INFLUENCE OF TECHNOLOGICAL STRATEGIES ON PERFORMANCE OF STANDARD GAUGE RAILWAY IN KENYA

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DECLARATION

This rsearch project is my original work and it has not been submitted for examination in any other university.

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D61/79143/2015

This research project is submitted for examination with my approval as the university supervisor.

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DEDICATION

I dedicate this work to my family who have been a source of inspiration for me and to my siblings for their continuous love, encouragement and support during the entire course.

TABLE OF CONTENTS

DECLARATION.....ii

ACKNOWLEDGEMENT..... iii

DEDICATION.....iv

ABBREVIATIONS AND ACRONYMS..... viii

ABSTRACT.....ix

CHAPTER ONE: INTRODUCTION.....1

1.1 Background to the Study.....1

1.1.1 Technological Strategies.....3

1.1.2 Performance of Organization in Kenya.....5

1.1.3 Railway Transport in Kenya.....6

1.1.4 Standard Gauge Railway Project in Kenya.....7

1.2 Research Problem.....8

1.3 Research Objectives.....10

1.4 Value of the Study.....10

CHAPTER TWO: LITERATURE REVIEW.....12

2.1 Introduction.....12

2.2 Theoretical Foundation.....12

2.2.1 Resource Based View.....12

2.2.1 Technology Acceptance Model.....13

2.3 Technological Strategies and Organizational Performance 14

2.4 Empirical Studies and Knowledge gaps 19

2.5 Conceptual Framework 22

CHAPTER THREE: RESEARCH METHODOLOGY 24

3.1 Introduction 24

3.2 Research Design 24

3.3 Census Technique 25

3.4 Data Collection 26

3.5 Data Analysis 26

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION 28

4.1 Introduction 28

4.2 Result Findings and Discussion 29

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 39

5:1 Introduction 39

5.2 Summary of the findings 39

5.3 Conclusion 41

5.4 Recommendations of the Study 42

5.5 Limitations of the Study 43

5.6 Suggestions for Further Research 44

REFERENCES 45

APPENDICES 49

Appendix 1: Letter of Introduction 49

Appendix II: Interview guide questions 49

ABBREVIATIONS AND ACRONYMS

ATIS	-	Advanced Traveler Information Systems
ETCS	-	European Train Control System
EU	-	European Union
GPS	-	Global Positioning Systems
HSR	-	High Speed Rail
ICT	-	Information and Communication Technology
ITS	-	Intelligent Transportation Systems
PEOU	-	Perceived Ease of Use
PFNA	-	Pulsed-Fast Neutron Analysis
PU	-	Perceived Usefulness
RBV	-	Resource Based View Theory
RFID	-	Radio Frequency Identification Devices
SGR	-	Standard Gauge Railway
TAM	-	Technology Acceptance Model

ABSTRACT

Rapid technological advancement is changing how business operates. Organizations that have integrated technology in their operations are more likely to be more competitive than those who do not and tend to perform better. Advanced transport and freight technologies and intelligent transport systems are transforming transportation globally. Most businesses are currently transporting their cargo from Mombasa to Nairobi via SGR reducing congestion in the roads. The purpose of the study was to explore the technological strategies in enhancing performance of Standard Gauge Railway in Kenya. The study adopted the case study research design. Data was gathered using an interview guide. Top management personnel at Standard Gauge Railway participated in the interview session. It was established that SGR Company has invested in e-ticketing technology. E-tickets lower costs, saves time on queuing and increases operational efficiency. It was also found that the Company has invested automated cargo handlers. Automated stacking cranes and automated guided vehicles (AGVs) have been introduced to fasten cargo management at SGR. Intelligent Transport Systems (ITS) allows holistic, control, information and communication upgrade to classical transport and traffic systems, which enables significant improvement in performance, efficiency of passenger and cargo transportation. The goal of rail ITS systems are increase efficiency and effectiveness and to increase safety of transportation. It was also established that there are various dangers affecting rail transport. Rail should work with innovation suppliers to grow more successful security hardware that can identify interruption, animosity, vandalism, trespass, extortion and so on and in addition more protection agreeable arrangements in existing advancements, for example, cameras. It was also found that SGR Company has adopted e-maintenance technology. Track maintenance costs can be reduced by introducing automated track maintenance technology and electronic and computerized systems can reduce the administration costs. The e-maintenance technologies help in the identification rail defects. The study concluded that technological advancement in the rail industry is changing how rail transport operates. The study recommends investment in rail technologies to improve efficiency at SGR.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Rapid technological advancement is changing how business operates. A technology strategy supports a firm's technological inclination, which entails the introduction development of technology into organization's business operation (Mytelka, 1999). Technology refers to knowledge or 'know-how' that makes our understanding better about how to do things (Capon & Glazer, 1987), it is categorized into three: types; product, process and management technologies. The importance of technology strategies in business management are immense. Results show that the quality generated by technological strategies manifests in new ideas, efficiency, processes that leads to enhanced organizational performance. Organizations that have integrated technology in their operations are more likely to be more competitive than those who do not and tend to perform better (Read, 2000).

The study is guided by Resource Based views Theory and Technology Acceptance Model. Resource Based views Theory was posed by Penrose's in 1959 (Wernerfelt 1984). The resource based view theory (RBV) suggests that superior growth of a firm is mainly determined by its resources. Technology Acceptance Model (TAM) was proposed by Davis (1989). TAM advocates for adoption and usability of technology.

Standard Gauge Railway (SGR) is the second railway transport after that one build during colonial. The new railway is supplementing the old railway network thereby increasing the efficiency and significantly reducing the damage caused by heavy trucks carrying cargo to roads. Most businesses are currently transporting their cargo from Mombasa to Nairobi via SGR reducing congestion in the roads.

Lack of modern railway technologies is an impediment to rail transport. Advanced transport and freight technologies and intelligent transport systems are transforming transportation globally (Beugin & Marais, 2012). The need to boost energy efficiency of railways and minimize emissions without negatively affecting growth is driving the increased utilization of sophisticated materials and alternative fuels (Urry, 2016).

Intelligent transport systems can increase system performance, minimize travel times, improve safety and enhance the customer experience (Giannopoulos, 2004). Intelligent Transportation Systems (ITS) are increasingly being tapped as cost-effective strategies. Current technological advancement are therefore key drivers of railroad efficiencies, as appropriate technological advancement facilitates enhanced asset maintenance, improved communication with passengers, and automated task management.

The dynamic and effective rail area that this procedure backings is one working comprehensively and enhances to develop, expanding its capacity to contend, to hold existing and pull in new clients (Gunselmann, 2005). Along these lines, it enhances improved extensive social and monetary objectives inside the networks it serves. A technical strategy depends on innovative technology to enhance service delivery in the rail industry (Larue, Rakotonirainy, Haworth & Darvell, 2015). Mention all of them because it is the first time

To expand benefits, railroads will along these lines to analyze better ways to encourage change, that include the foundation of cutting edge authoritative and operational structures and frameworks. Basic to conveying advancement inside the railroad segment is its capacity and readiness to look outside its own particular limits generally advantageous and frequently most monetary arrangements, working

together with innovation engineers and different masters (Kazanskiy & Popov, 2015). By employing railway technologies management of transit goods from warehouses to the market is tracked.

Rail must have the capacity to grasp every one of the assortments of data originating from the utilization of new innovations and to support the outline of standard frameworks engineering and the joining of data frameworks. Ongoing connected information and administrations distributed by everyone and everything on the web ought to be utilized to produce savvy answers for versatility issues of the two Passengers and Freight (Tolley and Turton, 2014). Information and business insight will assume an essential interchanges part, not just to broadcast crucial operational data to clients, for example, prepare delays, yet in addition for giving focused on offers and administrations to all clients (Profillidis, 2016).

It is crucial for passengers to be informed of the rail technologies in operation (Qteishat, Alshibly & Al-ma'aitah, 2014). By tailoring IT arrangements, rail can have the capacity to make a particular client encounter; by totaling and examining client information it can recognize patterns and open doors for new items and administrations (Mašek, Kolarovszki and Čamaj, 2016). Rail administrations will adjust to client needs, be alluring and simple to utilize. The frameworks utilized by rail will enable travelers to design effortlessly the most financially savvy, time-effective and helpful co-modular trips.

1.1.1 Technological Strategies

In Kenya basic technology strategies are found. Advanced rail technologies in Japan, Germany, USA has led to improved freight services (American Association of Railroads, 2012). Rail technology strategies in Kenya include e-ticketing, e-

maintenance, automated cargo handlers, some forms of robotic technologies and intelligent transport system (Siror, Huanye, Wang, & Jie, 2009). Technological improvement enhances rail efficiency (Ródenas, García & García, 2017).

Create progressed imaginative answers for moving stock, flagging and foundation that are taken a toll focused, including retrofitting arrangements (Hillmansen and Ellis, 2014). Significantly more encouraging than rail division interior advancement might recognize and embracing mechanical development driven by different parts and not yet abused by rail (Herranz-Loncán, 2014). Rail grasps all advances that empower new types of data and correspondence. This oversees huge volumes of information over the life of benefits (He et al., 2016). The railroad has a co-ordinated way to deal with the administration of the data expected to run the operational framework.

The web of transportation things associates every one of the advantages, permitting much better observing of the rail framework, with preventive support and adaptable adjustment of the distinctive parts (Al-Douri, Tretten and Karim, 2016). Cargo is followed and followed progressively through all phases of travel, whatever the mode. Travelers appreciate a consistent way to-entryway travel, because of new administrations tending to all parts of the movement whatever the method of transport (Thaduri, Galar & Kumar, 2015).

Discontinuity of various administrations (shopping, booking, ticketing, approval, and so forth.) and between various modes has been evacuated. Also, the accessibility of continuous activity and entire voyage data keeps the traveler side by side of the fluctuating choices, incorporating between association with different modes, should travel issues emerge (Parida,Stenstr¨om & Kumar, 2014). Advanced technologies and communications systems will enable the provision of the right information in real

time to end-users whether passengers, freight customers, maintainers or operators (Tokody & Flammini, 2017). Such information will be based on precise train location and up to date asset bases.

1.1.2 Organization Performance

Richard, Yip, Johnson and Devinney (2009) defined organizational performance as fulfillment of the intended mission of organizations which is obtained through good management, persistent efforts and superior governance in order to achieve goals. The multiple performance criteria for organizations include responsiveness, flexibility, cost, productivity, asset efficiency utilization and reliability (Chang, Tsui, & Hsu, 2013). An organization's performance is centered on the kind of activities that it carries out in fulfillment of its mission. End results are the observable aspects that determine an organization's performance (Valmohammadi & Servati, 2011).

Financial performance usually depicts business sector results that reveal total financial health of the sector over a given period (Chandrapala & Knápková, 2013). It reveals how a unit is using its resources in order to increase the shareholder's profitability and wealth (Naz, Ijaz & Naqvi, 2016). Firms are held accountable by measuring performance measurement. In this study ROA and ROE financial ratios will be applied. ROA, refers to profitability measure which divides the net income by the amount of its assets while ROE is measured as Net Income divided by capital. Other ratio to be used in the study is return on investment (ROI). Return on Investment is measured by dividing net profit by total assets.

According to Richard et al., (2009) how an organization performs is centered on three fields of outcomes which include financial performance in terms of profits, ROA and ROI; performance of the product measured by market share, sales volume; and returns

made on investments by the shareholders that includes total shareholder return and economic value added. There are, however, challenges in using these measures; for starters most managers are unwilling to allow researchers access their financial records, savings are inconsistent from year to year, environments are constantly changing which makes it difficult to compare the savings made years after.

1.1.3 Railway Transport in Kenya

Railroad execution and limit can be upgraded by growing foundation; presenting better innovation; and enhancing the productivity and adequacy of activity and support (Stenström, 2014). The growth of railway transport requires technology intervention to ensure that the traditional manual ways of customer and goods management is eliminated (Fourie, Herranz-Loncan & Herranz-Loncán, 2015). Queue management is possible by use of e tickets. The growth of electronic tickets enhances the performance of rail transport. E-ticketing presents illustrate the value of technology in railway industry (Mašek, Kolarovszki & Čamaj, 2016).

The kind of cargo-handling device used is dependent on the nature of the cargo and technology to employ (Mašek, *et al.,* 2016). Intelligent Transportation Systems (ITS) enhances transportation system performance and capacity through better management and control mechanism.

However, it is evident that there are no advanced technological strategies adopted in the railway transport in Kenya. Bulk of operations is still done manually including ticketing, cargo handling and security management. There is need to explore technological strategies adopted by standard gauge railway in Kenya.

1.1.4 Standard Gauge Railway Project in Kenya

The development of a Standard Gauge Railway (SGR) from Mombasa to Nairobi was meant to improve efficient, safe, accessible and sustainable transportation services. Kenya Vision 2030 imagines a nation comprising of integrated and firmly interconnected transport infrastructure including railway transport. SGR is the second railway transport after that one build during colonial. The new railway is supplementing the old railway network thereby increasing the efficiency and significantly reducing the damage caused by heavy trucks carrying cargo to roads. Most businesses are currently transporting their cargo from Mombasa to Nairobi via SGR reducing congestion in the roads.

Before the introduction of standard gauge rail in 2017, Kenya rail transport network was dependent on the old rail system that was developed during the colonial system. The old rail system was characterized by inefficiencies such as delays in delivery of goods due to the low speed and persistent breakdowns. This led to so many people opting to transport their goods through the road system and this has had an effect on economic development as roads have dilapidated at a high rate in addition to traffic jams caused by the trucks transporting cargo from Mombasa to Nairobi and other towns (Jedwab, Kerby & Moradi, 2017).

As soon as the standard gauge was launched, benefits were realized immediately as many passengers opted to travel between Mombasa and Nairobi using the SGR because of its speed and comfort compared to road transport. In addition, the SGR reduced the cost of travel significantly and this was a boost especially to people who

travel frequently for business. The extension of the SGR from Nairobi to Mombasa is expected to improve transport in the country even further (Jedwab, Kerby & Moradi, 2017).

Rail technology has enhanced persons and freight transport via rail network has increased efficiency in the transport sector (Thaduri, Galar & Kumar, 2015). Unfortunately, railway transport in Kenya have no capability to develop technologies to meet the demands of today's passenger and freight customers, enabling rail transport expand (Jedwab, Kerby & Moradi, 2017). One solution to these problems is the introduction of technological strategies in the railway sector.

1.2 Research Problem

The importance of technological strategies in business management are immense. Results show that the quality generated by technological strategies manifests in new ideas, efficiency, processes that leads to enhanced organizational performance. Technological advancement in the railway transport in Kenya is underdeveloped. Bulk of operations is still done manually including ticketing, cargo handling and security management. This minimizes the opportunities for the corporation to reap from benefits brought about by technological strategies in enhancing organizational performance.

The integration of technology strategies in rail sector has enhanced railway transport in developed countries. Rail enhances economic growth by expanding productivity. The SGR has solved some problems that faced the transport of cargo from Mombasa to various destinations. The decongestion of the port is one of the policies of the SGR project and any cargo above fifteen tonnes is carried using the trains to avoid the damage of the roads. The project has reduced the cost of transporting the cargo that

has been expensive using the roads. However, most of commercial operations in the SGR are done manually. Different modes were snappier to fuse new advancements (as it occurred in the vehicle and flying machine businesses) than the railroad business. Rail has a crucial part in conveying an aggressive and naturally agreeable transport framework, developing the economy, improving individual portability and supporting social attachment. The rail framework has not adjusted new innovation, empowering further modular move and keeping up its situation as the method of decision.

In Kenya, the survival of the SGR is largely depended on the technological strategies in the corporation. However, there are limited technological strategies in the rail sector in Kenya as compared to railways in advanced nations like Germany, Japan and United States. In Japan the rail industry is highly developed. The successful development of rail industry Japan is anchored on technology. The areas include speed, safety, passenger comfort and convenience and environmental friendliness. The Germany rail sector is dominated by new technology such as signaling and communication and other IT tools can do much to help modernize Europe's railways. Minimal technological strategies have been adopted in railway transport in Kenya. Contextually, the technological strategies in the rail sector in Kenya underdeveloped as compared to those of advanced economies.

Cheng and Huang (2014) studied e-ticketing in Taiwan High Speed Rail (THSR) and established that technology has led to the growth of rail transport. Al-Douri, Tretten and Karim (2016) conducted a study on improvement of railway performance in Sweden. The study found that incorporating new technologies in the rail sector would enhance its operations in Sweden. Božičnik and Schliephake (2005) conducted a study on technologies used in freight transport in Europe. Soejima (2003) did a study

railway technology in Japan and established that Japan has continuously developed its rail sector by integrating technological strategies to enhance the sector.

The empirical studies indicate that there are no studies done in Kenya on technological strategies adopted to enhance operations in the sector. Some of the studies presented were done in advanced countries with advanced technological strategies in the rail sector (Al-Douri, *et al.,* 2016; Božičnik & Schliephake, 200; Soejima, 2003).These presents both empirical and methodological gap. The current study sought to explore the technological strategies enhancing railway transport in Kenya, a case of SGR by answering the research question: What is the influence of technological strategies on performance of standard gauge railway in Kenya?

1.3 Research Objectives

The objective of the study was to find out the influence of technological strategies in enhancing Kenyan standard gauge railway performance.

1.4 Value of the Study

There are numerous technologies in the railway sector. However, some of the rail technologies are only found in technologically advanced countries. The results may be of important to the management of Kenya Railways authority. The result findings from the study may be used in advising the Kenya Railways Corporation on some of the available technological strategies in the railway sector. They can adopt the same technologies in order to enhance railway transport in Kenya. The technologies may help in queue management, cargo handling and warehousing.

The study may contribute to theory and practice. The study is expected to inform the Resource Based View Theory and Technology Acceptance Model. Technology

growth is dependent on Research and Development (RD) that require massive resources. Technology acquisition may also require the investment of resources. The study therefore may inform the Resource Based View Theory. The study will also inform practice as managers of SGR and other transport areas will learn from this study and implement principles that will positively influence performance.

The study may additionally benefit scholars who might wish to embrace additional studies aimed at studying technological strategies that can be employed in the rail industry in Kenya. Researchers and academicians from strategic management, business management, and engineering and computer science may find this study important in their research. The results may form basis for future research on technologies in the railway transport.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The section introduces the literature review. It comprises of the, theoretical framework, the empirical review and technological strategies. The chapter further presents conceptual framework and critique of existing literature and the research gap. A review of both theoretical and empirical literature explore the technological strategies in enhancing railway performance of transport in Kenya is presented.

The chapter starts by looking at the theoretical literature review where the theories that anchor the study namely Resourced Based View and Technology Acceptance Theory are discussed. The chapter presents the linkages between theoretical and empirical literature to establish the existing relationships among the variables. The chapter lastly presented the chapter summary.

2.2 Theoretical Foundation

Theories are assumptions and theories that a research study is always grounded on (Zima, 2007). This study is guided by technology Acceptance Theory and Resource Based View Theory (RBV).

2.2.1 Resource Based View

Resource Based views Theory was posed by Penrose's in 1959 (Wernerfelt 1984). The resource based view theory (RBV) suggests that superior growth of a firm is mainly determined by its resources. The resource based view model to achieve competitive advantage emerged post 1980's, this was after studies done by Wernerfelt (1984), Prahalad and Hamel (1990) and Barney (1991).

This theory suggests that corporations should look internally for sources of competitive advantage rather that searching from the external competitive environment. Rumelt (1991) defines the firm as consisting of capabilities and resources. These capabilities and resources include intangible, human, financial and physical assets. The theory is based on the fact that resources lack homogeneity and mobility.

It was concluded that RBV is one of the main theories of strategic management that can be used to explain a firm's performance. The theory is applicable to the study by advocating the importance of resources in commercial prosperity. The Kenya Railways Corporation will require adequate resources in order to acquire some of the technologies available in the rail transport. Some of the devices call for lots of money in order to acquire one.

2.2.1 Technology Acceptance Model

Technology Acceptance Model (TAM) was proposed by Davis (1989). TAM depends on the Theory of Reasoned Action (TRA). TAM builds, saw value and saw usability, are the basic determinants of framework utilize, and foresee demeanors toward the utilization of the framework, that is, the client's readiness to utilize the framework. Seen helpfulness refers to "the extent to which one accepts that embracing a certain system would raise the performance of his job", and perceived ease of use is "the extent to which one accepts that embracing a certain system would be free of effort" (Davis, 1989).

Davis' (1989) TAM is broadly used to consider client acknowledgment of innovation. As per TAM, saw helpfulness (PU) and saw usability (PEOU) impact one's disposition towards framework utilization, which impacts one's conduct expectation to utilize a framework, which, thus, decides real utilization of a recommender

framework. Statistic factors, for example, area are additionally the precursor that actuates apparent value and saw convenience.

Accordingly, TAM depends on both vital keen factors as apparent convenience and saw usability. This is seen on the exploration did by (Mohammad, 2009) in which he called attention to that TAM is exceptionally prominent model for clarifying and anticipating framework utilize. The Technology Acceptance Model is applicable to the study by informing the intention of the Kenya Railways Corporation to adopt a particular technological strategy in order to enhance its commercial operations.

2.3 Technological Strategies and Organizational Performance

The continued growth of passengers using SGR is dependent on its strength to address the needs of rail users using e-ticketing (He *et al.,* 2016). Electronic ticketing is one of the examples of values brought by technology in the rail industry. E-ticketing enhances maximum fulfillment to the users without the worry of losing tickets (Ng-Kruelle, Swatman & Kruelle, 2006). E-ticketing reduces administrative costs while at the same time providing better services to the users (Sahney, Ghosh & Shrivastava, 2013). E-ticketing is very important in queue management. In Romania, modernizing the rolling stock has improved the service for the customer. E-Ticketing prevents such fraudulent behavior (Heneberg, 2008). Meenakumari (2015) in a study mentioned that E-Ticketing improves the service quality as well as enables ease of use, flexible mode of choice, save time and money. Mezghani (2008) in a study established that e-ticketing systems enhance payment systems while facilitating better management of rail transport. E-Ticketing avail the service recipients to buy ticket in a more convenient way (Karami, 2006).

In 2017, the Kenya Railways Corporation rolled out online ticketing for train services for the new standard gauge railway. E-Ticketing minimizes the costs of printing and sending them to customers (Kumar *et al.,* 2011). E-Ticketing is also safe and secure. Bar code eliminates the cases of counterfeit and duplicate tickets (Ng-Kruelle, Swatman & Kruelle, 2006). The kind of cargo-handling device used is determined by the nature of the actual cargo and the type of packing employed (Murthy, Narang, Bankapura & Pandian, 2015). Technology in cargo management is critical in the rail industry. Loading and offloading cargo from the train require efficient automated machines (Bar-Am, 2015). The study wishes to establish the type of cargo handlers' machines adopted in the SGR in Kenya.

Innovation enhancements (driven by advertise rivalry) came in numerous structures in the U.S. railroad division prompted the blast in the segment (Kazanskiy and Popov, 2015). Track support costs were decreased through the presentation of computerized track upkeep innovation (Tampa, 2012). Furthermore, organization costs were lessened through the presentation of electronic/mechanized frameworks that took into consideration exchanges amongst shippers and the railroad to be computerized (Woodrooffe, 2000).

Such frameworks likewise mechanized the procedure of information gathering and streamlined bookkeeping work for exchanges (Hillmansen and Ellis, 2014). The rail advances empowered longer cargo trains to work securely on the framework, (for example, tracks that can deal with heavier burdens and further developed trains) have added to decreased expenses for cargo railroads (Velde *et al.,* 2012). Nations that are utilizing less cutting edge innovations could possibly acknowledge noteworthy

advantages from assist interest in enhanced customer connection, support and different advances.

Intelligent Transportation Systems (ITS) enhances cargo and customer management in the rail sector (Christurner, tiwarI & Starr, 2016). The integration of information provided by Advanced Traveller Information Systems (ATIS) and freight control systems is one technology to be admired in the rail transport (Larue, Rakotonirainy, Haworth & Darvell, 2015).

Intelligent Transport System (ITS) technologies allow easy flow of freight data across the system (Hodge, O'Keefe, Weeks & Moulds, 2015). The identification technology development facilitate further logistics information exchange and acquisition and allow the fast and accurate tracking and tracing of shipments which leads to significant advantage, time savings, increase level of service (Ning, Tang, Gao, Yan, Wang & Zeng, 2006). Further, flexibility and responsiveness is increased due to the provision of real-time information providing increased level of service with fewer resources.

There are various dangers affecting rail transport. By tending to these dangers, (for example, metal burglary or digital culpability) in a various ways, railroad more cost-viably addresses the fundamental issues (Hodge, O'Keefe, Weeks and Molds, 2015). Expanding security system along the inventory network and between modes without obstructing the free stream of people and cargo will encourage the interoperability of transport security knowledge inside and between various transport networks.

This sort of information has impressive sensitivities encompassing it and an institutionalized approach over all vehicle modes would prompt an organized arrangement of access conditions for information with respect to transport security (Kriaa, Pietre-Cambacedes, Bouissou and Halgand, 2015). Rail should work with innovation suppliers to grow more successful security hardware that can identify interruption, animosity, vandalism, trespass, extortion and so on and in addition more protection agreeable arrangements in existing advancements, for example, cameras. There will be a more prominent dependence on computerized intercession and execution techniques (Kazanskiy & Popov, 2015).

Technology plays a critical role in integrating security measures in the freight transportation/logistical system operations (Chernov, Butakova & Karpenko, 2015). More specifically the technologies will be necessarily involved in order to support the acquisition, processing and communication of information between the different actors, terminals, and modes of transport. This information can either be used to optimize the various processes such as terminal space allocation and loading or unloading plans (He *et al.,* 2016). It can also give services that can increase the speed of the inspection process i.e. pre-screening of containers.

Bar codes, Global Positioning Systems (GPS) and Radio Frequency Identification Devices (RFID) enhance visibility along the chain of supply, increasing in this way the effectiveness and efficiency in the process of making (Kazanskiy & Popov, 2015). Cargo scanning systems gives a great contribution in the performance of security systems since it can detect the specific type of item based on pulsed-fast neutron analysis (PFNA).

Trains should be insightful with the goal that they are continually self-checking (robotized condition observing), to set up what, when and where support is required (Kans, Galar and Thaduri, 2016). Execution of the framework and the interface between theprepare and track and between the prepare and control, charge and correspondence is basic to framework proficiency (Al-Douri, et al., 2016). Moving stock outlines should be financially savvy and in the meantime assess the future traveler and cargo prerequisites and be versatile to this change.

What's more, rail innovations are utilized to expand openness and convenience. The advancements upgrade data trade over the upkeep forms. This, thusly, proposes the need to characterize and grow new advancements ready to oversee and utilize this data (Karim, Candell, So¨derholm, 2009). The e-support oversees railroad errands and data utilizing computerized advancements. E-Maintenance gives different advantages, for instance, expanded an incentive to clients, expanded accessibility, and diminished life cycle cost of railroad track (Kour, Ret al., 2014).

Nonetheless, creating e-upkeep requires the change of customary "come up short and fix" support practices to an "anticipate and avert" procedure (Djurdjanovic et al., 2006). It can coordinate creation frameworks, tasks frameworks, and remote client destinations, similar to those found in railroad industry (Kajko-Mattsson, Karim, Mirjamsdotter, 2010). In this unique situation, e-support gives dynamic data to the clients and to the whole railroad track framework. Creating and executing this kind of framework enables data to be handled continuously. Thusly, upkeep data can be utilized all through the entire framework life cycle of the rail.

2.4 Empirical Studies and Knowledge gaps

Hoque, Ahmed, Sharmin, Mahmud, Chandra Roy and Hassan (2017) led an investigation to evaluate e-ticketing administrations of Bangladesh Railway through the passage of TCV+ show. After usage of E-ticketing administrations, travelers gather ticket without visiting railroad station through E-Ticketing which possibly spare administration conveyance time, cost and number of travelers' visits to stations. This investigation was led to assess whether E-Ticketing spares time, cost and number of visit of the administration beneficiaries. In light of 384 examples, the investigation uncovered that normal time diminished by 75% in E-Ticketing than manual process, normal cost lessened by 84% to gather ticket in E-Ticketing and no visit is required as travelers utilize claim portable or PCs to produce tickets. As far as fulfillment 19% individuals were extremely fulfilled, 62% were fulfilled and 17% were modestly fulfilled.

Dark and van Geenhuizen (2006) led an investigation to address the impact of data and correspondence innovation (ICT) on feasible transport in two different ways, i.e. by looking at the connection between ICT utilize and transport request and by inspecting the immediate use of ICT in the vehicle framework. The investigation especially centered around subjective and quantitative effects of a few ICT applications on movement conduct (counting fatalities) and on contrasts in the potential appropriation of these advancements between the United States and Europe. The presentation of the institutionalized flagging, control and prepare assurance framework (European Train Control System, or ETCS) speaks to a key essential for making an effective cross-outskirt European rail arrange. This includes the advancement of movement procedures that will permit the financial and operational

advantages to be abused at the earliest opportunity, with the goal that the innovation, and accordingly the rail systems, will likewise be available to littler rail administrators.

Qteishat, Alshibly and Al-ma'aitah (2014) led an examination the effect of e-ticketing procedure on consumer loyalty in Jordan. The results indicated that e-ticketing in the rail sector enhanced freight and passenger flow. The study recommended the Jordan railway corporation to implement the initiative.

Harris, Wang and Wang (2015) led an examination on ICT in multimodal transport and technology. The point of our paper is to investigate the potential purposes behind such a moderate appropriation and evaluate how late innovative advances, for example, distributed computing and Internet of Things may have changed the scene and subsequently help to defeat these obstructions. By means of a broad audit of 33 EU systems program extends, the examination merges and shows current real endeavors in ICT improvements in the cargo multimodal transport setting at European level. The investigation commitment was two-overlay: it progresses current information by showing mode outline of existing and rising ICT applications in the field of multimodal transport and boundaries to e-empowered multimodal transport. It likewise catches a portion of the prescribed procedures in industry and expects to incite a discussion among professionals and scholastics through the investigation of how creative utilization of ongoing mechanical advancements could possibly bring down the obstructions to multimodal ICT selection.

Al-Douri, Tretten and Karim (2016) led an examination on change of railroad execution: an investigation of Swedish Railway Infrastructure. This contextual analysis examined the requirements of railroad partners in charge of investigating the track state and what data is important to settle on great support choices. The objective

is to enhance the railroad track execution by guaranteeing expanded accessibility, unwavering quality, and wellbeing, alongside a diminished upkeep cost. Meetings of eight specialists were embraced to learn of general zones needing change, and a quantitative examination of condition checking information was directed to discover more particular data.

The outcomes demonstrate that by executing a long haul upkeep methodology and by leading preventive support activities upkeep expenses would be diminished. Notwithstanding that, issues with estimated information, missing information, and mistaken area information brought about expanded and superfluous support assignments. The conclusions demonstrate that proactive arrangements are expected to achieve the coveted objectives of enhanced security, enhanced accessibility, and enhanced unwavering quality. This likewise incorporates the advancement of a perception instrument and an existence cycle cost show for support techniques.

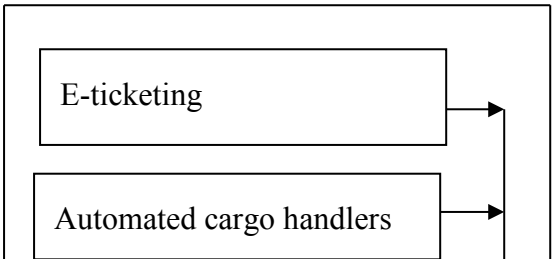
Božičnik and Schliephake (2005) directed an investigation on cargo transport advancements of European railroads - new market shots and innovative points of view. The paper examinations the principle specialized and monetary components of the present European rail cargo market and exhibits the fundamental ideas of conceivable new innovations in the rail cargo framework. New innovations are stood up to with different boundaries and troubles made by the current and prevailing mechanical ideal models. These are frequently sufficiently intense to keep the presentation of options and promising advancements. The experimental piece of the paper centers around the conceivable outcomes of consolidating the current inventive rail cargo innovations which could, with the fitting authoritative arrangements (time-tables) and political help, increment the aggressiveness of the rail cargo transport in new and promising business sector fragments.

Cortes, Serna and Gomez (2013) led an examination on data frameworks connected to transport change. Transport is a standout amongst the most significant components for the aggressiveness of organizations and urban areas. An insufficient transportation framework creates high expenses and low client benefit levels, which at last delivers a negative monetary effect for both. This article shows an outline of the innovation devices that are a piece of the ITS employed in enhancing the execution and security of transport, of load as well as of travelers, in various modes, for example, air, sea, rail and street. This article starts with a depiction of ITS, trailed by the introductions of their advantages and, at last, it displays a survey of the distinctive apparatuses for ITS.

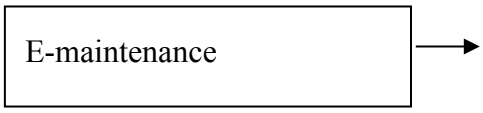
2.5 Conceptual Framework

It is the figurative representation of research variables (Anderson, Sweeney, & Williams, 2006). The study identified the following variables and their relationships which are given in the conceptual framework in Figure 2.1.

Figure 2.1: Conceptual framework



Dependent Variable



(Source: author, 2018)

The above chapter evaluated the different hypotheses that clarify the autonomous and ward factors. The reasonable system is drawn up from the checked on writing in accordance with the accompanying criteria, title, scope, technique shaping the reason in conducting the study. It is from these studies that the examination gaps both conceptual and methodological and contextual gaps are distinguished. The next chapter presents the methodology that the study will adopt so as to accomplish the expressed goals.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter sets out different stages followed in completing the study. It includes a gathering plan, estimation as well as investigation of information. The exploration approach distinguishes the methodology and strategies that were utilized in the gathering, handling and investigation of information to accomplish the targets of the examination.

The chapter starts with discussing the research design adopted for the study to ensure the study effectively address the research problem. It constitutes an arrangement of techniques and systems applied in collecting and investigating measures of the factors indicated in the exploration issue. Research design is a blueprint guiding the study.

The chapter also presents the data gathering techniques and data manipulation procedures. Under the data collection section, the study highlights the kind of data to be gathered, the instrument for data collection, the respondents and procedures for data collection. The section ends with a section on data analysis procures and how the analyzed data were presented.

3.2 Research Design

Research design alludes to how the specialist assembled an examination concentrate to answer an arrangement of inquiries. Research design fills in as a deliberate arrangement sketching out the examination, the specialists' strategies for assemblage, points of interest on how the investigation will touch base at its decisions and the restrictions of the exploration. Research configuration may fuse both quantitative and subjective investigation (McLaughlin, 2012).

The research design used was a case study since the unit of examination is one association. Case study research design inquire about is a philosophy which can take either a subjective or quantitative approach. In the subjective approach, contextual investigation alludes to the inside and out examination of a unit (Yin, 2009). The significance of a contextual investigation is stressed by Kothari (2004) who recognized that a contextual investigation is a great type of subjective examination that includes a cautious and finish perception of a social unit, independent of what kind of unit is under examination.

In this study, SGR formed the case study. The study sought to conduct an in-depth analysis of how technological strategies enhance railway transport in Kenya, the case of SGR. The nature of the study facilitated use of an interview guide approach to data collection so as to help have a deeper understanding of the subject matter. Case study approach was therefore deemed appropriate for this study.

3.3 Census Technique

Census method, in essence, is to count every individual of the population. A census can be defined as a process of listing all elements in a group and measuring one or more characteristics of the elements (Lavrakas, 2008). In this method, all the units of the population have to be investigated.

However, census method is tedious and difficult because it is time taking, it requires more labor and it is very expensive. The method is time consuming. There might not be sufficient resource when collecting data using census technique.

Since the population is small, the study adopted census approach. Therefore all the 15 top management of Standard Gauge Railway were used as a unit of analysis. The

respondents were the top management of Standard Gauge Railway. Therefore 15 top management personnel participated in the interview session.

3.4 Data Collection

The study gathered first hand data through the use of an interview guide. The data was collected from approximately 15 top management of SGR Corporation. The study specifically sought to get information from the staff at the management level since they are mandated to ensure successful implementation of technological strategies in the company and hence they are deemed knowledgeable and informed on the research problem at hand, hence expected to give reliable information.

The interview guide was deemed fit for the study since it facilitated in-depth research which yields most extravagant information, points of interest, and new experiences. The meeting aide allowed a close and personal contact with respondents; give a chance to investigate points thoroughly and enable the questioner to clarify questions, improving the chances of receiving valuable reactions.

The researcher sought permission to collect data from the respondents by getting the relevant letters from the university and from management of SGR Corporation. The researcher further made appointments with the respective respondents in the organization. A deadline was set by which the completed interview guides must be ready for analysis.

3.5 Data Analysis

Analysis of data characterized as the way toward assessing, cleaning, changing, and demonstrating information so as to get helpful data, proposing conclusions,

and supporting basic leadership. After receiving the data from the interview guides, the data was inspected and cleaned for purposes of data analysis.

The data collected for this study were qualitative data and were analyzed through content analysis which is an exploration system used to make replicable and legitimate inductions by deciphering and interpreting literary material. It is a flexible method and is extremely well-suited to analyze data on this sensitive phenomenon to arrive at analytical conclusions.

The qualitative data generated from the interview guides were therefore categorized in themes/concepts in accordance with research objective. This involved comparing the responses from each of the interviewees. The researcher further made inferences about the messages within the texts under the identified themes. The qualitatively analyzed data analyses were presented in prose (narrative) format.

This chapter outlined the methodology applied in the research study. It described the research design to be adopted, the data collection instrument and procedures, and the data analysis procedures which outline how the collected data will be summarized into meaningful results to address the research objective. The next chapter covers the analysis of data as well as discussion of the study results.

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

The previous chapter explained in detail the methodology and strategies applied in gathering primary data of the investigation: the determination and depiction of the units of examination, the courses in which in-depth interviews have been analysed, how the information has been broken down and the ways in which legitimacy and dependability have been guaranteed.

This chapter has the outcomes and exchanges of the primary data that the author has gathered using far-fetching interviews. According to the objectives of the study, the results are presented. The study objective was to explore the technological strategies in enhancing railway performance of transport in Kenya. The data collected were analyzed through content analysis and the findings compared with the objective of the study and theories anchoring the study. The data collected via in-depth interview was analyzed qualitatively. The method used to analyze data was content analysis. The researcher did this by converting data from audio to written form.

Ryan, Coughlan and Cronin (2009), reveal that content investigation is watchful, point by point efficient assessment and understanding of written document, in order to identify pattern, themes and meanings. Leedy and Ormrod (2005) urgue that content analysis is applicable in capturing participant's words in a text. A team of researchers used this method in which the listened to the words of the participant and tried to acquire the meaning and feelings of emphasis as presented in the text. Bryman (2004) asserts that subjective substance investigation technique is assumed to be the most

predominant method of dealing with the subjective examination of records and it entails seeking out important topics in the information being broken down.

Content analysis was found helpful here since it allows the measuring of the frequency of different categories. The researcher, utilizing content examination initially isolated the important parts of the content and then analyzed it by recording it in a separate form.

Eight (8) of the 15 participants took part in the study. The reaction rate was therefore 53.3% which is an acceptable rate of return. A reaction rate of over 50% is satisfactory as revealed by Kothari (2004).

4.2 Result Findings and Discussion

Rapid technological growth is shaping transport industry. The benefits of technological application in rail industry are immense. Some of technologies shaping rail transport include E-ticketing, automated cargo handlers, some forms of robotic technologies, Intelligent Transportation systems, Security systems and E-maintenance.

During an interview with senior management, participant I indicated, “The Company has invested in e-ticketing technology. E-tickets lower costs, saves time on queuing and increases operational efficiency”. Participant II noted, “e-ticketing services are future of operations for the company. The company is seeking to streamline operations and improve customer service”. Participant V said, “e-ticketing has helped the company in queue management”. It is evident that e-ticketing improves the booking system by promoting time management culture and it is also potential good strategy for promoting railway effectiveness. E-ticketing systems are increasingly added in transports systems. This has led to a reduced economic costs and time intervals as well as the system control is greatly improved. The results agree with

Hoque, et al. (2017) e-ticketing spare administration conveyance time, cost and number of travelers' visits to stations. The results agree with Ronggosusanto (2012) that e-ticketing increases the competitiveness of rail transport services that enable to create a multimode journey across the operators, flexibility by reducing the cash payment, and enhance attractiveness using rail transports.

Participant VI noted,

“SGR Company has introduced e-ticketing system strategy to increase the attractiveness of people to use rail transport and to increase convenience.” An automated ticketing system lead to an easier accessibility, flexibility, and reliability in rail transport will increase the attractiveness of people to use rail transport and reduce some of the problems caused by transportation. E-ticketing enhances maximum fulfillment to the users without the worry of losing tickets.

Participant III said,

“SGR Company is automating operations including queue management to make rail transport attractive as compared to other means including road transport. Operators of rail transport at SGR have already implemented the e-ticketing system, but the system is still improving”. Ticketing system is one of the services attributes that have an importance degree to increase the competitiveness and attractiveness of rail transports compare to road transport. By developing an automated ticketing system, the SGR Company tries to enhance the flexibility, accessibility, and reliability of rail transport.

Participant IV noted,

“E-ticketing reduces administrative costs while at the same time providing better services to the users. E-ticketing is very important in queue management”. The results are in agreement with ALCO, (2012), that the benefits of an electronic ticketing

system for are immense. E-ticketing create a multimode transportation across the operators, flexibility by reduce the cash payment and single ticketing system, possibility to offers the affordable price as well as discount opportunity, and enhance attractiveness using rail transports.

Moreover, the benefits for operators are; increasing the number of passenger, reduce operation cost and cash management, flexibility of pricing systems, speed up the dwelling time, and availability of data to analyze the services. Meenakumari (2015) in a study mentioned that E-Ticketing improves the service quality as well as enables ease of use, flexible mode of choice, save time and money. Mezghani (2008) in a study established that e-ticketing systems enhance payment systems while facilitating better management of rail transport. E-Ticketing avail the service recipients to buy ticket in a more convenient way (Karami, 2006).

Participant I noted,

“The Company has automated cargo handlers”. Today, the railway cargo company has made an internet portal, where they can concentrate all the important information regarding the transport and ancillary services in one place. Automation of operations has also led to increase in revenue collection through accurate billing.

Participant II said,

“Automation is transforming cargo handling. The standard dimensions of shipping containers facilitate the automation of intermodal freight transport. Automated stacking cranes and automated guided vehicles (AGVs) have been introduced to fasten cargo management at SGR”. The biggest improvement in rail freight productivity is cargo handling automation. The automation of cargo handling process

has led to the reduction of crew sizes. The future is bringing increased demands for greater efficiency and for more sustainable designs in cargo handling technologies.

Participant V added,

"Automation of cargo handling at SGR has led to the introduction of double stacked trains that are capable of carrying twice the quantities of heavy cargo at once". The use of double stacked trains minimizes the number of train trips, time and cost of transport. Through the use of train, SGR can counter many of its problems of rail transport and deliver its services efficiently and effectively. Embracing automated cargo handling technology will help SGR to have improved service delivery and hence become the efficient, reliable and effective freight rail service provider in the country.

Participant VI said,

"Automation is transforming cargo handling. The standard dimensions of rail containers facilitate the automation of intermodal freight transport. Automated stacking cranes and automated guided vehicles (AGVs) have been introduced. More recently, automated straddle carriers have been pioneered and introduced in Mombasa terminal. The kind of cargo-handling device used is determined by the nature of the actual cargo and the type of packing employed.

Technology in cargo management is critical in the rail industry. Loading and offloading cargo from the train require efficient automated machines. The results agree with Harris, Wang and Wang (2015) who led an examination on ICT in multimodal transport and technology and established that technology improvements has led to the growth of cargo multimodal transport. According to Božičnik and

Schliephake (2005) technology growth in the rail industry has enabled efficient cargo handling.

Participant VI indicated,

"The Company is in the process of acquiring intelligent transportation systems". Intelligent Transport Systems (ITS) will allow holistic, control, information and communication upgrade to classical transport and traffic systems, that allows notable improvement in performance, efficiency of passenger and cargo transportation.

Participant II noted,

"Intelligent Transportation Systems (ITS) will allow the integration of individual transportation elements and link them up using information and communication technologies into a single system". Intelligent Transportation Systems gives a chance to increase the use of existing transportation system and generate additional capacity from the existing physical infrastructure. The goal of rail ITS systems are increase efficiency and effectiveness and to increase safety of transportation. Applying communications and information technology in the rail transport sector, has resulted to the development of ITS which improve traffic efficiency and safety, with positive results for sustainable development. The results agree with Cortes et al (2013) that the ITS improved the functionality and safety of transport, not just of cargo but also of passengers, in different modes including rail transport.

Participant VII said,

"Through intelligent transport systems, we have been able to optimize freight processes using the appropriate exchange of information between rail management and cargo management systems. This permits the merging of these two sources of information and developing distribution plans for optimizing the number of trips and

the amount of cargo for each trip. This produces a lower total cost of the distribution system".

From the above, one can argue that ITS are the set of multiple applications that improve transport systems. These applications lead to improvements and benefits reflect in more efficient traffic control systems, better identification of goods and people, improved multimodal management, increased security and comfort in transport, real-time information, reduced costs, and many more. The findings are in line with Ranaiefar (2012) who suggested that the goal of Freight ITS systems are to increase efficiency and effectiveness, increase safety of transportation and reduce Environmental impacts of freight transportation. Intelligent Transport System (ITS) technologies allow easy flow of freight data across the system (Hodge, O'Keefe, Weeks & Moulds, 2015).

The development of identification technologies facilitate further logistics information exchange and acquisition and allow an accurate and fast tracing and tracking of shipments and this leads to substantial benefits, time savings, increase level of service (Ning, Tang, Gao, Yan, Wang & Zeng, 2006). In addition the provision of real-time information increases flexibility and responsiveness providing increased level of service with fewer resources.

Participant I said,

"e- Maintenance technology has been adopted by the company". Committing more to technology, more so in the freight market can be beneficial in regard to making the railway system efficient. Track maintenance costs can be minimized through the introduction of automated track maintenance technology and electronic and computerized systems can decrease the cost of administration. Moving to automated

systems and other technology has notable benefits. More examples are the capacity to operate longer freight trains safely on the system which contributed to the decreased costs for freight railways. The system has resulted in improvements in SGR freight management.

Participant VII noted,

“SGR Company has adopted e-maintenance technologies to identify rail defects”. Rectification and detection of rail malfunctions are the main issues for all rail companies around the world. Rail e-maintenance decisions covers rail lubrication, rail grinding and rail weld, rail material, rail traffic density and axle load and track geometry. Standards govern both the admission and maintenance of rolling stock.

Participant III noted,

“The SGR Company is on a process of acquiring ProRail system”. Participant V, said, “A framework is described and performance monitoring tool is proposed to enhance Performance Based Railway Infrastructure Maintenance (PBRIM) contracting as a strategy for improving the effectiveness of maintenance function”. The system will enable defects to be detected earlier and, as a result, may prevent potential incidents.

This can be done by tightening the standards governing the rolling stock (and infrastructure) and intensifying the supervision of compliance with the standards (rather than implementing a safety system that, in their opinion, is relatively expensive). The management and maintenance of railway infrastructure performs a pivotal role in making sure that the rail transport is reliable and available. In case of transport market whose competition is high, the rail industry is needed to employ new and innovative maintenance strategies that will place rail transport as an affordable and reliable transportation alternative.

In order to realize this, implementation of maintenance strategies that prioritize efficient resource allocation is done. Application of reliability-based techniques to make informed decisions in maintenance management, with an objective of minimizing operational expenditure while maintaining safety and efficiency, has been increasing. The results agree with Al-Douri, Tretten and Karim (2016) that rail maintenance costs would be minimized by implementing a long-term maintenance strategy and by conducting preventive maintenance actions.

The development of a visualisation tool and a life cycle cost model for maintenance strategies are vital in rail maintenance. Track maintenance must consider availability, reliability, and safety, and also be cost effective. Railway maintenance is crucial for increasing safety and to reduce costs. Participant VII indicated, "The SGR Company practices predictive maintenance and condition-based maintenance". Predictive maintenance strategies are used in defining maintenance over predetermined time intervals. Optimization and maintenance planning of predictive maintenance can be made more effective, which can minimize interruptions of train operation, lower the costs and ensure safety.

Timely decision-making for issues like safety, scheduling as well as system capacity can be improved by predictive maintenance program which monitors the state of the most relevant parts constantly. Now that rail transport is capital intensive and has a long life span, a long term and sustainable strategy is required in its operation and maintenance. Condition-based maintenance (CBM) is another strategy for sufficient maintenance before a failure occurs; it triggers maintenance when degradation occurs in the track. Condition Monitoring (CM) is required in order to realize this.

CM means that the status of the railway track condition is monitored, recorded, and reported so that maintenance actions can be done before a problem occurs, thus reducing breakdowns hence improving the overall track performance and lowers costs. The findings collaborate with Stenstrom (2014) that a model for monitoring and analysis of operation and maintenance performance of rail infrastructure is developed in order to facilitate improvements and optimization of decision-making in railways. The results are also supported by Fourie and Zhuwak (2017) that the maintenance and management of railway infrastructure is key in ensuring the reliability and availability of rail transport.

Participant V,

"There are various dangers affecting rail transport. By tending to these dangers, in a various ways, railroad more cost-viably addresses the fundamental. Expanding security system along the inventory network and between modes without obstructing the free stream of people and cargo will encourage the interoperability of transport security knowledge inside and between various transport networks". Rail should work with innovation suppliers to grow more successful security hardware that can identify interruption, animosity, vandalism, trespass, extortion and so on and in addition more protection agreeable arrangements in existing advancements, for example, cameras. There will be a more prominent dependence on computerized intercession and execution techniques.

Participant IV said,

"Technology plays a critical role in integrating security measures in the freight transportation/logistical system operations. The company has adopted Bar codes, Global Positioning Systems (GPS) and Radio Frequency Identification Devices

(RFID) in their operations". All these enhance visibility all along the supply chain, increasing in this way the efficiency and effectiveness in decision-making process (Kazanskiy & Popov, 2015).

Cargo scanning systems gives a substantial contribution in the performance of security systems. It can actually detect the specific type of item based on pulsed-fast neutron analysis (PFNA). The technologies are necessarily involved in order to support the acquisition, processing and communication of information between the different actors, terminals, and transportation modes. These data can be used either to optimize the various processes, i.e. terminal space allocation and loading/unloading plans (He et al., 2016). It can also provide services that expedite the inspection process i.e. pre-screening of containers.

Participant 1 added,

"Numerous technological developments and innovations result in increased safety. For example, mobile workplaces have been developed and commissioned for rail maintenance Systems have also been developed for video inspections of the track". Innovations are resulting in continual improvements in the collision safety of new trains. The Online registration system for the Transport of Dangerous Goods (OVGS) contains information about the transport of dangerous goods that enables the emergency services to work faster and more effectively following a disaster.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5:1 Introduction

The study was undertaken with the aim of in exploring the technological strategies in enhancing railway performance of transport in Kenya. This chapter summarizes the research findings, conclusion, recommendation for policy and practice, limitations of the study and suggestions for further study.

5.2 Summary of the Findings

The study adopted the case study research design. Data was gathered using an interview guide. Top management personnel at Standard Gauge Railway participated in the interview session. The conversation during the interview was transcribed.

It was established that SGR Company has invested in e-ticketing technology. E-tickets lower costs, saves time on queuing and increases operational efficiency. E-ticketing has helped the company in queue management. It is evident that e-ticketing improves the booking system by promoting time management culture and it is also potential good strategy for promoting railway effectiveness. Systems of E-ticketing are increasingly being introduced in transports systems and this has produced a decrease in the associated economic costs and time intervals and there is an improved control of the system. By developing an automated ticketing system, the SGR Company tries to enhance the flexibility, accessibility, and reliability of rail transport.

It was also found that the Company has invested automated cargo handlers. Automated stacking cranes and automated guided vehicles (AGVs) have been introduced to fasten cargo management at SGR. The automation of cargo handling

process has led to the reduction of crew sizes. The future is bringing increased need for more efficiency and sustainable designs in technologies of handling cargo. The automation of cargo handling at SGR has led to the introduction of double stacked trains that are capable carrying twice quantities of heavy cargo at a go. The use of double stacked trains minimize the number of train trips, transport costs and time. If this type of train is used, SGR will overcome many of its rail transport challenges and will be more efficient and effective in delivering its services.

ITS allows holistic, control, information and communication upgrade to classical transport and traffic systems, which allows positive change in performance, passenger efficiency and cargo transportation. The goal of rail ITS systems are increase efficiency and effectiveness and to increase safety of transportation. Applications of information and communications technology in the rail transport sector, have led to the development ITS which improve traffic efficiency and safety, with positive results for sustainable development.

It was also established that there are various dangers affecting rail transport. Rail should work with innovation suppliers to grow more successful security hardware that can identify interruption, animosity, vandalism, trespass, extortion and so on and in addition more protection agreeable arrangements in existing advancements, for example, cameras. The company has adopted Bar codes, GPS as well as RFID in their operations". These devices enhance visibility all along the chain of supply, increasing in this way the efficiency and effectiveness in decision-making process. Numerous technological developments and innovations result in increased safety. It was established that mobile workplaces have been developed and commissioned for rail maintenance Systems have also been developed for video inspections of the track.

It was also found that SGR Company has adopted e-maintenance technology. The costs of track maintenance can be minimized by introducing automated track maintenance technology and electronic and computerized systems can lower the administration costs. The e-maintenance technologies help in the identification rail defects. Globally, detection and rectification of rail malfunctions are the main issues. The development of a visualization tool and a life cycle cost model for maintenance strategies are vital in rail maintenance. Track maintenance must consider availability, reliability, and safety, and also be cost effective. In order to reduce cost and to improve safety, railway maintenance is important

5.3 Conclusion

This study concluded that technological advancement in the rail industry is changing how rail transport operates. It was concluded that e-ticketing technologies saves time on queuing and increases operational efficiency. By developing an automated ticketing system, the SGR Company tries to enhance the flexibility, accessibility, and reliability of rail transport.

It was also concluded that investing in automated cargo handlers has helped fasten cargo management at SGR. The automation of cargo handling process leads to the reduction of crew sizes. The automation of cargo handling at SGR has led to the introduction of double stacked trains that are capable carrying twice the quantity of heavy cargo at a go. The use of double stacked trains minimize the number of train trips, transport costs as well as time. Through adopting automated cargo handling technology, SGR is able to improve delivery of service to its clients, becoming the efficient, reliable and effective freight rail service provider in the country.

The study concluded that ITS allows holistic, control; information and communication upgrade to classical transport and traffic systems, which enable significant improvement in performance, efficiency of passenger and cargo transportation. ITS systems has helped SGR company improve efficiency and effectiveness and to increase safety of transportation.

The study concluded that there are various dangers affecting rail transport. The SGR Company has invested in security systems to identify interruption, animosity, vandalism, trespass, extortion and so on and in addition more protection agreeable arrangements in existing advancements, for example, cameras. The company has adopted Bar codes, GPS and RFID in their operations to enhance visibility all along the chain of supply, increasing in this way the efficiency and effectiveness in process of decision-making.

The study concluded that SGR Company has adopted e-maintenance technology to reduce maintenance costs. Electronic and computerized systems can minimize the administration cost while track maintenance costs can be reduced by introducing automated track maintenance technology. The e-maintenance technologies help in the identification rail defects. Railway maintenance is crucial for increasing safety.

5.4 Recommendations of the Study

The study recommends adoption of e-ticketing technologies as it helps save time on queuing and increases operational efficiency. By developing an automated ticketing system, the Company is able to enhance the flexibility, accessibility, and reliability of rail transport.

The company should also invest in automated cargo handlers to fasten cargo management at SGR. The automation of cargo handling process improves efficiency

of cargo leading and offloading. By adopting automated cargo handling technology, SGR is able to improve delivery of service to its customers, becoming the efficient, reliable and effective freight rail service provider in the country.

The study recommends the adoption of Intelligent Transport Systems (ITS) to allow holistic, control; information and communication upgrade to classical transport and traffic systems, which enable significant improvement in performance, efficiency of passenger and cargo transportation. ITS systems may help SGR company improve efficiency and effectiveness and to increase safety of transportation.

The study recommends the investment in in security systems to identify interruption, animosity, vandalism, trespass, extortion and so on and in addition more protection agreeable arrangements in existing advancements, for example, cameras. The company may acquire Bar codes, GPS and RFID in their operations to enhance visibility all along the supply chain, increasing in this way the efficiency and effectiveness in decision-making process.

The SGR Company may also adopt e-maintenance technology to reduce maintenance costs. Track maintenance and administration costs can be minimized by introducing automated track maintenance technology and electronic and computerized systems respectively. The e-maintenance technologies help in the identification rail defects.

5.5 Limitations of the Study

The findings of this research were limited due to some technicalities arising in the course of the study. The major challenge in conducting the study was due to the fact that the management of the bank would want to keep some issues regarding SGR confidential.

The method use to collect data also had same challenges because some respondents find it tedious and waste of time sitting with the researcher answering questions with a lot of probing as compared to other methods like questionnaire which has only "yes or no" answers.

The study relied solely on interview guide as the main data collection tool. This method is limited because we cannot quantify the data collected to show performance of SGR as a result of implementing technological strategies.

5.6 Suggestions for Further Research

The use of interview guide was quite limited. There was a need to complement it with a questionnaire. Further research can combine a questionnaire and in interview guide to measure the effects of technological strategies on firm performance.

The study was not exhaustive of the independent variables affecting performance of Standard Gauge Railway in Kenya and this study recommends that further studies be conducted to incorporate other variables like management efficiency, growth opportunities, organization culture, internal controls, corporate governance, industry practices, political stability and other macro-economic variables. Establishing the influence of each variable on performance of SGR will enable policy makers know what tool to use when maximizing shareholder's wealth.

REFERENCES

Chandrapala, P., &Knápková, A. (2013).Firm-specific factors and financial performance of firms in the Czech Republic. *ActaUniversitatisAgriculturaeetSilviculturaeMendelianaeBrunensis*.

Naz, F., Ijaz, F., &Naqvi, F. (2016). Financial Performance of Firms: Evidence from Pakistan Cement Industry.

Al-Douri, Y. K., Tretten, P., & Karim, R. (2016). Improvement of railway performance: a study of Swedish railway infrastructure. *Journal of Modern Transportation*, *24*(1), 22-37.

American Association of Railroads (2012). America's Freight Railroads: Global Leaders. Brief policy paper on the AAR website, published October 2012.

Bar-Am, M. (2015). *U.S. Patent No. 8,942,426*. Washington, DC: U.S. Patent and Trademark Office.

Beugin, J., & Marais, J. (2012). Simulation-based evaluation of dependability and safety properties of satellite technologies for railway localization. *Transportation Research Part C: Emerging Technologies*, *22*, 42-57.

Black, W., & van Geenhuizen, M. (2006). ICT innovation and sustainability of the transport sector. *European Journal of Transport and Infrastructure Research*, *6*(1), 39-60.

Božičnik, S., & Schliephake, K. (2005). Freight Transport Innovations of European Railways-New Market Chances and Technological Perspectives. *Promet-Traffic&Transportation*, *17*(1).

Candell O, Karim R, So¨derholm P (2009) eMaintenance—information logistics for maintenance support. Robot Comput Integr Manuf 25(6):937–944

Chen, X., & Lin, L. (2016). The integration of air and rail technologies: Shanghai's Hongqiao integrated transport hub. *Journal of Urban Technology*, *23*(2), 23-46.

Cheng, Y.-H. and Huang, T.-Y. (2014). High speed rail passenger segmentation and ticketing channel preference. Transportation Research Part A: Policy and Practice, 66(1):127-143.

Chernov, A. V., Butakova, M. A., & Karpenko, E. V. (2015, November). Security incident detection technique for multilevel intelligent control systems on railway transport in Russia. In *Telecommunications Forum Telfor (TELFOR), 2015 23rd* (pp. 1-4). IEEE.

Christurner, P. T. R., tiwarI, A., & Starr, A. (2016). A software architecture for autonomous maintenance scheduling: Scenarios for UK and European Rail. *COMPRAIL: Railway Engineering, Design and Operation*, *94*, 65.

Fourie, J., Herranz-Loncan, A., & Herranz-Loncán, A. (2015). *Growth (and segregation) by rail: how the railways shaped colonial South Africa* (No. 538).

Giannopoulos, G. A. (2004). The application of information and communication technologies in transport. *European Journal of Operational Research*, *152*(2), 302-320.

Grabara, J., Kolcun, M., & Kot, S. (2014). The role of information systems in transport logistics. *International Journal of Education and Research*, *2*(2), 1-8.

Gunselmann, W. (2005, September). Technologies for increased energy efficiency in railway systems. In *Power Electronics and Applications, 2005 European Conference on*(pp. 10-pp). IEEE.

Haneberg, D. (2008). Electronic ticketing: risks in e-commerce applications. In Digital excellence (pp. 55-66). Springer Berlin Heidelberg

Harris, I., Wang, Y., & Wang, H. (2015). ICT in multimodal transport and technological trends: Unleashing potential for the future. *International Journal of Production Economics*, *159*, 88-103.

He, R., Ai, B., Wang, G., Guan, K., Zhong, Z., Molisch, A. F., ... & Oestges, C. P. (2016). High-speed railway communications: From GSM-R to LTE-R. *Ieee vehIcular technology magazIne*, *11*(3), 49-58.

Herranz-Loncán, A. (2014). Transport technology and economic expansion: The growth contribution of railways in Latin America before 1914. *Revista de Historia Económica-Journal of Iberian and Latin American Economic History*, *32*(1), 13-45.

Hillmansen, S., & Ellis, R. (2014). Electric railway traction systems and techniques for energy saving.

Hodge, V. J., O'Keefe, S., Weeks, M., & Moulds, A. (2015). Wireless sensor networks for condition monitoring in the railway industry: A survey. *IEEE Trans. Intelligent transportation systems*, *16*(3), 1088-1106.

Jedwab, R., Kerby, E., & Moradi, A. (2017). History, path dependence and development: Evidence from colonial railways, settlers and cities in Kenya. *The Economic Journal*, *127*(603), 1467-1494.

Kajko-Mattsson M, Karim R, Mirjamsdotter A (2010) Fundamentals of the eMaintenance Concept. In: Anonymous 1st international workshop and congress on eMainteance, p 22

Kans, M., Galar, D., & Thaduri, A. (2016). Maintenance 4.0 in Railway Transportation Industry. In *Proceedings of the 10th World Congress on Engineering Asset Management (WCEAM 2015)* (pp. 317-331). Springer, Cham.

Karami, M. (2006). Factors influencing adoption of online ticketing. Master Tesis, Lulea.

Karim R, Candell O, So¨derholm P (2009) E-maintenance and information logistics: aspects of content format. J Qual Maint Eng 15(3):308–324

Kazanskiy, N. L., & Popov, S. B. (2015). Integrated design technology for computer vision systems in railway transportation. *Pattern Recognition and Image Analysis*, *25*(2), 215-219.

Kour, R., Karim, R., Parida, A., & Kumar, U. (2014). Applications of radio frequency identification (RFID) technology with eMaintenance cloud for railway system. *International Journal of System Assurance Engineering and Management*, *5*(1), 99-106.

Kriaa, S., Pietre-Cambacedes, L., Bouissou, M., & Halgand, Y. (2015). A survey of approaches combining safety and security for industrial control systems. *Reliability Engineering & System Safety*, *139*, 156-178.

Larue, G. S., Rakotonirainy, A., Haworth, N. L., & Darvell, M. (2015). Assessing driver acceptance of Intelligent Transport Systems in the context of railway level crossings. *Transportation Research Part F: Traffic Psychology and Behaviour*, *30*, 1-13.

Lee J, Ni J, Djurdjanovic D et al (2006) Intelligent prognostics tools and e-maintenance. Comput Ind 57(6):476–489

Mašek, J., Kolarovszki, P., & Čamaj, J. (2016). Application of RFID technology in railway transport services and logistics chains. *Procedia Engineering*, *134*, 231-236.

Meenakumari, J. (2015). Enhanced &Integrated E-Ticketing-An One Stop Solution. *International Journal*, 3(6)

Mezghani, M. (2008). Study on electronic ticketing in public transport. European Metropolitan Transport Authorities (EMTA), 56, 38

Murthy, M. N., Narang, S. N., Bankapura, S., & Pandian, P. S. J. (2015). *U.S. Patent Application No. 14/257,322*.

Ng-Kruelle, G., Swatman, P. A., & Kruelle, O. (2006). e-ticketing strategy and implementation in an open access system: The case of deutsche bahn. *Information Technology and Tourism*.

Ning, B., Tang, T., Gao, Z., Yan, F., Wang, F. Y., & Zeng, D. (2006). Intelligent railway systems in China. *IEEE Intelligent Systems*, *21*(5), 80-83.

Parida, A., Stenstr¨om, C. and Kumar, U. (2014) Performance measurement for managing railway infrastructure. International Journal of Railway Technology, vol. 2, no. 4, pp. 888-901.

Profillidis, V. (2016). *Railway management and engineering*. Routledge.

Qteishat, M. K., Alshibly, H. H., & Al-ma'aitah, M. A. (2014). The impact of e-ticketing technique on customer satisfaction: An empirical analysis. *JISTEM-Journal of Information Systems and Technology Management*, *11*(3), 519-532.

Ródenas, R. G., García, J. C. G., & García, M. L. L. (2017). Commercial actions management for railway companies. *Transportation Research Procedia*, *27*, 1250-1255.

Sahney, S., Ghosh, K., & Shrivastava, A. (2013). "Buyer's motivation" for online buying: an empirical case of railway e-ticketing in Indian context. *Journal of Asia Business Studies*, *8*(1), 43-64.

Siror, J. K., Huanye, S., Wang, D., & Jie, W. (2009, August). Application of RFID technology to curb diversion of transit goods in Kenya. In *INC, IMS and IDC,*

2009. NCM'09. Fifth International Joint Conference on (pp. 1532-1539). IEEE.

Soejima, H. (2003). Railway Technology in Japan—Challenges and Strategies. *Japan Railway Transport Rev*, *36*, 4-13.

Stenström, C. (2014). *Operation and maintenance performance of rail infrastructure: Model and Methods*(Doctoral dissertation).

Tampa B.. (2012). Private Passenger Train Would Change Rail Debate. As reported on the Tampa Bay Online website, 25.11.2012.

Thaduri, A., Galar, D., & Kumar, U. (2015). Railway assets: A potential domain for big data analytics. *Procedia Computer Science*, *53*, 457-467.

Tokody, D., & Flammini, F. (2017). The intelligent railway system theory. *International Transportation*, *69*(1), 38-40.

Tolley, R., & Turton, B. J. (2014). *Transport systems, policy and planning: a geographical approach*. Routledge.

Urry, J. (2016). *Mobilities: new perspectives on transport and society*. Routledge.

van de Velde, D., Nash, C., Smith, A., Mizutani, F., Uranishi, S., Lijesen, M., Zschoche, F. (2012). Economic effects of Vertical Separation in the railway sector, for the Community of European Railway and Infrastructure Companies (CER).

Woodrooffe, J. H., Ash, L. L., & Champion, J. (2000). *Rail Operations Efficiency Report*. Woodrooffe & Associates.

APPENDICES

Appendix 1: Letter of Introduction

University of Nairobi
School of Business
P. O. Box 30197
Nairobi

Dear Sir/ Madam,

RE: REQUEST FOR PARTICIPATION IN RESEARCH

I am post graduate student from University of Nairobi in pursuance of MBA in Strategic Management. I am completing a study on the technological strategies enhancing railway transport in Kenya, the case of SGR.

I kindly request you to assist me collect data from the corporation. The data given will be utilized purely for the study purpose and will be held in strict confidentiality.

Yours faithfully,

Lin Jincheng

Appendix II: Interview guide questions

This interview guide is aimed at gathering information about on **the technological strategies enhancing railway transport in Kenya, the case of SGR.** The information will be held in total confidence and will be used for the purposes of this study.

1. What are some of technologies strategies used by SGR to enhance railway transport? Explain how they are used to enhance railway transport at SGR
   a) ……
   ……

b) ……
……
……

c) ……
……
……

d) ……
……
……

2. How has e-ticketing technological strategy enhanced railway transport?

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……

And if the organization has not adopted e-ticketing technological strategy, what are the reasons?

……
……

3. How has automated cargo handlers technological strategy enhanced performance of railway transport?

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……

And if the organization has not adopted this technology strategy, what are the reasons?

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……

4. In what way has the adoption of intelligent transportation systems technological strategy at SGR enhanced performance?

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……

And if the organization has not adopted this technology strategy, what are the reasons?

……
……

5. In what ways has the company implemented security systems technological strategy at SGR and how has it enhanced organizational performance?

   ……

   ……

   And if the organization has not adopted this technology strategy, what are the reasons?

   ……

   ……

6. How is e-maintenance technological strategy enhancing organizational performance at SGR?

   ……

   ……

   And if the organization has not adopted this technology strategy, what are the reasons?

   ……

   ……

THANK YOU FOR PARTICIPATING