing standards and what it entails

Responses	Frequency	Percent
Annually and it entails strict rules and regulations	23	25.0%
Annually and entails procedures of operations	15	16.3%
Annually and it involves removal of unwanted processes	5	5.4%
Continuous process-entails quality feedback loops and product audit	17	18.5%
Monthly and comply with ISO standards	10	10.9%
Monthly with quality meetings	14	15.2%
Weekly to ensure standards	8	8.7%
Total	**92**	**100.0%**

4.6.2 Relationship between Standardization and Quality improvement in vehicle assembly plants

The relationship between standardization and quality improvement was assessed through a simple regression model and the results are presented in Table 4.14.

Table 4. 14: Overall relationship between Standardization and Quality improvement in the motor vehicle assembly

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0.733	0.537	0.533	0.402738696

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	25.191	1	25.191	155.312	0.000
	Residual	21.735	134	0.162		
	Total	46.926	135			

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	1.470	0.231		6.354	0.000
	Standardization	0.675	0.054	0.733	12.462	0.000

From the findings in Table 4.14, the value of R=0.733 represents the simple correlation between quality improvement (dependent variable) and standardization (independent variable). It indicates that there exists a high degree of correlation between quality improvement (dependent variable) and standardization (independent variable). The value of R square = 0.537 indicates how much of the total variation in the quality improvement (dependent variable) are explained by standardization (independent variable). In this case, 53.7% of the variation in the quality improvement (dependent variable) are accounted for by standardization (independent variables). The value of adjusted R square =0.533 represent the total variation in quality improvement (dependent variable) as explained by standardization (independent variable) if population data were to be used. Furthermore, the study findings indicate that the regression model predicts the dependent variable (quality improvement) significantly well given that p-value (sig) =0.000<0.05 (5% significance level). This indicates that the regression model is a good fit for the data, that is, it significantly predicts the outcome variable (quality improvement). The coefficients of the regression model provide the necessary information to predict quality improvement from standardization. Moreover, the results also provide information showing whether standardization

contribute statistically significantly to the model. The coefficients of the model are obtained from the unstandardized coefficient column (B) and given as:

Quality improvement = 1.470+ 0.675 Standardization

Standardization contributes statistically significantly to the model given the p-values 0.000 less that 0.05 (5% significance level).

4.7 The influence of Sustain on Quality Improvement in the vehicle assembly plants

In this section, we provide the descriptive statistics results on the influence of Sustain on the quality improvement of motor vehicle assembly plants. We also present the relationship between sustain and quality improvement of the motor vehicle assembly plants.

4.7.1 Descriptive statistics of Sustain on Quality improvement

The fifth objective of the study was to determine the influence of sustain on quality improvement in the vehicle assembly plants. This was done on a Likert scale of 1-5, where 5= strongly agree, 4= Agree, 3= Moderately Agreed, 2= Disagree and 1= Strongly Disagree. The mean and standard deviations (std) are as illustrated in Table 4.15.

Table 4. 15: Influence of Sustain on Quality Improvement in vehicle assembly plants

	LSHS		AVA		ISUZU		All 3 plants	
Statements	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**
Training plays a fundamental role in sustaining 5S and quality in assembly plant	4.79	0.412	4.51	0.668	3.97	0.816	4.32	0.777
It's important to provide training to all staff on the best ways to sustain quality at all times	4.79	0.491	4.74	0.492	3.95	0.844	4.38	0.789
Regular audits and spot checks to verify compliance in the entire assembly are conducted	4.34	0.814	4.58	0.544	3.86	0.794	4.19	0.794
Audits findings are shared with everybody to establishing root cause & provide counter measures	4.07	1.193	4.37	0.787	3.83	0.767	4.05	0.905
Employees are encouraged to generate ideas and recommend changes for improvement	4.31	1.105	4.35	0.752	3.84	0.839	4.10	0.905
Recommended changes are evaluated and implemented if they are likely to improve quality	4.41	0.825	4.26	0.789	4.05	0.677	4.19	0.755
Recognition and reward programs for good ideas are in place and practiced to motivate employees	4.10	0.900	4.02	1.034	3.70	0.749	3.89	0.892
A 5S policy framework is in place that stipulates and safeguards initiatives and acts as a clarion call	4.41	0.682	4.60	0.583	3.75	0.926	4.16	0.871

The study findings in Table 4.15 indicate that most of the respondents agreed that training plays a fundamental role in sustaining 5S and quality improvement in assembly plant (mean=4.32, std=0.777), it's important to provide training to all staff on the best ways to sustain quality at all times (mean=4.38, std=0.789), regular audits and spot checks to verify compliance in the entire assembly are conducted (mean=4.19, std=0.794), audit findings are shared with everybody to establishing root cause & provide counter measures (mean=4.05, std=0.905), employees are encouraged to generate ideas and recommend changes for improvement (mean=4.10, std=0.905), recommended changes are evaluated and implemented if they are likely to improve quality (mean=4.19,std=0.755), Recognition and reward programs for good ideas are in place and

practised to motivate employees (mean=3.89, std=0.892) and a 5S policy framework is in place that stipulates and safeguards initiatives and acts as a clarion call (mean=4.16, std=0.871).

Additionally, using an open-ended item, the study sought to find out why it proved cumbersome for firms to sustain 5S. The respondents varied opinions and similarities were analyzed and summarized in table 4.16. From the findings in Table 4.16, most of the respondents (20.8%, n=21) indicated that there is a problem with attitude of employees on the need in embracing it while 13.9% (n=14) indicated that there are inadequate resources to implement 5S in the firms. This shows that there is need for employee training and acquisition of adequate resources to implement 5S in various firms for improvement of quality.

Table 4. 16: Reason why it proves so cumbersome for firms to sustain 5S

Responses	Frequency	Percent
5S proves to be cumbersome and constant employee motivation is required	7	6.9%
Attitude of employees on the need to embrace it	21	20.8%
Challenges in changing culture	4	4.0%
Come up with proper schedule	4	4.0%
Cost and lack of interest from the employees to sustain it	8	7.9%
Cumbersome and need training of the employees	6	5.9%
Enhance good quality and standardization of our products	3	3.0%
Improve and maintain the process of 5S	6	5.9%
Inadequate resources	14	13.9%
Lack of regular trainings to accommodate new staff	8	7.9%
Management ignores ideas of the junior staff	5	5.0%
Overstocking	7	6.9%
Stakeholders become reluctant on achieved targets	4	4.0%
When the process is standardised, it becomes easy to sustain	4	4.0%
Total	**101**	**100.0%**

4.7.2 Relationship between Sustain and Quality improvement in the vehicle assembly plants

The relationship between sustain and quality improvement was assessed through a simple regression model and the results are presented in Table 4.17.

Table 4. 17:Model summary showing the relationship between sustain and quality improvement in the vehicle assembly

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0.732	0.536	0.533	0.403077520

ANOVA					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	25.155	1	25.155	154.826	0.000
Residual	21.771	134	0.162		
Total	46.926	135			

Coefficients					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.377	0.239		5.756	0.000
Sustain	0.708	0.057	0.732	12.443	0.000

From the findings in Table 4.17, the value of R=0.732 represents the simple correlation between quality improvement (dependent variable) and sustain (independent variable). It indicates that there exists a high degree of correlation between quality improvement (dependent variable) and sustain (independent variable). The value of R square = 0.536 indicates how much of the total variation in the quality improvement (dependent variable) are explained by sustain (independent variable). In this case, 53.6% of the variation in the quality improvement (dependent variable) are accounted for by sustain (independent variables). The value of adjusted R square =0.533 represent the total variation in quality improvement (dependent variable) as explained by sustain (independent variable) if population data were to be used. Furthermore, the study findings indicate that the regression model predicts the dependent variable (quality improvement) significantly well given that p-value (sig) =0.000<0.05 (5% significance level). This indicates that the regression model is a good fit for the data, that is, it significantly predicts the outcome variable (quality improvement). The coefficients of the regression model provide the necessary information to predict quality improvement from sustain. Moreover, the results also provide information showing whether sustain contribute statistically significantly to the model. The coefficients of the model are obtained from the unstandardized coefficient column (B) and given as: **Quality improvement = 1.377+ 0.708 Sustain.**

It can be seen that sustain contribute statistically significantly to the model given the p-values 0.000 less that 0.05 (5% significance level).

4.8 Quality Improvement in motor vehicle assembly plants

The study sought to find factors that influence quality improvement in motor vehicle assembly as a formal approach of analysis of performance and systematic efforts to improve it by use of data to monitor the outcomes. This was done on a Likert scale of 1-5, in which 5= strongly agree 4= Agree 3= Moderately Agreed 2= Disagree 1= Strongly Disagree. The results are presented in Table 4.18.

Table 4. 18: Factors that influence Quality improvement in motor vehicle assembly

	LSHS		AVA		ISUZU		All 3 plants	
Statements	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**
The organization strives to reduce the number of customer complaints	4.83	0.384	4.81	0.394	3.97	0.908	4.42	0.803
Increase in customer satisfaction index (VOC) is seriously monitored and appropriate measures taken	4.79	0.491	4.72	0.504	4.13	0.826	4.46	0.739
Rejection rates/ratios due to improper assembly are kept at the bare minimum during and after assembly	4.69	0.471	4.74	0.441	4.06	0.906	4.41	0.774
Shorter Lead times (Cycle times) excite customers who don't have to wait for longer periods	4.69	0.541	4.69	0.513	3.94	0.871	4.34	0.800
There is a reduction in number of warranty claims/costs	4.48	0.634	4.48	0.592	3.84	0.801	4.18	0.772
Quality inspection procedures are well defined, understood and complied with by all to ensure no product failure	4.59	0.501	4.60	0.583	3.73	0.761	4.19	0.784
The organization has a Quality policy and ISO certification in place that puts the customer first.	4.59	0.628	4.56	0.589	3.78	0.826	4.20	0.815
The organization always aims to reduce the number of defective units/recall rates	4.66	0.669	4.60	0.623	4.09	0.659	4.38	0.699

The results in Table 4.18 most of the respondents agreed that the organization strives to reduce the number of customer complaints (mean=4.42, std=0.803), increase in customer satisfaction

index (VOC) is seriously monitored and appropriate measures taken (mean=4.46, std=0.739), rejection rates/ratios due to improper assembly are kept at the bare minimum during and after assembly (mean=4.41, std=0.774), shorter lead times (Cycle times) excite customers who don't have to wait for longer periods (mean=4.34, std=0.800), there is a reduction in number of warranty claims/costs (mean=4.18, std=0.772), quality inspection procedures are well defined, understood and complied with by all to ensure no product failure (mean=4.19, std=0.784), the organization has a quality policy and ISO certification in place that puts the customer first (mean=4.20, std=0.815) and he organization always aims to reduce the number of defective units/recall rates (mean=4.38, std=0.699).

The study findings in Table 4.19 shows that erroneous supply of materials from manufacturers is the main setback in quality improvement at the motor vehicle assembly plants with 12.6% (n=15) of the respondents affirming so. Financial constraint is another setback reported by 9.2% (n=11) of the respondents while 10.9% (n=13) indicated that ignoring the instructions and guidelines is a setback in attaining quality improvement in the motor vehicle assembly plants. On the other hand, most of the respondents indicated that training of the technicians is necessary to improve quality (12.6%, n=15) and supply of materials and tools of good quality would significantly reduce defects (5.0%, n=6).

Table 4. 19: Setbacks encountered in Quality Improvement and possibility of producing non-defective products

Responses	Frequency	Percent
Employees attitude towards work and lack of knowledge and skills	9	7.6%
Erroneous supply from manufacturers	15	12.6%
Failure by employees to follow set standards	2	1.7%
Failure to deliver materials	2	1.7%
Financial constraints	11	9.2%
Genuine Parts too expensive and sometimes not available	4	3.4%
Impossible to produce zero defects	7	5.9%
Instructions and guidelines ignored	13	10.9%
Lack of financial support and culture and lack of support	4	3.4%
Late shipment of some requested missing parts	3	2.5%
Materials & tools of good quality reduces defects	6	5.0%
Not having the right information from customers for root cause analysis	7	5.9%
Poor quality materials	7	5.9%
Poor working conditions	8	6.7%
Technician training is wanting	15	12.6%
Wrong shipment of parts needed	6	5.0%
Total	**119**	**100.0%**

4.9 Overall relationship between 5S and Quality Improvement in motor vehicle assembly plants

To demonstrate the effect of 5S on the quality improvement in the motor vehicle assembly plants, the researcher carried out correlation and regression analysis. The researcher began by carrying out correlation analysis between quality improvement and the 5S for each firm and all the firms together. This was done at 5% level of significance (95% confidence level). The outcome is summarised in Table 4.20.

Table 4. 20: Overall Correlation between 5S and Quality Improvement

	Quality improvement in motor vehicle assembly plants							
	LSHS		AVA		ISUZU		All 3 plants	
5S	Correlation coefficient	P-value	Correlation coefficient	P-value	Correlation coefficient	P-value	Correlation coefficient	P-value
Sorting	0.036	0.852	0.297	0.053	0.890	0.000	0.693	0.000
Set in order	0.516	0.004	0.603	0.000	0.790	0.000	0.781	0.000
Shining	0.067	0.731	0.283	0.066	0.826	0.000	0.744	0.000
Standardization	0.336	0.075	0.366	0.016	0.717	0.000	0.733	0.000
Sustain	0.344	0.067	0.515	0.000	0.811	0.000	0.732	0.000

From the findings, it was established that there is a significant positive association between Set in order and quality improvement of motor vehicle in LSHS plant (r=0.516, p-value=0.004<0.05). The correlation analysis between Sorting and quality improvement, Shining and quality improvement, Standardization and quality improvement, Sustain and quality improvement were established to have no association given the p-values greater than 0.05 in LSHS.

In AVA, the study findings show that there is a significant positive association between Set in order and quality improvement (r=0.603, p-value=0.000<0.05), Standardization and quality improvement (r=0.366, p-value=0.016<0.05), Sustain and quality improvement (r=0.515, p-value=0.000<0.05). Overall, there is a strong significant positive association between Sorting and quality improvement (r=0.693, p-value=0.000<0.05), Set in order and quality improvement (r=0.781, p-value=0.000<0.05), Shining and quality improvement (r=0.744, p-value=0.000<0.05), Standardization and quality improvement (r=0.733, p-value=0.000<0.05), Sustain and quality improvement (r=0.732, p-value=0.000<0.05). The relationship between 5S and quality improvement in the motor vehicle assembly plants. A multiple regression model was used where 5S represents the independent variables and quality improvement as the dependent variable. The results are presented in Tables 4.21 and 4.22.

Table 4. 21: The regression model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.824	0.679	0.667	0.34034365

The result in Table 4.21 provide three critical parameters namely R, R square and adjusted R square. The value of R=0.824 represents the simple correlation between quality improvement (dependent variable) and the 5S (independent variables). It indicates that there exists a high degree of correlation between quality improvement (dependent variable) and the 5S (independent variables). The value of R square = 0.679 indicates how much of the total variation in the quality improvement (dependent variable) are explained by the 5S (independent variables). In this case, 67.9% of the variation in the quality improvement (dependent variable) are accounted for by the 5S (independent variables). This is a high variation in quality improvement. On the other hand, Adjusted R square =0.667 represent the total variation in quality improvement (dependent variable) as explained by the 5S (independent variables) if population data were used.

Table 4. 22: The analysis of variance of the model

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
	Regression	31.868	5	6.374	55.023	0.000
	Residual	15.058	130	0.116		
	Total	**46.926**	**135**			

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	0.380	0.244		1.557	0.122
	Sorting	0.026	0.092	0.026	.288	0.774
	Set in order	0.411	0.106	0.371	3.881	0.000
	Shinning	0.236	0.096	0.225	2.452	0.016
	Standardization	0.154	0.094	0.167	1.628	0.106
	Sustain	0.107	0.105	0.111	1.025	0.307

The study findings in Table 4.22 indicate that the regression model predicts the dependent variable (quality improvement) significantly well given that p-value (sig) =0.000<0.05 (5% significance level). This indicates that the regression model was a good fit for the data, that is, it significantly predicts the outcome variable (quality improvement).

These results provide the necessary information to predict quality improvement from the 5S (sorting, set in order, shining, standardization and sustain). Furthermore, the results also provided information showing whether 5S contributed statistically significantly to the model. The coefficients of the model are obtained from the unstandardized coefficient column (B). Thus, the model can be precisely written as follows:

Quality improvement = 0.380 + 0.026Sorting + 0.411Set in order + 0.236Shining + 0.154Standardization + 0.107Sustain

From this model, all the 5S's contributed positively towards quality improvement. However, Set in order and Shining were the only independent variables that contribute statistically significantly to the model given the p-values 0.000 and 0.016 which were respectively less that 0.05 (5% significance level).

4.10 Chapter summary

In this Chapter, the influence of 5S on the quality improvement in the motor vehicle plants was assessed. The study findings from the simple linear regression models indicated that Set in order was the most impactful on the quality improvement of motor vehicle with a beta coefficient of 0.866 in which it accounts for 61.0% variability in quality improvement. From the multiple regression the study established that the 5S significantly contributes to the quality improvement in the motor vehicle plants. However, these may prove to be challenging owing to lack of financial resources, lack of support by the top management, lack of motivation from the employees and lack of skilled manpower.

CHAPTER FIVE
SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, discussion of the findings, conclusion sand recommendations for further research.

5.2 Summary of findings

The research study aimed to examine the role of Kaizen concept on quality improvement in motor vehicle assembly plants in Kenya. The research study was focused on the 5S stages namely; sort, set in order, shine, standardize and sustain and their influence on quality improvement. The research was entrenched on quality improvement, lean manufacturing and theory of constraints. The research was conducted on three motor vehicle assembly plants with a target population of 146 and the response rate of 93% was obtained from 136 respondents. The study findings showed that set in order was the most impactful on the quality improvement of motor vehicle with a beta coefficient of 0.866 in which it accounts for 61.0% variability in quality improvement.

Concerning factors affecting quality improvement in the organizations, it was established that most of the employees strive to reduce the number of customer complaints, increase in customer satisfaction index (VOC) is seriously monitored and appropriate measures taken, rejection rates/ratios due to improper assembly are kept at the bare minimum during and after assembly and the organization always aims to reduce the number of defective units/recall rates. Furthermore, it was established that wrong shipment designated as erroneous parts/raw material supplied and non-adherence to quality guidelines posed the greatest setbacks in achieving improved quality in the assembly plants. On the effect of 5S Kaizen on the quality improvement, results from model summary showed the effect of 5S on the quality improvement presented an R square value of 0.679 indicating that 67.9% of the variation in the quality improvement (dependent variable) are accounted for by the 5S (independent variables). This is a high variation in quality improvement. The significance values associated with the predictors (5S) were all lower than 0.05 indicating that the coefficient was statistically significant at 95% confidence level. The study established that a unit increase in 5S (sorting, set in order, shining,

standardization and sustain, respectively) resulted to 0.026, 0.411, 0.236, 0.154 and 0.107 increase in the quality improvement, respectively. These findings consistent with the findings in Ishijima et al., (2014)

5.3 Discussion of Findings

5.3.1 Sorting and Quality improvement

The safety of records for scraped and disposed items and guidelines for disposal of unwanted parts and materials were rated at lower average mean of 4.01 and 4.08 than the rest of the study questions. Furthermore, it was noted at the Isuzu plant they scored a mean rating of 3.69 and 3.72 respectively. This portends an area of concern for the management and calls for increased risk assessment and audits for adequate controls to be in place to ensure integrity of data is always maintained. These findings are collaborated with Lean Management practices ultimate target of zero waste and zero defects. These objectives are attained by efficient use of resources from reduced material losses to scrap, less time, low energy consumption and reduced waste to maximise essential output (King and Lenox 2001; Ball 2015; Chugani et al. 2017). Interestingly, Lean Management practices like 5S and Kaizen advocate smart and organized work environments which in turn persuade employees to diligently dispose rejects from the assembly line as genuine scrap (Vinodh et al. 2011).

Timely delivery by suppliers enables firms to keep low inventories and improve customer response times. Lean supply management is linked with proper scheduling and optimization to reduce lead-times, improve quality and service (Martin & Towill, 2000). This is true with the Lean Management model that advocates for improved response to customer demands and cost reduction and recognizes that no clear or standard framework is place and therefore both management and employees should work together to fully realize its benefits (Bhamu & Kuldip, 2014).

The regression analysis summary showing the relationship between Sorting and quality improvement gave a value of R to be 0.481 implying that sorting accounts for 48.1% of the variation in the quality improvement. The coefficients of the regression model were established to be statistically significant given the p-values of 0.000 being less that 0.05 (5% significance

level). It was established that a unit increase in sorting activities in the motor vehicle plants leads to 0.697 increase in the quality improvement. The study established that in sorting, identification process of materials and parts used in the plant and segregation and removal of unnecessary items are particularly important in improving quality of motor vehicles in the plants. These results are consistent with the findings in productivity, quality and business performance (Anand et al., 2017).

The foundation and initial focus of lean manufacturing is putting people first, followed by process and organization outlooks (Martínez-Jurado and Moyano-Fuentes, 2014). The human (employee) element is a critical major factor of any Lean Manufacturing (Sajan et al., 2017). Their studies support our findings where a mean average score of 4.22 showed that relevant staff are involved in identification of parts and materials used in the assembly plants.

5.3.2 Set in order and Quality improvement

The labelling of parts and materials had the most impact with a mean score of 4.35 with a standard deviation of 0.729 while proper arrangement of fast moving parts near the counter to reduce serving time had the lowest mean of 4.16 with the highest deviation of 0.845 on this construct. On the issue of excess inventory 11.0% of respondents felt it consumes space resulting to congestion and 15.4% felt it consumes production time. A sizeable number of 7.7% felt it slows movement. The study findings agree with Maggie (2006), who indicated that dedicated employees can maintain an orderly, neat and safe workplace by strengthening good working habits to reap the benefits of 5S Kaizen.

The regression model results showed a strong positive correlation between set in order and quality improvement with the value of R given as 0.781. The results presented an R square value of 0.610 indicating that 61.0% of the variability of the quality improvement was accounted for by set in order. The predictor variable (set in order) was statistically significant at 5% significance level. A unit increase in set in order was established to impart 0.866 increase in quality improvement. The study noted that labelling and marking of parts and materials for use in the plant for all to see and retrieve easily and proper utilization of storage were particularly important in improving quality improvement in the plants. Similar findings were also obtained in Library as a place: Implementation of 5S system by Maggie (Maggie, 2006).

5.3.3 Shining and Quality improvement

Daily cleaning of machines, equipment and the shop floor before and after work had the highest influence with mean scores of 4.26 while inspection and analysis reports for shining activities had the least impact with a mean of 3.93 and a deviation of 0.772. On the question of water for cleaning, 18.5 % of the respondents affirmed that that they use air pressure to dust machine's and equipment's and alternative measures of water supply have been put in place with local communities and stakeholders. Discipline and control, continued training and learning, common values, participation and empowerment support lean production (Olivella, et al 2008).

The regression model summary showing the effect of shinning on the quality improvement presented an R square value of = 0.553 indicates how much of the total variation in the quality improvement (dependent variable) are explained by shining (independent variable). In this case, 55.3% of the variations in the quality improvement (dependent variable) are accounted for by shining (independent variables). The significance values associated with the predictor (shinning) was lower than 0.05 indicating that the coefficient was statistically significant at 95% confidence level. The study established that a unit increase in shinning resulted to 0.779 increase in the quality improvement. The findings of the study are consistent with Ma et al., (2018) who identified crucial factors for adoption in shop management and quality control. It is thus apparent from this observation that considerations on cleaning of machines and equipment are very important in improving quality of motor vehicles in various plants.

Increased competition in the labor market as a result of globalization has forced firms to hire contractual workers to attain lean and flexible status. Our findings are reinforced by Tan et al. (2012) studies that recommended organizations manage and train provisional workers to improve effectiveness and efficiency of lean improvement programs especially during the early implementation stages. Cultural support and assimilation is a vital prerequisite for the application of lean principles (Perez, et al 2010;Chen and Meng,2010). Contractual workers need to feel part and parcel of the organization and take ownership of daily requirements and if anything else, cultural differences relate largely to internal opposition and openness to change (Bhamu and Kuldip, 2014) .

5.3.4 Standardization and Quality improvement

On the issue of sharing and cascading of manufacturers and assembly guidelines, the respondent's rated it the lowest with a mean score of 4.11 with a deviation of 0.833 on this construct. This could be that some employees are not fully cognizant with all the requirements or the method of sharing and communicating the information is not suitable for them. Considering most automobile manufacturers have automated and digitized their operational and supply chain platforms for speedy and seamless updates across the globe and most shop floor employees are not tech savvy, it could well explain why it's rated the lowest. This results are consistent with studies by Jugraj and Inderpreet (2017), in which they advocated for the inclusion of 5S principles in the organisations strategic plans and provision of resources by top management in support of 5S Kaizen continuous improvement agendas. Thus it is imperative for the senior management to demonstrate a knack for business acumen intertwined with consistent process reviews and timely removal of procedural impediment's that hinder employees from discharging their pivotal roles across the various support functions for fully realization and support of 5S Kaizen.

The results from model summary showing the effect of standardization on the quality improvement presented an R square value of = 0.537 indicates how much of the total variation in the quality improvement (dependent variable) are explained by standardization (independent variable). In this case, 53.7% of the variation in the quality improvement (dependent variable) are accounted for by standardization (independent variables). The significance values associated with the predictor (standardization) was lower than 0.05 indicating that the coefficient was statistically significant at 95% confidence level. The study established that a unit increase in standardization resulted to 0.675 increase in the quality improvement. These findings can be closely linked to the findings in Münstermann et al., (2010) who showed that standardization has a decisive impact on performance of business process and consequently quality improvement. Therefore, it is clear from these findings that vehicle quality checklist should be uniformly used across the production processes and that standardization enhances uniformity of product designs, final product quality and services. Fullerton et al., (2003) postulated and agreed with our findings that firms should review entire processes to create opportunities for improvements however they didn't state how often reviews should be done. They observed special emphasis should be on results that lead to achievements of goals that bring out the benefits of Lean management implementation. 5S Kaizen

is a lengthy journey that entails steady building up of expertise and organizational capabilities to find and solve new problems.

5.3.5 Sustainability and Quality improvement

In regard to 5S sustainability, provision of training to all staff was deemed important for quality improvement at all levels to be in place. This is explained from the mean score of 4.38 with a standard deviation of 0.789. However, the low mean score of 3.89 for the question on recognition and reward for best idea generated and implemented, could have indicated a subdued commitment and support from top management towards employees. Considering the last stage is viewed as the most difficult to embed, genuinely, it was observed that lack of employee commitment due to negative attitude and inadequate resource allocation contributed more to the deficiency on consistent efforts of 5S Kaizen culture implementation.

This finding is buttressed by Simson et al. (2011); Eswaramoorthi et al. (2011) from their studies about lean implementation that showed lack of finances and resource constraints as barriers that posed a great challenge for both top management and employees to supplant the quality culture in the organization. They also observed that shop floor employees and top management had different views and shared the same fear of movement on the factory floor operations about the requirements of lean which starts by having a robust 5S preparation in place.

The findings are also consistent with studies by Cetindere et al., (2015), which attested that leadership and training plays an integral role in enhancing performance and have a positive association with business performance. They affirmed that employees should receive relevant training on quality under the guidance of top management to support Kaizen activities within the organization.

The results from model summary showing the effect of sustain on the quality improvement presented an R square value of = 0.536 indicates how much of the total variation in the quality improvement (dependent variable) are explained by sustain (independent variable). In this case, 53.6% of the variation in the quality improvement (dependent variable) are accounted for by sustain (independent variables). The significance values associated with the predictor (sustain) was lower than 0.05 indicating that the coefficient was statistically significant at 95% confidence

level. The study established that a unit increase in sustain resulted to 0.708 increase in the quality improvement. These findings consistent with the findings in Ishijima et al., (2014). Therefore, it is important to provide training to all staff on the best ways to sustain quality at all times as well as conducting regular audits and spot checks to verify compliance in the entire assembly are conducted. Mohanty et al. (2007) observed the same trend with the outcomes of this study that initial success from lean implementation remain confined and organizations fail to subsequently advance sustained progress improvements. This was largely attributed to lack of adequate planning and in the post implementation phase.

5.4 Conclusions

Our study findings have shown that all the five independent variables had an impact on quality improvement. In order of significance, objective 2 Set in order was the most impactful on the quality improvement of motor vehicle with a beta coefficient of 0.866 in which it accounts for 61.0% variability in quality improvement, followed in second place by objective 3 Shining with a beta coefficient of 0.779 accounting for 55.3% variability in quality improvement. In third place objective 4 Standardization with coefficient of 0.675 accounting for 53.7% followed closely in fourth place was objective 5 Sustain with a beta coefficient of 0.708 accounting for 53.6% in variability in quality improvement in motor vehicle assembly plants. The last objective in terms of impact was objective 1 Sorting with a beta of 0.697 accounting for 48% in variability in quality improvement in motor vehicle assembly plants

Overall, from the multiple regression we conclude that 5S significantly contribute to the quality improvement in the motor vehicle plants. Thus, proper implementation of the 5S would result in an improvement in the quality of motor vehicles. However, these may prove to be of challenge owing to lack of financial resources, lack of support by the top management, lack of motivation from the employees and lack of skilled manpower.

5.5 Recommendations

1. Assembly plants should conduct an in-house exercise and survey to establish what makes employees view 5S implementation and sustainability as cumbersome when in essence it should be making their lives at work more comfortable and ideal.
2. Top management should participate more and initiate forums that encourage a culture of trust within the organization so that feedback and idea generation can be shared freely across the board without prejudice.
3. Some of the plants were built many years ago with the facility layout still reflecting those eras, and since Kaizen is a continuous improvement process, it could be nice for some little investment in resources to be put in place to reflect the modern and best assembly practices in production lines by benchmarking with global entities.
4. For sustenance of 5S Kaizen to effectively take shape and assembly plants to reap rewards from this ingenious initiative, provision of relevant training & development of all employees by management on a continuous basis should be planned and implemented to equip them with requisite skills to understand and solve problems using quality control tools.

5.5 Suggested Areas for Further Research

1. How 5S contributes to the personal development goals of the employees at the workplace when most of them are only contracted for short periods of time during peak seasons and let go thereafter when production slows down.
2. Studies should be done to determine how 5S impacts employees outside the workplace (at home) for them to fully commit their efforts in implementation and sustaining the culture when fully aware that they are not the owners of the enterprises they work for.

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APPENDICES

APPENDIX I: INTRODUCTION LETTER

13/01/2020
Strathmore Business School
Nairobi

Dear respondent,

Re: Research Data on the Role of 5S Concept in Quality improvement in Motor Vehicle Assembly plants

I am **Charles Motieri,** a graduate student currently studying Master of Business Administration degree at the Strathmore University Business School. I am carrying out a research study in partial fulfillment of the requirement for the award of the degree in addition to enhancing my knowledge about Kaizen in the manufacturing industry. The study is titled the '***The Role of 5S KAIZEN concept on Quality improvement in motor vehicle assembly plants in Nairobi Kenya'***

I humbly request your participation in this study research and guarantee that the data collected from this research study will be treated with utmost confidentiality and used for the sole purpose of academic reasons. The outcome of this study will also be used to support the body of knowledge on the impact of 5S in organizations in the motor vehicle manufacturing industry. The findings of the study will be availed to you at your request and up to this end we consider your response and view to this study vital. Any assistance offered in the collection of data will be deeply appreciated.

Thank you

Yours faithfully

Charles Motieri

Researcher

PARTICIPANT'S INFORMATION AND CONSENT FORM

THE ROLE OF KAIZEN CONCEPT ON QUALITY IMPROVEMENT IN MOTOR VEHICLE ASSEMBLY PLANTS IN KENYA

SECTION 1: INFORMATION SHEET

Investigator: C h a r l e s M o t i e r i
Affiliated Institution: Strathmore Business School (SBS)

SECTION 2: INFORMATION SHEET– THE STUDY

2.1: Reason for carrying out the study?

To help understand and determine the impact of Kaizen on quality improvement and also to supplement knowledge creation for other researchers in the academia. From the gaps identified, organizations can come up with ways of enhancing quality of their products and services and for research academicians, they can conduct further detailed studies to bridge to those gaps and build into the body of knowledge.

2.2: Is it compulsory to take part?

No, P a r t i c i p a t i o n in the study is exclusively uncompelled and the choice is entirely with the individual. In case you resolve to participate; you will be invited to fill a questionnaire to obtain data on Kaizen and explicitly on 5S Concept. In case of inability to respond to all the questions effectively on the first attempt, one may be requested to sit over a second time to attempt the questions. Respondent is at liberty to decline not to participate in this study at whichever interval devoid of providing any details.

2.3: Who is suitable to participate in this study?

- Production staff
- Management staff in production or assembly plants

2.4: Who is not eligible to take part in this study?

- Employees without any knowledge of Kaizen
- Employees not honest and committed to telling the truth

2.5: What is my involvement in participating in this study?

The researcher **Charles O. Motieri** will approach you with a request to participate in this

study. If you are contented and fully comprehend the aim of this study, the researcher will request you to append a signature for the informed consent thereafter you will be guided through the questionnaire to fill.

2.6: What probable dangers and risks will be encountered in participating in this study?

None. We have not envisioned any at this time and therefore, there are none in participating in the study. Every information provided will be handled with utmost confidentiality and only for purposes of this research.

2.7: How beneficial is it to take part in this study?

Data provided will be applied in increasing the understanding of the role and impact Kaizen has created in the industry towards improving quality. From the gaps identified processes and work plans can be improved and training opportunities can be offered to production employees to equip them with more relevant skills

2.8: What happens if I decline participating in this study?

Nothing… your involvement in the study is volitional. Suppose you participate in the first attempt and later decide to opt out, you are obliged to renounce your decision without giving any clarification. No employee should feel uncomfortable or afraid for not having participated in the study, nevertheless it will be very noble for the participant to kindly at his own desire to provide the relevant information and the researcher will be very humbled and grateful for the feedback received.

2.9: Who will have access to my data for the period of this study?

Entire research data obtained shall be stored in safely protected cabinets. Data recorded in the database will adequately be coded and secured with a password. Simply authorized personnel involved with in the study will be authorized to access to information. Utmost confidentiality to your information will be observed.

2.10: Who should be contacted in case of additional questions?

Kindly contact **Charles O. Motieri** at SBS, or via e-mail: (motieri.charles@strathmore.edu), or by phone (0721-242431). You may also get in touch with my supervisor, **Dr. Everlyne Makhanu,** at the Strathmore Business School, Nairobi, or by e-mail (emakhanu@strathmore.edu) or by phone (0722-672473)

In case of intention to ask any autonomous person questions regarding this study, Kindly contact:

The Secretary–Strathmore University Institutional Ethics Review Board, P. O. BOX 59857, 00200, Nairobi, email ethicsreview@strathmore.edu Tel number: +254 703 034 375

I, _____, confirm that the study has been clarified to me. I have mastered everything that I have perused both explanations offered as well as my questions have been responded to adequately. I fully comprehend that I can reverse my decision at any time.

Kindly tick the boxes as appropriate;

Participation in the research study

☐ I ADMIT participating in this study

☐ I DON'T ADMIT participating in this study

Preservation of information on the finalized questionnaire

☐ I UNDERTAKE that my completed questionnaires be kept for future data analysis

☐ I DON'T UNDERTAKE that my complete questionnaires be kept for future data analysis.

Participant's Signature: ……

Date: _____/_____/_____

Participant's Name: _____

Time: _____ /_____

(Please print name) ***HR / MN***

I, _____ confirm that I have upheld the standard operating procedures (SOP) for this research and clarified the information about the study to the participant above, and that s/he has discerned the nature and the purpose of the study and accepts to participate in this research. She/he has been accorded a chance to probe inquiries deemed to have been responded to adequately

Investigator's Signature:

Date: ___29___/_04_____/_2020_____

Investigator's Name: Charles Motieri

Time: 10.00am

Strathmore UNIVERSITY

7th April 2020

Mr Motieri, Charles
motieri.charles@strathmore.edu

Dear Mr Motieri,

RE: The Role of Kaizen Concept on Quality Improvement in Motor Vehicle Assembly Plants in Kenya

This is to inform you that SU-IERC has reviewed and **approved** your above research proposal. Your application appeoval number is **SU-IERC0666/20.** The approval period is **7th April 2020 to 6th April 2021.**

This appeoval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and appeoval by SU-IERC.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-IERC within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-IERC within 72 hoars
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to SU-IERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

for Dr Virginia Gichuru,
Secretary; SU-IERC

Cc: Prof Fred Were,
Chairperson; SU-IERC

STRATHMORE UNIVERSITY INSTITUTIONAL ETHICS REVIEW COMMITTEE (SU-IERC)
07 APR 2020
TEL: +254 (0)703 034 000
P. O. Box 59857 - 00200
NAIROBI - KENYA

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 902052

Date of Issue: 28/April/2020

RESEARCH LICENSE

This is to Certify that Mr.. Charles Ondieki Meiiert of Strathmore University, has been licensed to conduct research in Mombasa, Nairobi on the topic: The Role of KAIZEN Concept in Quality Improvement in Motor Vehicle Assembly Plants in Kenya for the period ending : 28/April/2021.

License No: NACOSTI/P/20/4814

902052

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

APPENDIX II: QUESTIONNAIRE FOR PRODUCTION MANAGER, QUALITY MANAGER, KAIZEN CHAMPIONS AND PRODUCTION LINE TECHNICIANS

The below questionnaire endeavors to gather data that will help me undertake my research study. There are 5 sections in this questionnaire. It is my sincere appeal to respondents to respond to all the questions honestly and adequately. Choose by ticking (√) in the box next to answer of your choice.

Part A: General Information

1. What is your gender?
   - □ Male
   - □ Female
   - □ Transgender
2. What is your age?
   - □ 20-30
   - □ 31-40
   - □ 41-50
   - □ 51-60
3. What is your highest level of education attained?
   - □ Primary School
   - □ Secondary School
   - □ College Diploma
   - □ Undergraduate Degree
   - □ Post Graduate Degree
4. How long have you been in the manufacturing sector?
   - □ 1-3 years
   - □ 4-6 years
   - □ 7-9 years
   - □ Over 10 years
5. Please select your exact job Title below give options
   - □ Production Manager
   - □ Quality Manager
   - □ Kaizen Champion
   - □ Production Line Technicians

PART B: SORTING

Sorting is the process of removing unwanted and unnecessary items from the workplace and disposing it off or putting it where it should, hence creating space.

Kindly indicate in the table with a tick (√) on a scale of
5= strongly agree 4= Agree 3= Moderately Agreed 2= Disagree 1= Strongly Disagree
Please answer the following questions based on your agreement with the organization's performance. The scale level ranges from 1 – 5

No.	Sorting	5	4	3	2	1
1	Through Sorting, the organization has improved Quality of its products and services					
2	Relevant staff are involved in identification process of materials and parts used in the plant					
3	All unnecessary items are always segregated and removed from the racks and storage areas					
4	The time for searching and waiting for issuance of parts and materials to the production line has reduced					
5	Discarding of unwanted materials and items is done as per laid down guidelines					
6	Records of disposed items and materials are kept safely					

What could be done to improve the sorting process & how often should it be done?
.....
..……

PART C: SET IN ORDER

Set in order involves putting everything in its rightful place and arranged in racks. The items are coded and labeled or marked with clearly visible reflective tape of paint for ease of access and retrieval.

Kindly indicate in the table with a tick (√) on a scale of

5= strongly agree 4= Agree 3= Moderately Agreed 2= Disagree 1= Strongly Disagree

Please answer the following questions based on your agreement with the organization's performance. The scale level ranges from 1 – 5.

No.	Set in Order	5	4	3	2	1
7	Through Set in Order the organization has improved quality of its products by reducing damages					
8	Arranging of parts and materials is a daily exercise conducted as part of continuous improvement					
9	Parts and materials for use in the plant are well labelled and marked for all to see and retrieve easily					
10	Visibility in the plant has improved and by extension reducing chances of making errors/passing on defects					
11	Pathways & aisles are clearly painted and unhindered for staff and visiting customers to walk through					
12	By proper arrangement fast moving parts are placed next to counter to reduce serving time					
13	The storage area has been well utilized to enhance movement and improved space management					

How does excess inventory affect your Set in order process and by extension your quality?
……
……

PART D: SHINING

Shining is a proactive process of keeping the workplace and tools and equipment clean daily to promote overall workplace appeal and enhance quality of products and services produced.

Kindly indicate in the table with a tick (√) on a scale of

5= strongly agree 4= Agree 3= Moderately Agreed 2= Disagree 1= Strongly Disagree

Please answer the following questions based on your agreement with the organization's performance. The scale level ranges from 1 – 5.

No.	Shining	5	4	3	2	1
14	Shining plays a big role in quality of products and materials under storage for long periods					
15	Daily cleaning of the shop floor is done before and after work a safe and healthy workplace					
16	Machines and equipment are cleaned everyday by the users to ensure longevity & uptime					
17	The inspection reports of Shining activities are well maintained for reference and analysis					
18	Vehicles collected from the plant are thoroughly washed & cleaned before delivery to customers					
19	Shining ensures that machines and equipment don't aid in generating defects and accidents during assembly					

What measures have you put in place in the event water is not available for cleaning?
…….....

PART E: STANDARDIZATION

Standardization is the process of making something or products to conform to a particular expected norm by way of consensus to promote safety, interoperability and compatibility of products and services.

Kindly indicate in the table with a tick (√) on a scale of
5= strongly agree 4= Agree 3= Moderately Agreed 2= Disagree 1= Strongly Disagree

Please answer the following questions based on your agreement with the organization's performance. The scale level ranges from 1 – 5

No.	Standardization	5	4	3	2	1
20	Standardization plays a big role in embedding the quality culture in the assembly plant					
21	Work procedures and work instructions are strictly adhered to and followed by all staff					
22	Schedules are prepared on time and all activities are tracked and monitored					
23	Visual aid and boards are conspicuously displayed at designated places to cascade & share quality tips					
24	Manufacturers guidelines and assembly processes are well articulated & shared to all shop floor staff					
25	Vehicle quality checklist are uniformly used across the production processes					
26	Standardization enhances uniformity of product designs, final product quality & services					

How often are your standards reviewed and what does it entail?

……..……
…….

PART F: SUSTAINABILITY

Sustain is concerned with the aspect of maintaining and upholding discipline with quality in mind and being able to cultivate a culture of self-management practice for the workforce.

Kindly indicate in the table with a tick (√) on a scale of

5= strongly agree 4= Agree 3= Moderately Agreed 2= Disagree 1= Strongly Disagree

Please answer the following questions based on your agreement with the organization's performance. The scale level ranges from 1 – 5

No.	Sustainability	5	4	3	2	1
27	Training plays a fundamental role in sustaining 5S and quality in assembly plant					
28	It's important to provide training to all staff on the best ways to sustain quality at all times					
29	Regular audits and spot checks to verify compliance in the entire assembly are conducted					
30	Audits findings are shared with everybody to establishing root cause & provide counter measures					
31	Employees are encouraged to generate ideas and recommend changes for improvement					
32	Recommended changes are evaluated and implemented if they are likely to improve quality					
33	Recognition and reward programs for good ideas are in place and practised to motivate employees					
34	A 5S policy framework is in place that stipulates and safeguards initiatives and acts as a clarion call					

Why does it prove so cumbersome for firms to sustain 5S and what could you suggest be done?

……

……

PART G: QUALITY IMPROVEMENT IN MOTOR VEHICLE ASSEMBLY

Quality improvement is a formal approach of analysis of performance and systematic efforts to improve it by use of data to monitor the outcomes.

Kindly indicate in the table with a tick (√) on a scale of

5= strongly agree 4= Agree 3= Moderately Agreed 2= Disagree 1= Strongly Disagree

Please answer the following questions based on your agreement with the organization's performance. The scale level ranges from 1 – 5

No.	Quality Improvement	5	4	3	2	1
35	The organizations strive to reduce the No. of Customer complaints					
36	Increase in Customer Satisfaction Index (VOC) is seriously monitored and appropriate measures taken					
37	Rejection rates/ratios due to improper assembly are kept at the bare minimum during & after assembly					
38	Shorter Lead times (Cycle times) excite customers who don't have to wait for longer periods					
39	There is a reduction in the No. of warranty claims/costs					
40	Quality inspection procedures are well defined, understood & complied with by all to ensure no product failure					
41	The organization has a Quality policy and ISO Certification in place that puts the customer first					
42	The organization always aims to reduce the number of defective Units/recall rates					

What are the setbacks encountered in quality improvement and is it possible to produce zero defects motors vehicles? ……...
……
……