ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES

MBA PROGRAM IN PROJECT MANAGEMENT

THE PRACTICE AND CHALLENGES IN IMPLEMENTING GPS AND RFID TECHNOLOGIES: THE CASE OF CONTAINER AND CARGO HANDLING IN ERCA

BY:

AMHA TESFAYE

JANUARY 2018
ADDIS ABABA, ETHIOPIA

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LIST OF ACRONYM

NFMS	National Fleet Management System
ECTS	Electronic Cargo Tracking System
SPFMS	Service Provider Fleet Management System
ICT	Information Communication Technology
INSA	Information Network Security Agency
GPS	Global Positioning System
GPRS	General Packet Radio Service
SMS	Short Message Service
RFID	Radio Frequency Identification

Abstract

GPS and RFID systems are products of the very latest advancements in the vehicle tracking and fleet management technology. GPS tracks the movement of vehicles, relaying information about the speed, fuel consumption, and relative location of the vehicles in terms of latitude and longitude while RFID uses radio frequency waves to transmit information about the safety of goods in transit. The Revenues and Customs Authority of Ethiopia has launched this electronic cargo tracking system on the road between Addis Ababa and Djibouti Port.

***This** study was carried out to assess the practice and challenges in implementation GPS and RFID technologies: the case of container and cargo handling in ERCA in the country's logistic sector on 56 participants divided into two groups of samples namely, vehicles who have implemented the tracking system, or treatment (implemented) group, and those who have not, or the control group. Control (non-implemented) groups are used to avoid the problem of intervening variables (variables that are affecting the output of the research other than independent variables). The researcher used propensity score matching analysis.*

This study demonstrated that the use of RFID and GPS tracking technology is strongly associated with lower fuel and maintenance cost, shorter trip duration and a higher turnover of trips. The study also showed that the tracking technology has eliminated unsanctioned trips and illegal night driving. It has also been shown that it has prevented drivers from transporting unauthorized goods since the system monitors that the vehicles are not carrying any weight above that is indicated on the manifest.

KEY WORD

Radio frequency identification, global positioning system

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

Transport and logistics sectors are both key components of a successful economy. Governments widely seek to increase their competitiveness through constructing new infrastructure. The transport and logistics sector plays a major role in world economy and is a significant contributor at national and local level in any country. This sector supports the economy, enabling the efficient movement of goods, services and people. The increase in the concomitant management requirements of fleet operations has outweighed the human mental capacity as advances in the technology of vehicular dynamics and design increase year after year. Over the past decade, firms have undergone unprecedented changes due to the forces of globalization and internationalization, and the rapid advance of information technology (Chan & Peel, 1998). As a result, they gave higher value for competition, which in turn increased availability and flexibility of products/services (Ahmad &Schroeder, 2001) as well as the need to give greater attention to internal and external customer needs (Marjanovic, 2009).

Thus, firms are no longer able to satisfy the various demands of their customers effectively only by providing a product with an affordable and competitive price. They must also increase the performance of the product in terms of reaction speed, delivery policy, information services and flexibility. For this reason, firms are, in many instances, being forced to redesign their internal processes using different methods. Today, information technology (IT) is recognized as one of the most prevalent facilitators of such process changes (Chan & Land, 2000). Technology not only changes our life, but also changes the way we do business through the reduction of the total cost of running a business, saving time, and simplifying the general process. As a result, new advances in technology have become an integral part of companies in today's fierce market competition**.** IT not only enables firms to redesign their internal processes, but it also helps them to improve their competitiveness in both local and international markets (Motwani& Kumar, 2010). Nowadays, there are different technology products utilized in logistics sector for tracking the movement of goods and products, such as Automatic Identification (Auto-ID), Global Positioning System (GPS), Global Information

System (GIS), Radio Frequency Identification (RFID) and Electronic Data Interchange (EDI). However, a complete tracking system that combines all these advanced technologies is considered as the best option. These technologies used for tracking purpose help companies by preventing unnecessary extra expenses related to additional fuel consumption, frequent vehicle maintenance, employee overtime, etc as they ensures close monitoring and promote the operation of companies at optimal efficiency. For example, excessive vehicle idling not only uses fuel, but also causes unnecessary engine wear and tear.

GPS and RFID in particular are tools of the very latest advancements in the vehicle tracking and fleet management technology. GPS tracks the movement of vehicles, relaying information about the speed, fuel consumption, and relative location of the vehicles in terms of latitude and longitude. RFID is another useful technology that uses radio frequency waves to transmit information about the safety of goods in transit – used particularly to find out if the sealed container carrying the goods has been opened prior to reaching its destination.

In Ethiopia, large number of trucks carrying containers travel to different destinations every day. It is estimated that there are about 10,000 vehicles operating for import and export companies in Ethiopia. The number of trips made by these trucks carrying containers is very high, and only a small percentage of the containers are inspected. Losses of containers loaded due to theft, accidents and damages, and fleet unavailability is unfortunately increasing time to time. It seems like no local studies have been conducted about the practice and challenge of the implementation of the new technology on the logistic system in Ethiopia, particularly in companies under the supervision and control of ERCA. (ERCA Annual Report, 2016).

1.2 Statement of the Problem

GPS and RFID tracking aims to resolve the problem of securing the supply chain without interrupting the journey of the trucks. The Revenues and Customs Authority of Ethiopia (ERCA) has launched an electronic cargo tracking system on the road between Addis Ababa and Djibouti Port. The system, which began implementation in 2014, integrated two technologies for the tracking purpose; Radio frequency identification (RFID) and Global positioning system (GPS), These technologies give real time information and provide remote container vehicle tracking and monitoring helping to prevent losing asset load, fleet unavailability, unplanned cost and damage, as well as provide actionable information in order to retrieve goods or minimize damage. The container and cargo monitoring team will also be able to make the flow of vehicles secure and fast, by sharing information across all involved parties such as supply chain partners, ERCA, and some government agencies timely.

This study intends to assess the practice and challenge of implementation GPS and RFID technologies to container and cargo handling, to understand the consequences of the project in the few transport companies who have fully implemented the technologies. Thus, the research intends to explore the changes in the optimization of the logistic system practice and challenge the implementation of GPS and RFID tracking, in relation to container and fleet handling, improvement of the supply chain, efficiency and reduction of costs, achievement of a more efficient and individual container traceability, status of theft, diversion and counterfeiting, and security.

Transport companies' operations are plagued with different setbacks among which are the vehicles covering more kilometers than it is necessary to travel to their destination, high rate of accidents, and unauthorized people opening doors of sealed containers (while sealed, container doors must be opened by ERCA authorized employee only). To solve the above problems, ERCA have been using manual inspections of the vehicles at different stations for several years. However, this manual controlling system has been utilized in a few stations and proved to be inadequate to solve the problems seen in the logistic system. A study by Tsegaye (2016) also implicated the limited use of modern technologies such as RFID, GPS and GIS controlling systems in the transport sector as one of the major challenges gripping the logistics system in Ethiopia. The GPS and RFID system that has been implemented in Ethiopia 2014 was planned to

improve the efficiency and effectiveness of the logistic system of the nation. The GPS and RFID system can be controlled using computer and cell phones, while the vehicles move to any place within the borders of Ethiopia. A study done in Kenya on the vehicular fleet of the Power and Lighting Company that travels to three regions of the country demonstrated the positive effect of GPS and RFID technology on the overall running of the logistic system. The study focused on assessing the fleet availability and accident reduction and revealed that the companies with the system installed had a much better availability and a lower accident rate than those who have not. The study did fail to mention the challenges encountered during the implementation of the system, and its shortcomings include not including the assessment of fuel and maintenance cost. Our study assesses the challenges faced during the enactment of the technology, and tries to reveal the changes brought about by the system by comparing the vehicles who have installed the GPS and RFID tracking with those who have not. No local studies have been conducted so far in that effect, particularly in the companies under the supervision and control of ERCA. Therefore, this study aims at filling up the existing knowledge gap due to differences in the contexts of import-export system and those from abroad. The study carried out by Tsegaye (2016)to identify problems in the logistic system in our country has suggested to have an information technology based system implemented in the logistic sector, but has not gone beyond that and assessed the practices and challenges implementation of GPS and RFID. Because no study is done in Ethiopia about the advantages of using the new technology, some logistic companies are reluctant to accept and implement it. This research has been designed to extensively study the success and shortcomings of the practice of the new technologies, and identify the challenges as well as advantages of its full implementation.

Research Question

The research attempts to answer the following questions:

1. What are the challenges in the implementation of the GPS and RFID on logistics system?
2. What are the practices and contributions of the GPS and RFID (reducing accident, fleet operation cost, Improve fleet availability) in the logistic system of the nation?

1.3 Objective of the study

1.3.1 General Objective

The general objective of this study is assessing the practice and identifying the challenges in the implementation of GPS and RFID tracking in the logistic system of transport companies working under ERCA.

1.3.2 Specific Objective

- To assess the practice of the new technologies in transport companies who have already reached.
- To identify the challenges of using the new technologies and ways to overcome the challenges faced by the ERCA Managers and other employees, drivers, service providers and transport company logistics managers.

1.4 Significance of the study

This study intended to contribution the benefits of adopting technologies in the logistic sector in Ethiopia, and the challenges of adopting thereof. The container and cargo tracking services provide many benefits for logistic system, among which are improvement in security, reduction of unnecessary cost, and other social and economic benefits. The research hopes to uncover the benefits that companies are enjoying by adopting the tracking technologies. The results of the study will encourage more transport companies to be aware of the advantages of the tracking system and eventually adopt the technology. The study also assesses and identifies the challenges hindering companies from adopting the technology, and this will help ERCA to take the appropriate measures to ensure that these problems are curbed. Identifying the challenges will also help the transport companies who are using the technology to further improve their fleet planning and management system. The study might be useful to other stakeholders in terms of improving service delivery to international and local markets. By identifying problems in the security of goods being transported across the country and suggesting ways to solve them, the study could also help to attract investors who are reluctant to invest in our country because of the poor security in the transport sector.

1.5 Scope of the study

As discussed in the previous sections, transport companies have fully adapted the new technologies, while others are still in the implementation phase. This study focuses on c the practices and challenges of the project fully implementation, and also intends to identify the contributions of the GPS and RFID tracking in the logistic system in terms of reducing accident, maintenance cost, fuel and working hour.

The study only focuses on the RFID and GPS tracking technologies, and is limited to transport companies that adopted the technologies. From the nine stations operated by ERCA to control and monitor the vehicles and assets along the Addis Ababa–Djibouti transport corridor, a select three (Adama, Mojo, Kaliti) will be included in the study. There was also difficulty in obtaining data from the transport companies about their vehicles, due to the lack of practice of recording the day to day operation of the companies.

1.6 Organization of the study

This study has five chapters. The first chapter deals with background of the study, statement of the problem, objectives of the study, significance of the study, the scope of the Study, Limitations of the Study, organization of the study, and operational definition of terms. The second chapter Reviews Literature related to the concepts of the problem area. Chapter three deals with Research design and methodology including the sources of data ,the study population, sample size and sampling technique, procedures of data collection, data gathering tools, methodology of data analysis. Chapter four would include presentation of data analysis and interpretation of the findings. Chapter five would incorporate the summary, conclusion and recommendations of the study.

1.7 Definition of Terms

Relevant terms, words, or phrases which have special or unique meanings in the study are defined:

- RFID (**radio frequency identification**) is a technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal, or person.
- GPS (**Global Positioning System**) is a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world.
- A **GPS tracking** unit is a device, normally carried by a moving vehicle or person, that uses the **Global Positioning System** to determine and **track** its precise location, and hence that of its carrier, at intervals.
- **Ethiopian Revenues and Customs Authority** (ERCA) is the body responsible for collecting revenue from Customs duties and Contraband is an illicit act which has harmful effect on the socioeconomic development of a country. To avert the adverse effects of contraband most countries of the world take preventive measures. In Ethiopia the responsibility to prevent contraband rests with (ERCA).

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Introduction to the Literature Review

This chapter contains a review of existing literature on logistics and fleet management systems. Specifically, the chapter describes the main characteristics of the various types of fleet management Technology, especially the challenge and practice new technology implementation of tracking and tracing of shipments; In practice, there are several tracking systems available through GPS, GIS , RFID , Barcode, EID etc…However, all these systems are not fully compatible for industry. Most of the available tracking and tracing systems utilize proprietary tracking numbers those technology it can be help by: lower costs; improved customer service; heightened theft and security issues; information-sharing; regional multi-modal logistics growth; and the proliferation of new complex tools with which to optimize route scheduling.

The chapter also critically examines both the historical development of the fleet management systems technologies in transportation and also certain proven research concepts, principles and applications of new technology which are used in this study. These concepts, principles and applications provide an understanding and knowledge of the economics of the operations of a fleet as a result of the utilization of the intelligent electro cargo tracking systems. The chapter also evaluates the accrued benefits of real-time data in prompt decision making, while the improvement in the various aspects of fleet operations underscores the need for transport and logistics service providers to implement real-time fleet management. Finally, the chapter ends with a brief, concluding summary.

2.1.1 Definitions of Logistics

"Logistics" was originally use as an military term which defined as "a branch of military science having to do with producing, maintaining and transporting material, personnel and facilities." in Oxford English Dictionary. However, with the times goes by, in the modern days, it is used in a business term. Department of Trade Industry (**DTI**) and The Chartered Institute of Logistics and Transport (**CILT**) mentioned that the objective task of logistics is to distribute right products with

exact quantity and quality and moving it at the proper time to the right place with the right balance cost (**CITL** 2010).

The US-based Council of Supply Chain Management Professionals gives the definition of logistics management "Logistics management is part of supply chain management that plans, implements, and controls the efficient, effective, forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' requirements." Magan also stated '8Rs' of logistics in his book, namely, the right way, the right product, the right quantity, the right quality, the right place, the right time, the right customer and the right cost (Magan 2008).Logistics can be defined as the flow of materials, information, and money between consumers and suppliers (Frazelle, 2010). Similarly, Waters (2011) describes logistics as 'the function responsible for the flow of materials from suppliers into an organization, through operations within an organization, and out to customers'.

Logistics can also be defined as the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory through the organization and its marketing channels in such a way that current and future profitability are maximized through the cost effective fulfillment of orders (Christopher, 2011). On the other hand, logistics is defined in the Council of Supply Chain Management Professionals' Supply Chain Management Terms and Glossary (2012) as:' The process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements.'

Tilanus (1997) also defines Logistics as 'the process of anticipating customer needs and wants; acquiring the capital, materials, people, technologies, and information necessary to meet those needs and wants; optimizing the goods- or service-producing network to fulfill customer requests; and utilizing the network to fulfill customer requests in a timely way'. Simply to say, 'logistics is customer-oriented operation management'. Therefore, with these definitions in mind, logistics can be defined as: the management of the flow of goods from production through to after sales service, including: transportation, warehousing, inventory management, packaging, etc. Generally, the **IMF** (International Monetary Fund) report (2013), logistics costs average about 12 percent of the

world's gross domestic product. The report noted that for many firms, after the cost of goods sold, logistics represents the highest cost of doing business.

Logistics' role is to provide time and place utilities. Time and place Utilities facilitate the creation of global scale and scope economies while enhancing a firm's ability to provide high levels of seamless customer satisfaction (McGrath and Hoole, 2011). Similarly, Ronald (2012) argues that for many firms throughout the world, logistics become an increasingly important value-adding process for a number of reasons. Concerning logistics practices Lambert & Stock (2013) argues that good logistics practices can create a competitive advantage. More specifically they claim that best logistics practice plays an important role in three critical elements of the marketing concept. These elements are customer satisfaction; integrated effort and company profit (Lambert & Stock, 2011 as cited in Anna and Konrad, 2010).

Generally, the above arguments indicated that good logistics practice is increasingly recognized as the key enabler, which allows a company to gain and maintain its competitive advantage and ensure maximum customer satisfaction.

2.1.2 Customer Response

According to Frazelle (2010) the logistics of customer response includes the practices of developing and maintaining a customer service policy, monitoring customer satisfaction, orders entry (OE), order processing (OP), and invoicing and collections. Ronald (2012) argues that customers have been increasingly sensitized to expect quick response to their demands. He pointed out that rather than consumers having to accept the "one size fits all" philosophy in their purchases, suppliers are increasingly offering products that meet individual customer needs. This showed that the level of customer satisfaction shall be measured to make the required corrective action. Similarly, Frazelle (2012) argues that in today's just-intime world the ability to respond to customers' requirements in ever-shorter time-frames has become critical. Most authors and practitioners agree that building and enhancing long-term relationships with customers generates positive returns to firms.

Generally, the seasonality of footwear consumption in developed countries makes response more sensitive. Besides the firm level constraints for response, the country's infrastructure quantity and quality, mainly transport has a paramount influence on the customer.

2.1.3 Transportation

Transportation is one of the most visible element of logistics operation it provides two services product movement and storage. It is the movement of people, animals and goods from one location to another. Modes of transport include air, rail, road, water, cable, pipeline and space. The field can be divided into infrastructure, vehicles and operations. Transport is important because it enables trade between persons, which is essential for the development of civilizations (Coyl*et.al*, 2014).Transportation physically links the sources of supply chosen in sourcing with the customers we have decided to serve chosen as a part of the customer service policy (Frazelle, 2012).

Similarly, Frantisek (2013) describes transportation as a basic element of the logistics activities which runs from vendors through to you, to your customers. Transportation plays a connective role among the several steps that result in the conversion of resources into useful goods in the name of the ultimate consumers. Frazelle (2012) states,' the objective of transportation as to link all pick-up and delivery-to points within the response time requirements of the customer service policy and the limitations of the transportation infrastructure at the lowest possible cost.' On the other hand, Tyndall and colleagues (2013) argues that the most significant advances in modern logistics practices have not been in cost reduction, but in improved processes to move goods and material between nations in a timely and seamless manner. The study by Bemnet (2004) on Ethiopian transport system explored that transport costs are very high in Ethiopia.

2.2 Leveraging ICT in Transport Business Processes

In today's Supply Chain Management (SCM) practices, a successful strategy depends more and more on the performance of Third Party Logistics service providers (3PLs) (Morash,2001). Accordingly cooper, logistics providers play a key integrative role linking the different supply chain elements by the management of information flows connected with the entire delivery process of goods (Cooper 2002). In such scenario, Information and communication Technology (ICT) is becoming one of the main drivers of changes in the 3PL industry, posing new strategic challenges to logistics companies. ICT developments are more and more influencing the transport and logistics service market and give rise to new organizational forms for these services.

Information and communication technology (ICT) may be defined as those technologies that enable the recording, processing, retrieval and the transmission of information or data. Herselman and Hay

(2013) describe ICT as technologies that support the communication and co-operation of "human beings and their organizations" and the "creation and exchange of knowledge while Yu (2013) considers ICT to be a range of technologies that allow the gathering, exchange, retrieval, processing, analysis and transmission of information. In other words, ICT may be described as any tool that facilitates the communication, processing, transmission and sharing of information and knowledge through electronic means.

Rwashana and Williams (2010) maintain that ICT encompasses a range of electronic digital and analogue devices such as radio, television, telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the internet, but excludes the non-electronic technologies. According to Selwyn (2010) refers to ICT as "an umbrella term that includes computer hardware and software; digital broadcast and telecommunications technologies as well as electronic information repositories such as the World Wide Web or those found on CD ROMs". Sewyn further describes ICT as a strategic tool that allows users to become more efficient and effective.

In recent times, there has been an increasing need for stronger cost control as well as a sensitive demand for higher returns in businesses. The use of ICT in order to gain competitive advantage has become a key strategic issue in organization in a fast globalization environment. Particularly as a result of the fact that ICT plays a strategic role in the management for any organizations, among others emphasis the positive relationship between ICT and its benefits. This implies that ICT may bring about organizational advantage. There are immense possibilities as regards ICT applications in transportation and logistics and various studies have noted several types of application, each one contributing to the transportation and logistics system in a unique way.

ICT also known as logistics information technologies (LIT), may represent a major component of an organization's investment and includes the hardware and software expenditures associated with logistical activities such as ordering, warehousing, inventory and transportation management (Savitsikie, 2013). ICT applications emerged in the mid to late 1970s with electronic data interchange (EDI). This enabled a new form of chain management as a first step in the development of various e-commerce applications (Allen, 2001). E-commerce refers to any form of economic activity that is conducted by electronic means between two parties and includes the exchange of information (Hesse, 2002). However, the high price and non-standardization of e-commerce

applications meant that there was a limited degree of implementation as only large organizations were able to afford such technologies. Meanwhile, various hardware and software applications were produced. According to Vahid (2010), these applications were aimed at improving infrastructure and traffic and fleet management, facilitating the effective tracking of goods across the transport networks and also improved businesses and administrations connections. According to sarac Radio frequency identification (RFID) has proven to be an efficient, automatic identification and data capture technology. According to Parotti (2010) proposed a categorization of the main ICT applications available for cargo transportation companies in terms of three application types:-

a) Transportation fleet and cargo management,

b) Supply chain execution and

c) Field force automation.

De Jong, Algers, Papola and Burg (2010) conducted a survey on the perceptions of users of the impacts of new technologies on urban distribution systems performance. The survey found that the use of ICT is expected to reduce the share of empty and not fully loaded vehicles. When coupled with logistic innovations it is possible that developments in e-economy technology may bring about changes to the load factors. On the other hand, the use of technological tools may increase the number of small vehicle trips in the cities. Currently, there is rapid development in the use of ICT in organizations. ICT plays a crucial role in the present knowledge-based economy and, hence, organizations tend to rely heavily on ICT solutions in order to develop and grow their businesses (Asgarkhani& Young, 2012).

According to shanker the revolution in the use of ICT has profound implications for both economic and social development and has, in fact, pervade every aspect of human life (Shanker, 2012). The application of ICT is widespread with ICT being regarded as an essential tool in the efficient administration of any organization and the delivery of services to clients. Schware (2012) maintains that ICTs are being integrated into procedures, structures and products throughout businesses, governments and communities. The use of ICT increases the supply of information as ICT plays a key role in information sharing and dissemination.

According to Spanos, Prastacos and Poulymenakou (2012), ICT removes distance and time constraints in the accessing of required information flows. In addition, ICT reduces the cost of

production as knowledge is produced, transmitted, accessed and shared at the minimum cost, while there is also a reduction in the degree of inefficiencies and uncertainty because it enables businesses to interact more efficiently (Buhalis, 2012). Shanker (2012) is of the opinion that the use of ICT in many organizations has assisted in reducing transactional costs and, overcoming the constraints of distance by cutting across geographic boundaries; it has also contributed to improving the coordination of activities within organizational boundaries. According Spanos (2012) maintain that ICT enables buyers and sellers to share information and transfer goods across national borders and this, in turn, helps to increase access to global supply chains. ICT has also led to increased transparency in organizations as it enables the networking and information sharing that results in demands for greater openness and transparency.

(Kollberg & Dreyer, 2013) further argue that ICT plays an important role in the acquisition, creation and management of knowledge as it enables the diffusion of the organizational data that may be crucial in effective decision making and control at all management levels. Similarly, ICT helps in organizational planning and improves organizational communication and flexibility. Currently, the extensive use of ICT is changing the way in which people and companies work. The benefits of ICT include the saving of inputs, general cost reductions, higher flexibility and improvement in product quality (Mouelhi, 2013).

Ascertain that ICTs play a major role in networking and communication as firms use these technologies in order to facilitate communication among employees and reduce coordination costs. According to Hanna (2013), ICT enhances the production process in organizations as monitoring technologies may be used to reduce the number of supervisors required in the process. In addition, Arvanitis and Loukis (2014) maintain that the use of ICT has direct implications for firms, with ICT playing a role in areas such as information gathering and dissemination, inventory control and quality control. More specifically, ICT transportation fleet and cargo management applications have been defined as decision support tools in transportation planning, optimization and execution. Applications help planners to choose transportation modes, manage freight consolidation operations and coordinate company shipments. In addition, they may be used as reporting tools by logistics managers who need to know vehicle travel times, service times and the delivery points that were visited.

Supply chain management applications are designed to manage and automate the flow of products through the entire transportation process and all its phases tracking technologies in logistics networks are implemented fairly little in the global technology industry. Mostly high volume of global industries are implemented this technology with limited capabilities. The basic methods for all these tracking systems are usually confined for the customer to access the tracking information are within the area of tracing the shipments through manual queries such as using a www-site or telephone call, e-mailing, fax or to engage in developing systems interfaces or integrating with the tracking system. Specifically, they support functions related to information exchange. The field force automation applications, enabled by mobile technology provide a significant opportunity for both savings in operational costs and improvements in customer satisfaction as a result of the higher integration between remote workforces and the corporate business processes (Marchet 2015).

2.3 Deployment of ICT and applications

ICT are major potential influences on the mobility of people and goods. ICT are also potentially important enablers of changes in social and organizational practices, thus affecting the demand for transport in spatial and temporal terms. Technological trends will meet the demand for comfort, safety and speed through advances in ICT and telematics (traffic and transport management systems, travel information and reservation systems, vehicle guidance systems, mobility cards).

Overall business growth is likely to cause an increase in road traffic and hence, an increase in CO2 emissions. Road transport alone represents about 84% of all transport related CO2 emissions. With 98% dependency on oil, the transport industry not only has a big impact on air quality and greenhouse gas emissions, but high oil prices also have a significant influence on the transport sector and the economy as a whole. The use of ICT has been identified as possible way in which to reduce the cost of travel while ICT may also be an enabler for both front-end and back-end processing in a supply chain. Access to information by all of the parties in a supply chain may serve to ensure that logistical services are more accurate, swift and less costly according to Piplani, Pokharel and Tan (2012) the fact that the supply chain involves several steps, the impact of ICTs may save costs at every step and at every interface between the supply chain partners.

According to the European Commission DG Energy and Transport (2011), some software and information systems can improve both mobility and transportation management. These systems

provide innovative services and create favorable technical conditions for enhancing quality and efficiency while maintaining safety standards. A document on freight distribution management identifies the innovative e-logistics as best practice for improvement in transportation management. A number of ITS applications (e.g. web-enabled information and booking services, delivery notification and information through mobile telephones, trip planning and resource optimization, GPS-based vehicle location systems, long range, wireless communications, and others) enable the user to manage his/her logistical resources in such a way as to realize flexible, demand-driven freight distribution schemes.

Davies, Mason and Lalwani (2013) conducted a field survey focusing on the United Kingdom and examined the extent to which internet freight exchanges and the use of ICT processes are affecting general transport. They found that 85% of their respondents considered ICT important for their companies, while there was a positive association between fleet size and the importance of ICT. It emerged that 56% of the respondents were using ICT for vehicle routing and planning, 33% for vehicle tracking and 13% for vehicle telemetric. According to the opinion of 69% of the respondents, the freight exchanges were helpful only in the area of less empty running. However, in all the other areas, including choice of loads, reducing the time required to find backloads, reducing the cost of finding loads and the accuracy of information, the usability was not confirmed. They concluded that, when the industry structure is characterized by an extremely large number of smaller operators, there is a well-developed adoption of ICT and also a widespread reliance on the traditional means of operation.

Bertolini (2011) analyses the practice of ICT on supply chain processes in the specific case of the Italian footwear industry. The main aim of the study was to quantify the current supply chain lead time (the entire process from manufacturing the product until the product reaches the final customer) of the industry and to simulate the impact of the adoption of ICT tools as a viable way in which to reduce the supply chain lead time. They found that advanced ICT tools have the potential to significantly reduce the lead time of most of the logistical processes while also resulting in substantial improvements in the integration of firms and their suppliers. The findings of Sarac et al. (2011) on the impact and practice process of ICT show that RFID technologies may offer several advantages to supply chain management through enhanced traceability, as well as the improved visibility of products and processes all along the supply chains. Other advantages include an

increase in the efficiency and speed of processes, improvements in the accuracy of information and a reduction in inventory losses.

Wang (2012) also focused on the way in which RFID can improve the information flow of a construction supply chain. Through the analysis of a dynamic model and the real time demonstration of RFID, they concluded that this type of software technology can significantly improve supply chain control and construction project management by improving the efficiency of operations and providing dynamic control. According to Tanyas (2012), ICT is regarded as a promising technology for the optimizations of supply chain processes. This is as a result of the fact that tracking technologies improves manufacturing and retail operations, including forecasting demand, planning, managing inventory and distribution. This is as a result of smaller, more frequent orders, increasing international trade and global logistics, rising fuel costs, labor shortages, decreased carrier competition as a result of tier mergers and acquisitions, and increased union penetration in the labor market. "Reducing transport costs while maintaining and improving customer service levels and levering private and third-party transportation systems caused the need for some serious technology to be developed in the supply chain".

As indicated above, there is a clear move towards improving the supply chain in an organization.

- Technology allows for real-time communications through devices such as the global positioning system (GPS), short message service (SMS), electronic mail as well as the World Wide Web (www.). This helps organizations to address issues when they occur, and not after they have occurred.
- Technology allows for paperless operations. This reduces the cost of paper and printing and ensures that all transactions are properly recorded, archive.
- Technology allows for system-driven activities as opposed to human-driven activities. This results in a decrease in human-error related incidents and better adherence to business rules.
- Technology allows for more accurate and comprehensive data as it enables the more efficient management and utilization of data through the use of the appropriate systems.
- Technology allows for the support of value-added services.

- Technology allows for greater visibility and control over an organization as a result of real-time information and user accountability
- Technology leads to more efficient operations by reducing costs and allowing for more efficient processes.
- As a result of the ability to provide information in real time, technology allows for improved customer responsiveness.
- Technology allows for enhanced compliance with the organization's planned trip schedules so as to ensure cost control.

Business management technology gives small and medium enterprises an advantage by automating the flow of information between departments and reducing the mistakes associated with the double entry of information across systems. This creates a more efficient supply chain. The main objective in creating an efficient supply chain is to reduce costs while meeting customer requirements and needs is another essential objective of successful supply chain management. Today's customers expect the same level of experience and efficiency, irrespective of whether they are dealing with a small, medium or large organization.

"The Internet has made customers less patient and forgiving about problems with transactions, deliveries, orders and customer service" (Jani, 2010). It is, crucial that small and medium-sized organizations develop a flowing and efficient supply chain in order to provide improved quality and customer responsiveness. Business management software allows small and medium enterprises to better serve their customers by having instant access to information regarding their order, status of shipping and payment information. Business management software provides small and medium enterprises with real-time information, which reduces response time to customers, and ensures faster order fulfillment and extended service.

2.4 Real-time Fleet Management Technologies

Current real-time fleet management systems may be categorized according to the type of real-time information which they process. Available work addresses cases where a new customer request appears and must be fulfilled in a specific time period. The systems that existed in the previous decade were able to cope with new customer requests although they either assumed that travel times were constant throughout the day or they used simple procedures to adjust such travel times, including other factors that were associated with different periods of the day. However, these

assumptions were weak approximations of the real-world conditions in which travel times are subject to more subtle variations over time. These variations may result either from predictable events such as bottleneck during peak hours or from unpredictable events such as accidents, mechanical failures, and so forth. were the first to introduce real-time traffic examined its value to optimal vehicle routing in a non-stationary, stochastic network by developing a systemic approach for determining driver attendance times, optimal departure times and optimal routing policies under a stochastically changing traffic flow.

According to Ichoua et al. (2009) presented a real-time fleet management model based on time-dependent travel speeds. An experimental evaluation of the proposed model was performed in both a static and a dynamic setting, using a parallel tab, search heuristic. The results showed that the time-dependent model provides substantial improvements as compared to a model based on fixed travel times. Presented a dynamic routing system that dispatches a fleet of vehicles according to customer orders arriving at random during the planning period. The system disposes of online information of travel times from a traffic management center.

Taniguchi and Shimamoto (2010) also presented an intelligent transportation system based on dynamic vehicle routing and scheduling with variable travel times. Results indicated that the total cost decreased by implementing the dynamic vehicle routing and scheduling model. The real-time information was based on variable travel times compared with those of the forecast model.

Finally, Haghani and Jung (2012) suggested a systemic approach to addressing the dynamic vehicle routing problem with time-dependent travel times. They also presented a genetic algorithm with which to solve the problem. The latter is a pick-up or delivery vehicle routing problem with soft time windows in which they consider multiple vehicles with different capacities, real-time service requests and real-time variations in travel times between demand nodes. Dynamic travel times are obtained by on-board terminals. However, recorded vehicle incidences may also include travel time and service time delays and vehicle breakdowns that have not been addressed by any of the systems mentioned above.

This research gap emphasized the need for real-time incident handling systems. The world of fleet management has, in recent years, been revolutionized by the introduction of various tracking technologies. ICTs have become well established in transportation as the pivotal enablers of the integration and alignment of dispersed suppliers, manufacturers and logistics providers. Now a

day's mobile technologies has been witnessed recently, mainly focus challenges and practice during the selection and installation period. Since this research focus on the challenge and practice during this technology implement but they try to highlight a little bit about the benefit of the technologies.

2.4.1 Types of Real Type Technologies on Logistic System

License Plate Matching (Via Portable Computer or Video)

License plate matching was used as early as the 1950s for the purposes of travel time studies, but it has been used more commonly for tracking or identifying vehicles in origin destination surveys (Turner, 1996). Early methods relied on observers to note both the license plates of passing vehicles and the corresponding times on either paper or into a tape recorder. License plates were manually matched later in the office, and travel times computed. However, recent advances have greatly improved the ease and accuracy of this technique (Liu, 2010) and portable computers can now be used to record and match license plates, significantly decreasing the data reduction time. Video cameras are also used to record license plates with image processing and computer algorithms.

Automatic Vehicle Identification (AVI)

Automatic vehicle identification (AVI) is a technology that has emerged recently in various traffic management and toll collection applications. An AVI system consists of an in vehicle transponder (tag), a roadside reading unit and a central computer system (Boyce, Hicks &Sen, 1991). When a vehicle containing a transponder passes a roadside reader unit, the information on the transponder is transferred to the reader unit. The transferable information may range from a simple vehicle identification number to toll account balances or trip information. For the purposes of computing travel times, the central computer monitors several consecutive reader units and matches them to the transponder identification numbers created in the central computer system.

Electronic Distance Measuring Instruments

The integration of an electronic distance measuring instrument (DMI) with the floating car technique provides an easier and safer way in which to collect detailed travel time information. The sensor of the electronic DMI is attached to the test vehicle's transmission with the DMI being able to provide instantaneous speeds up to every 0.5 seconds (Thurgood, 1994). This detailed

travel time information can be automatically downloaded to a portable computer in an easy-to-use data format.

An electronic DMI coupled with a portable computer enables travel time runs to be performed with a driver only. This technique provides detailed travel time and delay information that is particularly valuable for the purposes of bottleneck identification and intersection evaluation.

Automatic Vehicle Location (AVL)

Automatic vehicle location (AVL) is another technology that is found in several applications in transportation management. AVL permits the location of a vehicle to be known automatically. This is made possible by the use of transmitters that are carried in a vehicle (on-board telematics devices). The transmitters enable the location of a vehicle to be determined at frequent intervals, if not continuously. The location of each vehicle is projected onto a vector map. Travel times can be calculated by using data such as a vehicle's mean velocity and variance in real-time mode (Perkinson, 1997). AVL systems have become common in freight fleets, as well as in emergency and rescue vehicles. There are several different technologies (ground based and satellite) that can be categorized as AVL. GPS is the most common satellite technology utilizing orbiting satellites for continuous location determination.

Mobile technologies

Mobile technologies such as global positioning systems (GPS), general packet radio service (GPRS) and geography information systems (GIS), coupled with advanced Internet solutions, provide both transparency and more specific information to supply chain collaborators in terms of the instant locations and traceability of shipments and also delivery status. Giannopoulos (2012) and Skinner, have all concluded that tracking physical goods in real time greatly improves logistical performance, cost efficiency and customer satisfaction. Global poisoning system (GPS) technology in the mid 1990 evolved in the American Department of Defense's (DOD), DOD launched the first generation GPS between 1978 – 1985 for military use, However in 1983 president Ronald Reagan system to identify a location on a map and to design identify the nearest decided to permit civilian use of GPS technology once it become operational.

GPS are space-based, radio positioning systems that provide 24-hour three dimensional position, velocity and time information to suitably equipped users anywhere on the surface of the earth the

impact of these mobile technologies is all the more marked on contemporary, sophisticated logistics which include multi-tiered suppliers and manufacturers that are globally dispersed. It is, thus, apparent that, with the increase in global integration and complex business networks, it imperative to develop network options beyond the boundaries of internal logistics. This brings with it both new opportunities and also the risks inherent in implementing new logistics.

Effective management may be a daunting task, especially for those businesses that deal with employees or assets in transit. Fleet management uses GPS technology to track vehicles, employees and assets effectively. In addition, the use of GPS tracking brings with it several benefits for traffic planning. For example, vehicles equipped with a GPS device may provide speed data to the Traffic Management Centre which, in turn, disseminates congestion information and forecasts to wireless information service providers (Thill, 2013).

All GPS receivers make use of orbiting satellites to determine their location. As the technology has advanced, there has been an upsurge in the use of GPS. Handheld GPS units may be used for outdoor sports such as hiking, boating, fishing and navigating at sea. For instance, a GPS receiver can be used to guide the user on his/her current position when lost and then to help the user to navigate his/her way out of woods or at sea. A GPS receiver can also be used to measure the distance of a ball from the hole for golfers and to assist cyclists in keeping to the correct path.

The GPRS-based and GPS-GSM vehicle tracking system communicates between the hardware and software through the GSM modem via the Internet to a server, which can be accessed by a local computer on which the software has been installed. While there many GPS applications the most common GPS application is vehicle navigation where most vehicles are installed with a GPS receiver with a monitor to indicate to the user the shortest route to the user's destination by road. Currently, cellular phones are equipped with an integrated GPS receiver. In addition, a GPS may be used as an emergency locator and security feature to track vehicle locations. The GPS is one way in which satellites have become part of everyday life (Egbert & King, 2013). There are three main segments in a GPS system:-

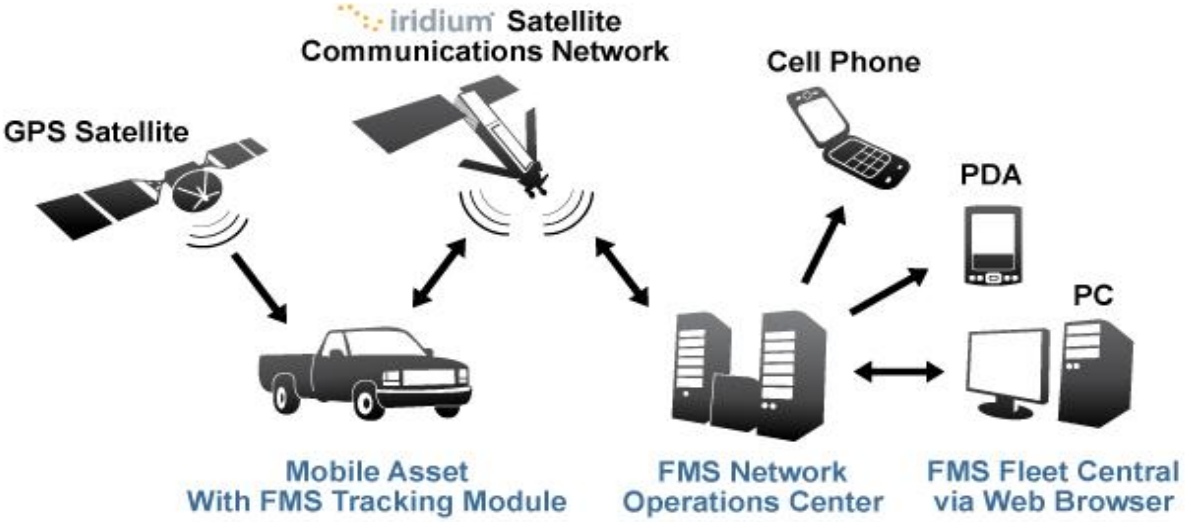
- **Space segment**. There are 27 GPS satellites which orbit the earth. The nominal orbit height is approximately 20,200 kilometres covered in a 24 hour operation. Each GPS satellite transmits a signal to the GPS receiver on the ground. The GPS receiver then calculates the

distance to the satellites. Eventually, information such as the coordination of current location, time and speed can be retrieved from the receiver

- **Control segment**. The control segment comprises a master control station which has five ground stations located around the world to ensure that the satellites are functioning properly. The main control station (MCS) is located in the United States. GPS satellites use the ground stations to determine, among other things, the location of the satellites and the status of atomic clocks.
- **User segment**. The user segment comprises GPS receivers that are designed to decode the signals from the satellites in order to determine the position, velocity and time of the receiver. There are two types of service available to GPS users, namely, the civilian (SPS) and the military (PPS). GPS is free to all users all over the world

Fleet management systems enable the real-time monitoring of various parameters, such as vehicle location and velocity and field data (e.g. load temperature), in order to detect bottleneck in delivery execution and minimise operational costs. These systems comprise specialised software packages that are aimed specifically at fleet operations. The architecture of such a system is depicted in and comprises three main components:

Figure 1: main components of GPS



In view of the fact that GPS is available globally and is free of charge it would appear that GPS provides the best vehicle navigation system and, thus, GPS frequently comprises part of the existing vehicle infrastructure for many firms (Zeimpekis & Giaglis, 2009). For this reason, GPS represents a broader use of IT in the transport industry. GPS is a satellite-based navigation and time transfer system which was developed by the United States Department of Defence. It serves marine, airborne, and terrestrial users, both military and civilian.

Specifically, GPS includes the standard positioning service (SPS), which provides civilian users with 100 metre accuracy, and the precise positioning service (PPS), which provides military users with 20 metre accuracy. Both of these services are available worldwide with no requirements for a local reference station. In contrast, the differential operation of GPS makes available two to ten metre accuracy to users within 1000 kilometres of a fixed GPS reference receiver GPS is essentially a passive mechanism in that it does not involve any intrinsic disclosure by the GPS receiver to any other device. However, it can be combined with transmitters and transponders to produce devices that disclose location to another party.

Primarily designed as a land, marine and aviation navigation system, GPS applications have expanded to include surveying, space navigation, automatic vehicle monitoring, emergency services dispatching, mapping, and geographic information system geo-referencing. Mobile geographic information systems which integrate the GPS with hand-held computers and special software make appropriate information available to the personnel working with them For example, fire-fighters are able to use these systems to locate the nearest fire hydrant while game park rangers may access the appropriate map and record changes in the natural habitat. In addition, the GPS equipment is able to capture data that it would not be possible to obtain using traditional methods, such as travel speed and the specific routes or paths taken by a driver. This information is necessary to enable transportation planners to analyse GPS-recorded travel.

2.4.2 Types of GPS Navigation Systems

There are different types of GPS systems categorised on the basis of their use. According Mohinder, Grewal, Angus and Bartone (2013), modern technology has improved the way we navigate, from the traditional compass and maps to the modern global positioning satellite, or GPS, systems. With GPS, travellers do not have to depend on stars, landmarks or even constellations. GPS systems use satellites that can send out signals back to earth. Mohinder

(2013) state that the atomic clock in the satellite sends information about your current location and time to your GPS system. This information assists the GPS in pinpointing your location on the map. The basic GPS system has the essential functions of a GPS without a lot of features. The system can report the location in terms of the latitude and longitude laid out in a high-quality map that details highways, landmarks and streets. This type of GPS is ideal for those who have a low budget but need the basic functionalities of a GPS.

According to Admiral (2013) there are three types of car navigation systems. These systems consist of navigation techniques that are designed to stand alone, handheld techniques which suit multiple reasons, and systems that are designed in order to use laptops, PCs, pocket PCs, and also PDA systems. Each of the types of auto navigation systems and devices provides different benefits and drawbacks. The stand-alone techniques tend to be often the most well-known choice and offer a steady power supply and turn-by-turn direction.

There are several ways in which users may use GPS navigation systems. For example, handwriting devices, voice recognition devices, and GPS systems enable users (especially the disabled and the elderly) to input their location parameters in a convenient way in different situations. In addition, with the help of eye-tracking devices, such systems may also be of benefit to those individuals with disabilities since they help to automatically choose a target device from a device set.Three types of GPS antenna are used in transportation navigation systems. GPS receivers also offer a fast and convenient method for obtaining position information that may be collected in real time. GPS technologies enable transportation engineers to collect data on, inter alia, vehicle route, travel time and travel speed (Mohinder et al., 2013). These GPS systems are as follows:

Passive System

Passive systems, either wireless or module, are the easiest and most economical way in which to manage information. In the main, no communication service contract is required. This system is also known as a “stored data” system. A more recent development is a wireless transmitter that automatically downloads GPS information to the office computer. However, one drawback is the fact that passive systems are not able to track a driver’s progress as this happens in “real” time or “near real” time (Arunkumar & Sivanandam, 2007).

Active (real-time) System

An active (real-time) system requires a GPS-mounted wireless receiver that automatically downloads information. These systems are Internet-based systems with real-time components that are able either to transmit data on demand or conduct polling at various intervals, that is, every 2, 5, 10 or 15 minutes. In addition, the system may require more staff and Internet storage data may be both limited and short-term. This makes it difficult to perform trend analysis over long periods of time. (Arunkumar & Sivanandam, 2007).

Hybrid System

The hybrid system combines features of both the passive and the active systems. It provides real-time vehicle data, as well as comprehensive information storage. Hybrid systems provide the most adaptability to business needs. However, one drawback is the facts that hybrids, like the active systems, require an Internet connection and would probably also require a dedicated computer. Connectivity and transmission charges would apply when using hybrid system (Arunkumar and Sivanandam , 2007).

RFID Technology

As we approach the end of the first decade of the 21st Century, Radio Frequency Identification (RFID) has increased. RFID is an innovative information technology that allows organizations the ability to attain massive amounts of data related to products, assemblies, equipment, supplies, inventory, customer service, and machinery.Radio frequency identification devices (RFID) are low-cost tags that assist in the tracking of goods and vehicles.

Radio frequency identification is a developing technology that uses several basic components in order to satisfy the needs of the implementing organization. Radio frequency identification (RFID) is not a new technology. It has been around since the early 1900's and was utilized during World War II (Domdouzis, Kumar et al. 2007). RFID technology consists of two primary components – tags and readers. An RFID tag has a microchip and an antenna. The microchip stores object information (such as the serial number), while the antenna enables the microchip to transmit object information to the reader. The reader creates a magnetic field with the tag antenna, and the tag uses this magnetic field to transmit object information to the reader. RFID system also has a third component – a computer that is used to interpret and store data, and

perform required actions (Attaran, 2007).According to Solanas and Domingo-Ferrer, RFID divide into two types, Active and passive. Active tags require a power source—they're either connected to a powered infrastructure or use energy stored in an integrated battery. In the latter case, a tag's lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo. One example of an active tag is the transponder attached to an aircraft that identifies its national origin. Another example is a LoJack device attached to a car, which incorporates cellular technology and a GPS to locate thecar if stolen. However, batteries make the cost, size, and lifetime of active tags impractical for the retail trade.

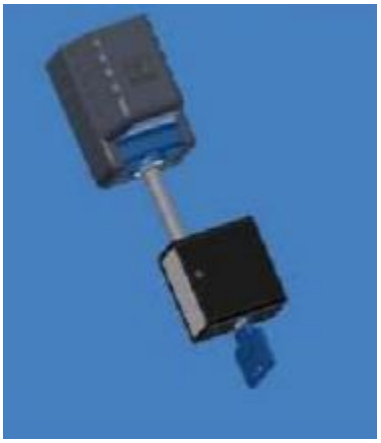


Figure 2 Active tag

Passive RFID is of interest because the tags don't require batteries or maintenance. The tags also have an indefinite operational life and are small enough to fit into a practical adhesive label.

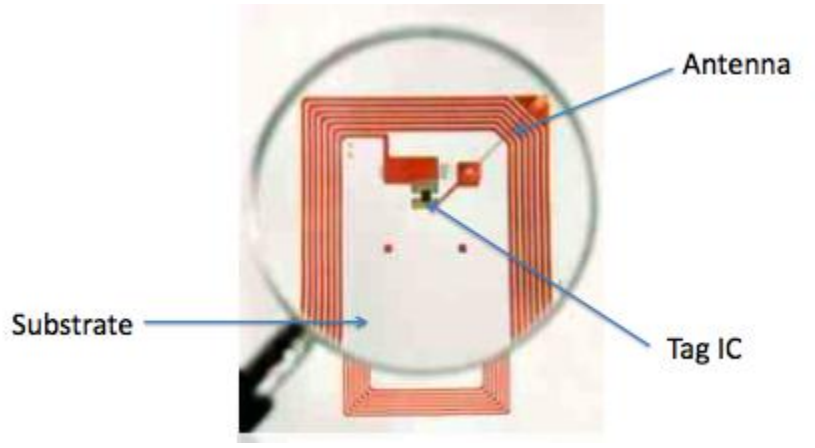


Figure 3 passive RFID

A passive tag consists of three parts: an antenna, a semi- conductor chip attached to the antenna, and Tag IC."RFID is wonderful technology," says Tom O'Boyle, director of RFID for Bar-

coding, a provider of RFID, bar-code, and wireless technologies. "It allows us to identify an item without having a direct line of sight."Passive RFID has no internal source of power—essentially falling asleep when not activated by the reader—a battery powers active. But this technology more used for products when a cargo container or pallet tagged with RFID moves through a "read zone"—a portal equipped with a special reader—the reader captures the tag's information using radio frequencies.

2.5 Benefits of Implementing a GPS Fleet Management System

It is to be expected that the successful implementation of ICT to support the logistical processes will bring a number of benefits to organizations (Lai et al., 2000). According to Gutiérrez and Durán (2007), these benefits may include a reduction in the errors made in data entry and also improvements in customer services. They point out that the use of ICT makes it possible for organizations to monitor their inventories, improve the utilization of their transportation and warehouse assets and eliminate the duplication of effort in the carrying out of their various logistical activities. Many logistics managers consider ICT to be a major reason for the improved productivity and competitiveness of their firms, while also regarding ICT as a key component in their logistics systems (Dawe,2009).

ICT capabilities significantly influence the overall competence of transport logistics. According to the experts, there is no single factor that has greater potential to improve logistical operations than information communication technologies. In fact, ICT not only improves the effectiveness and efficiency of the logistical processes but the successful implementation of ICT may have a significant impact on logistical strategies and on organizational structure.

Table 1 new technologies Benefit in logistic systems

NO	New technologies Benefit in logistic systems
1	Enhanced visibility along the logistic
2	Enhanced visibility of what a customer will need
3	Accurate time and asset tracking
4	To Help better manage process a business of the company
5	To control the import and export asset
6	Improved productivity by generating the fastest and lowest cost method
7	Improve productivity by generating the time
8	Improve velocity based on the company business and government regulation
9	Reliable and accurate order forecasting
10	Eliminate the duplicate cost
11	Push growth opportunity by different direction
12	Improve accuracy by reducing duplicated work
13	Improve technological return of investment
14	Improved the productivity
15	Improved the operation cost
16	Improved product quality and reliability including traceability
17	Improved the supply chain management by better tracking transportation
18	Reduce human error
19	Better decision for all participants
20	Improved driver productivity

2.6 New technologies Implementation Success Factors

Several studies have identified factors that contribute to the success or failure of a large system development project. According to Waters and Rahman, 2013 ten critical implementation Factors have been chosen

1. Clearly defined business needs/benefits
2. Top management involvement
3. Proper planning/scoping
4. Measurable business benefits (ROI)
5. Adequate funding
6. Partnership with competent technology providers
7. Integrating new technologies into a company's existing IT architecture
8. Determining which practices should be incorporated into their RFID systems
9. Project management (teamwork)
10. Proper staff training and participation

2.7 Consequences of Implementing new Technology in Logistic System

According to Howell and Wei (2010), as the utilisation and commerce of IT becomes more widespread throughout the world, the adoption of novel information technology can generate new business opportunities and various benefits. The business environment today has been undergoing unprecedented change and many companies are seeking new ways to stand out from the competition by sustaining their competitive advantage. Today's highly competitive global marketplace, the pressure on organisations to find new ways of creating and delivering value to customers is growing stronger (Benitez & Perez, 2010).

The concept of IT implementation success raises the three following issues. First, in the cycle of IT innovation diffusion, adoption, implementation and post-implementation are three discrete phases. The adoption phase addresses the decision-making process of whether to adopt IT, the implementation phase includes the physical deployment of IT tools in business, and the post-implementation phase deals with further technology adoption and sophistication. ICT is today being applied in many organisations in a wide range of operational areas.

According to Somuyiwa and Oyesiku (2010), it has provided new ways to store, process, distribute and exchange information both within companies and with customers and suppliers in the supply chain. This leads to increasing interaction between marketing and logistics, where logistics is considered a platform for supporting new strategic moves on the market. As an increasing number of firms are under pressure from their partners to change both their traditional styles of operation and organisation to replacing them with integrated systems that help increase the speed and fluidity of physical and information flows, reaching this kind of integration therefore requires investing in new information and communication technology (ICT).

According to Somuyiwa and Adewoye (2010), with the advancement of ICT, many companies have adopted the use of the technologies to improve the efficiency and effectiveness of their activities. The term IT-enabled business value, which has also been interpreted as IT effectiveness, is generally used to refer to the organisational performance effects of IT in terms of firm innovativeness, productivity/efficiency improvement, customer service enhancement, cost reduction and improved information sharing efficiency.

2.8 Challenges when Choosing and Implementing New Technology

Even though articles about new technologies tracking in the supply chain field usually concentrate on explaining the solutions and opportunities of the technology for the supply chain management, most of the articles also mention the challenges and obstacles to adoption of new technology for this purpose. There are even articles, which concentrate on presenting certain challenges and different viewpoints around the topic or presenting a list of possible challenges or even obstacles. GPS and RFID is becoming the most popular and the most widely used information system in logistics, especially in the transport industry. The need for different implementation approaches, because the factors of alignment between technology and business processes vary from company to company and between different solutions (Ruppel, 2012).

Technology will help improve an organization's operations only if it is supported by all the relevant managers and users. This is as a result of the fact that technology is useful only when the correct information is fed into the system in a timely and accurate manner. Without a flow of correct information, it becomes difficult to monitor the supply chain activities. The bid directional flow of information is imperative for the success of supply chain strategies. According to Ram "There is no advantage in being choosy while exchanging information. The ability to share information by itself is a competitive differentiator" (Ram, 2011).

It is essential that organizations fully understand the value of having and sharing information which technology will make possible before there are any improvements. According to the Hitachi Data Systems, (2015), choosing either one technology or a combination of technologies to support business continuity starts with an assessment of the potential risks facing an organization. An operational risk management approach will clarify business requirements and also reduce uncertainty by estimating the likelihood of potential loss that could occur either if the wrong technology is implemented, or if the correct technology is not implemented correctly and efficiently. By performing an operational risk analysis for each business-critical application, an organization will be able to determine the extent of vulnerability and the impact on business downtime that may come with the new technology. This information will ensure that the technologies that are accessed will achieve the optimal balance of recovery speed, data value and cost. The following are a number of suggestions to ensure the smooth implementation of the desired technology:

- Start early; get ahead of your competitors.
- Understand your objectives.
- Pick the right partners and do not "self-integrate" unless you happen to be a data integration specialist.
- Your information architecture will either make or break the long-term return on investment (ROI).
- Run a pilot test. It is easy to miscalculate during the design process or underestimate the costs. A validation exercise greatly reduces the time to ROI.

Each fleet is unique, with different trucks, business challenges, and goals so unique solutions will need to be the focus. The telematics providers(MIX telematics) should offer a number of GPS device options compliant with the make/model of those vehicles. Focusing on one type of vehicle platform or a single-use case is a narrow view on the industry and really is only providing one piece of the puzzle that is fleet management," said Ryan Driscoll, marketing director for GPS Insight. When doing research remember to consider all your needs. "Include both real/present and future/imagined and include any fixed assets you may want to monitor within your system. It's important to make sure your partner has the right foundational pieces to meet your needs both now and in the future," said Gabriel Nave, director of business development for Cal Amp. According to Brandt, the second-largest challenge is installation and project management. "Keeping track of where all vehicles are at any given time is difficult without GPS tracking. Finding them all and managing the installation process can be very difficult," she said.

In terms of installation, differences in vehicle class, as well as make and model can prove challenging. Vehicle manufacturers change data port specifications, wire locations, etc., all the time. Because of this, on the field test our devices on new model light- and heavy-duty vehicles.

Different standards and the insufficient technology

According Nagi one of a big challenge to implement a new technologies Deficient standards because globally agreed standards in RFID are a relatively new phenomenon this issue somewhat related to standards is the differing frequencies which are used around the world another technological challenge often mentioned is a tag reading problem. The poor reading can

be caused by radio wave-absorbing materials (e.g. metal or water) around or under the tags). The other reasons for poor reading can be the wrong position of antennas relative to the direction of the reader, or radio transmitting collisions caused by too many RFID tags, or just the varying quality of tags (Nagi 2014).

Cost of the technology and technology adoption

The cost of the technology is also commonly mentioned as a major problem concerning RFID and GPS technology adoption. The cost of the seals and GPS is the most obvious expense (IT and RFID Journal, 2011). However, before an new technologies (RFID and GPS) is installed, there are also many other infrastructure fulfill including Software adjustment is usually needed when integrating the tracking system to the existing enterprise resource planning (ERP) and other systems even if most of the current systems on the market In addition to the system integration requirements, the amount of data that information systems handle increases significantly when tracking is in use. According to Ilic he concern and focus after implementation the data of the tracking may need additional investment both side hardware and software this may be another challenge (Ilic 2012). According to Asif the implementation also requires the resources of technology experts, as well as resources for training of current employers to use the system and perhaps even for other new tasks, when the old duties are changed as a result cost also increased (Asif 2014).

The combination of the high implementation costs, along with unsecure payback time or conjectural return on investment (ROI) calculations, can also pose financing problems especially for smaller companies also point out the worry of some companies that maintaining the GPS and RFID system can become too expensive. If the maintaining costs are considerable, simple ROI calculations are not enough for estimating the total economic effects of GPS and RFID implementation.

Ethics and privacy

Numerous articles concentrate on discussing the ethics and privacy questions related to the new technologies some companies are afraid of the negative reaction of the customers and consumers organizations when implementing new technology for tracking purposes. (Blanchard, 2010).

Organizational issues related to the RFID tracking adoption

Some authors point out the different roles in an organization as a challenge. As an extensive tracking system is a big investment and requires changes inside organizations, considerable management commitment to system adoption is necessary (Brown &Russel,2010). Asif&Mandiviwalla (2014) also point out that the biggest potential benefits of tracking come when supply chain concepts are combined with customer strategies. Therefore they emphasize the involvement of marketing people in GPS and RFID system development; because supply chain management experts tend to concentrate on cost saving issues while marketing people attempt to find added value for a customer. However, combining marketing and supply chain management strategies is challenging. Generally for the new technologies faces numerous implementation challenges. The major challenges include technological maturity, global standardization, government regulations, and cost as summarized.

Table 2 major challenges include technological maturity

No	Types	Challenges
1	Fundamental	➢ High capital cost ➢ Challenges in finding the ROI ➢ Challenges in finding the "drives" for adoption
2	Technical	➢ Unproven system ➢ Lack of experts ➢ Lack of infrastructure (Cellular coverage)
3	Security	➢ Uncertainty of data storage ➢ Physical installation of data storage
4	Government Regulation	➢ Privacy concerns and potential legislations ➢ Uncertainty of data storage

CHAPTER THREE

3. RESEARCH DESIGN AND METHODOLOGY

3.1Research Approach & Design

The research methodology assists in fulfilling the purpose of the study in question. The methodology, tools and instruments must, therefore, be systematic, valid, reliable, neutral and objective. The choice of research method constitutes the foundation on which the entire research is conducted. In this chapter, the research methodology used in this study is described.

3.1.1 Research Approach

This study adopted both qualitative and quantitative methods. Qualitative research method is invaluable to the study as interviews with fleet managers, and high level officials in the structure of ERCA &Information Network Security Agency (INSA) help in the assessment of the practice of the project, in identifying if there challenges that are retarding the implementation of the technology. Data regarding the level of communication between ERCA and the service providers is also collected using this method.

Quantitative methods is also widely utilized in gathering and interpreting numerical data that is indicative of the impacts of the new technology in the logistic process; particularly in container and cargo handling, improvement of the supply chain, efficiency and reduction of costs, achievement of a more efficient and individual container traceability, deterioration of theft, diversion and counterfeiting, and increase in security.

3.1.2 Research Design

The importance of the research design stems from its role as a critical link between the theory and argument that inform the research and the empirical data collected (Nachmias&Nachmias, 2008). Therefore, it is a blueprint that enables researchers to find answers to the questions being studied for any research project. The study utilizes the propensity score matching (PSM) and descriptive. The most common implementation of propensity score matching is one-to-one pair matching, in which pairs of treated and untreated subjects have similar values of the propensity score, research. This research method does not provide the final and conclusive answer, but mere

explores the research topic. It has been noted that the initial research, this types of research is not intended to provide conclusive evidence, but helps us to have a better understanding of the problem and its good input for future researcher.

3.2 Sampling Techniques

The type of sample technique used in this Study is non-probability sampling technique of Quota sampling method. The study used non-probability sampling technique, this method is a method of gathering representative data from a group that represents certain characteristics of the population. Quota sampling contains two steps process:

Step1: specify a list of relevant control categories.

On this step some specific requirement category, the target population is first segmented into mutually exclusive sub-groups, which means that one individual can be a member of one category or sub-group, quota sampling care to obtain a sample that similar to the target population on some control category, in this study relevant quota selected under ERCA more than 20 transport company work from that who applying the technology.

Step 2: collect a sample that has the same properties as the target population.

A population refers to a select group of people that have common characteristics. The target population of the study will be vehicles that have and have not applied the technologies and are working under ERCA and service providers working with ERCA.

The researcher applied a simplified formula provided by (Yamane, 1967) as cited by Abiyot to determine the minimum required treatment group sample size at 95% confidence level, degree of variability= 0.5 and level of precision (e) = 10%

$$n= N/1+N(e)^2$$

Where n is sample size, N is the total number of study population - 4,500 vehicles who have implemented the GPS and RFID tracking system. Where e is the level of precision using the total population of 4,500 and level of precision of 10% the sample size will calculated as follows

$$n= N/1+N\,(e)^2$$

$$e=10\%$$

$n= 4,500/1+4,500(0.1)^2$

$n= 4,500/46$

$n= 98/4$

$n= 24.5$

A total of 56 respondents, 25 from the treatment or implementer group and 31 from the control group, were selected and observed 3 times over a period of 30 days, each time after they completed a round trip from Addis Ababa to Djibouti.

3.3. Data collection

The study uses both secondary and primary data. The primary data was collected using questionnaires, interviews and observations; and secondary data includes documents, data, and information from previous studies.

Questionnaire

Questionnaire is a carefully designed instrument for collecting data in according to research questions. The questionnaires prepared should be suitable for this study include important information about the population, and each questionnaires address the specific and general objective of the study, the questionnaires contain open- ended and Closed questions, it provides data that is easy to compute and analyze.

Interview

The general method to get qualitative data is interviews with participants or respondents and the main reason to interview is to gain full and detailed information of the experience under study (Polkinghorne, 2005). Interviews are the most broadly used source as a method of collecting data for evidence (Blumberg et al., 2005). There is a definition of interviewing as: “interviewing is a technique of gathering data from humans by asking those questions and getting them to react verbally” (Potter, 1996). In this research, structured interviews were used, by conducting face-to-face, phone, and e-mail interviews, a better understanding of problems was achieved. The study incorporates interviews with 4 people working in the management of the stake holders.

Secondary Data

The researcher collected the necessary documents from ERCA main office and other participant in this project. All research participants were be briefed about the purposes of the study.

3.4. Methods of Data Analysis

The best technique recommended for an overview interpretation of the data is a descriptive technique. This statistically descriptive technique is the mode. The mode refers to the most frequently occurring value in a data set (Oates, 2006: 256). Basically, descriptive statistics and correlations for the key variables will be used to present the characteristics and frequency distribution of the variables examined. They will be used in the study to provide a general overview of the variables being studied.

3.4.1. Propensity Score Matching

Rosenbaum and Rubin (1983) pioneered propensity score matching methodology followed by many other improvements and applications. They define propensity score as conditional probability of treatment given pre-treatment characteristics. Their argument is based on the fact that since assignment of subject to treatment and control groups may not be random, the estimation of the effect of treatment may be biased by the existence of confounding factors. Therefore, they proposed propensity score matching as a way-out to correct the estimation of effect of the participant controlling for the existence of these confounding factors. Based on the idea that the bias is reduced when the comparison is performed using treatment and control who are as similar as possible. To achieve main research question of this study, propensity score matching which makes matching feasible was applied. Propensity score is a conditional probability estimator, and any discrete model such as logit or probit can be used as they yield similar results (Caliendo and Kopeinig, 2008). This study employed logit model assuming logistic distribution of the sample mean and variances. The matching estimators are nearest neighbor, stratified, radius and caliper, and kernel matching method all conditional PSM. The PSM

$P(x)=Pr\{D=1/Xi\}=E\{D/Xi\}$……..1

Where D = (1, 0) the indicators of improvement in income, it is the binary variable whether a participating company income improve (improvement in income, 1= yes, 0 = otherwise) χi = is a vector

of pretreatment covariate propensity score to ensure that matching estimation is done on treatment and control company that are as similar as possible for effective comparison. As a result given a population of units denoted by (i) if the propensity score P (xi) is known as average effect of treatment (AET) can be estimated

AET = E {Y1i - Yoi / Di = 1} ……..2

={E{Y1*i*-Y0*i*/*DI*=1,P(*xi*)}}

=E{E{Y1i/D*1*=1,P(xi)}-E{Y0i/D*i*=0P(xi}/D*i*=1}…….*3*

Where AET is the average effect of treatmentY1i and Y0i are the potential outcome for the two counter factual situations of the treatment company and control company respectively. *P (xi)* is propensity score, D is company variable, where D= 1 if the company participated in installed the RFID and GPS and 0 otherwise.

1) **The balancing assumption**: States that participation is shaped by pre participation characteristics or that the balancing of participants and control is through the propensity score. Therefore, if P(xi) is the propensity score then

   D ⊥ X / P (X) ……*4*

   represents independence i.e. exposure to the program participant (*D*) is shaped by the participation covariates (*Xi*) the balancing assumption is thus the propensity score

   P (*D*) = 1, Xi = P (*xi*).

2) **Conditional independence assumption**: Assume that selection is biased on observable covariate of the subject and treat all the covariates that influence participation and potential outcomes are simultaneously observed. It is expressed as

Y1 , Y0 ⊥ D / P(xi)……5

Where Y1, Y0 are potential outcomes with and without, Di is participation variable, P(x) is propensity score. A logit model will applied to estimate propensity scores using a composite of predictors characteristics of the sampled companies (Rosenbaum and Robin, 1983) and matching were then performed using propensity scores of each observation. In estimating the logit model, the dependent variable is participation in installed RFID and GPS technology services, which takes the value of 1 if a participates in applied the technology service and 0 otherwise.

Measurement of Variables

Age (AGE): It is continuous variable defined as clients age at the time of interview measured in years. Vigano (1993) noted that with increase in age, it is usually expected that participants get more stability and acquire experience. So we expect this variable to have a positive effect on performance. Hence age of the participant was hypothesized to have positively related to the characteristics of the driver.

Marital Status (MARTSTA): This is a variable whether engaged in marriage or not. Respondents will be asking about their marital status whether they are unmarried, divorced and married in their life. The expectation of this variable will be positive relationship with family responsibility.

Cost: - Companies are always looking to find ways to decrease the overall cost of their operation without compromising the quality of the service offered. In the Transport sector, companies spend much of their capital on fuel and vehicular maintenance, with the time consumption of trips contributing significantly to the elevation of their budget. Firms tend to accept new technologies more readily when they offer instant net financial benefits. Therefore, the impact of the implementation of RFID and GPS tracking on the cost of operation needs to be evaluated.

Accident Reduction: - Ethiopia has one of the highest traffic accidents to number of vehicles ratio in the east Africa. Accidents occur due to various reasons; among which lack of skill and/or concentration of the driver, poorly maintained vehicles, poor and accident prone roads are the main culprits. Considering the huge burden, financial or otherwise, these accidents bring to the transport companies; implementation of a technology that can possibly lead to the reduction of accident rates is in the best interest of all involved parties.

Fleet availability: - A trip is defined as the movement of a vehicle, along with the goods it is carrying, from a starting point to a predetermined destination. Having the ability to oversee and control all the aspects of a trip, and in effect monitor the activities of the driver, can be an instrumental tool in a transport company's. It allows the firms to make sure that the vehicles have not covered more distance than stipulated, and are not being used for other purposes, and as a result generate more income from a single trip. Since the RFID and GPS tracking offers

companies the means to control trips from their base, the resultant effect in the operation of these companies needs to be studied.

The dependent variable of the Model Participation in implemented the RFID and GPS technology is variable indicating that whether a treatment (implemented) or control (non-implemented).

For treatment (implemented) participating =1 and Control (non-implemented) participating =2

Table 3 Measurement of variable used in PSM Analysis

Variable	Types and Definition	Measurement
Dependent variable		
PARTISPANT	A involved variable that measure the implemented and non-implemented the RFID and GPS technology	1= yes 2= Otherwise
Explanatory Variable		
Age	Represent the age of the driver	In years
Sex	Represent the age of the driver	1= male 2= female
Marital status	Represent the status of marital	1= unmarried 2= married
Educational background	Represent the educational level of the driver	1= under 8 2= competed 12 grade 3= diploma 4= degree 5 = above degree
Family size	Representing the size of family	In number
Model of the vehicle	Representing the model of the vehicle	IN name
Manufacture Year	Representing the vehicle manufacture year	IN year
Outcomes		
Cost(fuel consumption and maintenance)	Represent the cost of the vehicle	IN litter and IN Birr
Accident Reduction(trip night and speeding)	Represent the accident reduction of the vehicle	IN Number
Fleet Availability	Represent the distance coverage of the vehicle frequently available	IN Number

This chapter has reviewed the various strategies and methodologies relevant to this research study. It has presented the specific research methodology used to carry out the study and the reasons for adopting it the research methodology described and explained based on the objective and the aim of the study. In this study, the researcher focus on the literature review and the questionnaire survey targeted on different transport company who have work with ERCA installed RFID and GPS unit Both primary and secondary data were employed to conduct this research study. Primary data collected through structured questionnaire and interviews to supplement the secondary data for the analysis of the qualitative part of the study, while secondary data gathered through review some document of the ERCA Company and library's material. The literature review was done through refereeing, books, and internet and engineering journals, by referring to the previous literature, the information from the impact of the RFID and GPS technology. Finally the study chose the descriptive, content data and propensity score matching method analysis to enhance the understanding for an accurate and concise presentation of the results obtained in a way that answer the study questions.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Introduction

This chapter presents the result of the research study and outlines the practice and challenge RFID and GPS technology implementation. The research studies the impact on the new system on ERCA service on transport companies and their customers. It analyzes the impact of installed the RFID and GPS technology by comparing and contrasting vehicles who have installed the technology and those who have not. The results of the data analysis will be valuable in finding possible answers to the research questions.

Table 4 Characteristics of the respondents **F= number of frequency**

Variable Definition		Implemented	Non-Implemented	
		F	F	(%)
Gender	Male	25	31	100
	Female	0	0	-
Marital status	Single	2	1	5.36
	Married	20	28	85.71
	Divorced	3	2	8.93
Model	IVECO	14	17	55.36
	MAN	2	4	10.71
	VOLVO	9	10	33.93
	Merchandise	-	-	-
Manufacture Year	1997	2	3	8.93
	1998	7	8	25
	2012	11	15	46
	2013	2	4	10.71
	2014	3	2	8.93

Marital Status

Analysis of the marital status of the respondents revealed that 3 (5.36%) of 56 respondents are single, 48 (85.71%) are married and 5 (8.93%) of the respondents are divorced. As marriage is perceived as a factor that makes people more responsible by the society, the fact that most of the respondents are married may be beneficial.

Model

IVECO vehicle is the predominant model of vehicle in the study, driven by 31 (55.36%) of the respondents, while 6 (10.71%) of the respondents drive MAN model vehicles. The remaining 19 (33.93%) respondents drive VOLVO vehicles. Since all these models are well known brands in the world, it can make it easy to adapt and support new technologies that are utilized elsewhere in the world.

Manufacture year

Vehicles driven by 5 (8.93%) of the respondents were manufactured in 1997, while 14 (25%) of the vehicles have a manufactured year of 1998. The remaining vehicles were relatively newer as 26 (46.43%) of the vehicles manufactured in 2012, 6 (10.71%) manufactured in 2013 and the rest 5 (8.93%) were made in 2014. The vehicles manufactured after 2012 are expected to perform as they are produced optimized in terms of fuel consumption, trip duration, maintenance time and cost. In addition, the newer vehicles are CAN activated (Control Area Network), which will supplement the RFID & GPS Technology.

Table 5 comparison of continues variable

Vari	Implemented				Non-Implemented				Total				t-value	P-value
	Mean	MIN	Max	st.dev	Mean	MIN	Max	st.dev	Mean	MIN	Max	st.dev		
AGE	49.76	35	70	8.80	49.32	38	70	8.67	49.51	35	70	8.64	0.186	0.0*
Education	1.96	4	37	2.9	1.67	2	36	2.3	1.80	2	37	2.5	2.94	0.000***
Work experience	20.28	12	39	7.58	19.61	12	35	6.38	19.91	12	39	6.88	1.35	0.00**

AGE

As table 5 indicates, from a total of 56 respondents, 4 (7.14%) were aged 30-40, 30 (53.57%) of the respondent were aged between 41 and 50, 15 (26.79%) of the respondents were aged 51-60, while 7 (12.5%) of the respondent were older than 61 years. Considering that most of the respondents were older than 40 years, we can infer that they are mature age wise. Age maturity is presumed to be associated with an increase in responsibility and drivers are expected to care more about safety.

Educational Level

As illustrated in table 5 above, 9 (16.04%) of the total respondents have a primary school educational background, while 43 (76.79%) of the respondents were educated up to secondary school. The remaining 4 (7.14%) of 56 respondents have a college diploma. What we understand from the data above is that most of them are educated up to secondary school, and this has helped in easing the implementation of the RFID and GPS technology, as they usually can understand the new technology without difficulty.

Work Experience

All the respondents in the study are well experienced in their profession, with 25 (45%) reporting that they have 16-25 years of experience driving heavy vehicles, 20 (35%) have 10-15 years' of experience in the field, 10 (18%) have 26 – 35 years' experience, while 1 person (2%) has driven heavy vehicles for more than 35 years. The fact that all the respondents are well experienced has helped the researcher in evaluating the impact of the RFID and GPS technology, as all are aware of the way things are done before and after its implementation.

Variable	Implemented		Non –Implemented		Total	
	Yes (F)	NO(F)	Yes (F)	NO(F)	YES (%)	NO(%)
Children	20	5	28	3	85	15

Table 6 No of child

Children

Out of the 56 respondent in the study, 48 (85%) have children, while the remaining 8 (15%) do not. Having dependent family members like children is a factor thought to shape the character of drivers, as it usually makes them give more attention to their job and take greater care.

4.2. Practice of GPS and RFID implementation

Considering the fact that the technology is new to our country, and the lack of man power educated in the field, select graduates of computer and electrical engineering were sent to Israel for a two month long training where they received 180 hours' worth training in the area. This has enabled our country's logistic sector to have personnel skilled in the field. Preparations have been made in cooperation with Ethio-Telecom to allow the GPS and RFID tracking system to utilize the company's GPRS connection system using its own virtual private network to connect with the central database. The Information Network Security Agency (INSA) had also been considering different electro-cargo tracking technologies and vendors to select the one suited for our country, and eventually settled on the GPS and RFID technology offered by Hi.G.Tek Company. The company was apparently chosen due to its long years of experience working in the African market.

The necessary infrastructure has been installed in 9 Customs offices along the road between Addis Ababa and Djibouti and the required man power has been hired, trained and posted to the offices.

Service providers also had their own delineated responsibility in the implementation of the system, among which are acquiring the devices from the vendor (Hi.G.Tek) within 15 days of winning the tender and installing them on the vehicles. In addition to instalment of the devices, the service providers also offer periodic maintenance and repair, and overall monitoring of the system.

The Information Network Security Agency (INSA) oversees the entire operation and provides assistance to all the involved parties, should they require it. The fleet management system (SPFMS) was also developed by INSA.

Involved staff of the transport companies on whose vehicles the system is being installed have received appropriate training on the operation.

4.3. Challenges of GPS and RFID technology implementation

The implementation of the RFID and GPS tracking technology has been far from a smooth ride. In fact, many challenges encountered by all the stakeholders, including the transport companies, service providers, vendors and ERCA, have effectively delayed the full enactment of the system. Observation of the running of the system and interview of the involved parties revealed that the following to be the biggest challenges in the implementation.

4.3.1. Challenges from the Transporters' side

From what the researcher has gathered from interviews, the high initial cost of installing the equipment on the vehicles has discouraged the companies from implementing the system. Since the tracking technology also comes in direct conflict of the interest of drivers who use illegal means to benefit, some transport companies are worried its implementation will prevent drivers looking for employment to avoid their company, and have therefore opted out.

Interviews with fleet managers of some transport companies reflected their lack of faith in the service provider's ability to provide lasting support, training of staff, and solve problems that may arise in the system. A few have expressed interest to enroll if a government agency like INSA (Information Network Security Agency) takes over the operations as the service provider.

Non-reluctance of drivers to use the system due to misperception and lack of knowledge about the technology is another challenge inferred from the interviews. It has also been observed that the transport of cargo in containers without a lock that can be sealed makes the technology unable to monitor the cargo.

4.3.2. Challenges from the Service Providers' side

Only two service providers, GT and GCS, are currently licensed to work in the sector with Hi.G.Tek to implement the technology. Limitations of the local personnel in solving issues the system encounters are frequently seen as Hi.G.Tek employees are usually required to come to Ethiopia to repair the system.

The apparent inability of the local personnel to repair the system, and the consequential wait for a Hi.G.Tek employee to come to Ethiopia has resulted in a significant delay until the system can be fixed and be fully operational again. There is no established entity that focuses on working to fix problems in the system permanently and as soon as possible. In addition to this, there is lack of an adequately trained and skilled local expert that can supervise the maintenance of the system and fill in any knowledge gap the other employees may have.

It has also been witnessed that the service providers are able to repair the system on the vehicles only as far as Adama, as it is currently financially not viable to go further to provide support. This has in fact lowered the up-time of the system since problems may not be repaired as soon as possible.

Recording of the end of a trip is done using a hand-held device that is not reliable as it occasionally fails to communicate with the local servers, and frequently feeds false data.

4.3.3 Challenges from ERCA's Side

Interview with the system providers revealed that there is difficulty in acquiring the equipment needed for the cargo tracking system such as Electronic Seals, Seal Locks, Automatic Vehicle Locators, and GPS/GPRS Modems from abroad due to shortage of foreign exchange, often taking as long as 3 months to secure the dollars required for the purchase. Furthermore, the capacity of the network is apparently unable to support the 15,000 vehicles expected to enroll in the service.

The cargo tracking system is currently implemented in the route from Addis Ababa to Galafi. The absence of tracking from Djibouti port to Galafi and Dewele has made it impossible to monitor the cargo from the start of the trip to the destination.

The inadequacy of office space at the Custom posts is another challenge observed. The absence of ERCA employees outside of the Custom offices also means when the destination of the vehicles is away from Custom posts, like Industry zones and factories, the end of the trips are not recorded as there are no ERCA employees stationed outside of the Custom posts. The movement of trained IT employees leaving their work looking for greener pastures has also caused shortage of skilled man power.

4.3.4. Challenge from the Vendors' side

The software system at the data center needs to be interfaced with the ASYCUDA++ system which is running on Oracle data base management system for any communication and exchange of data between them. Despite this requirement, it is yet to be interfaced. According to information obtained from 2 companies (known as Mela and Bamilon) who are interested in working as Service Providers, their request to work with Hi.G.Tek in the sector has been met either with silence or with them being asked to pay an unfairly high amount of money to the company. This has discouraged IT companies from working as service providers in the sector.

Moreover, there is lack of adequate technology and skills transfer between Hi.G.Tek and the employees of ERCA and the service provider (GSS). The fact that when the hardware of the system needs repair, the equipment has to be sent overseas, or a Hi.G.Tek employee must come to Ethiopia to fix it is a reflection of the inability of the local personnel to acquire the necessary skills.

4.4. Contribution of GPS and RFID Implementation

This traditional data collection is time and worker -intensive, error-prone, and unreliable, due to the reluctance of workforces to monitor and record the presence of large numbers of vehicles in our country. Automating the task of identifying and tracking vehicles can provide timely and accurate information on vehicles available to the manager. The combination of Radio Frequency Identification (RFID) and Global Positioning System (GPS) technologies can facilitate extremely low-cost, infrastructure-free, and easy-to-implement solutions to uniquely identify vehicles, components, and equipment. The presented system is fully automatic and will lead to their location and tracking.

variable	Implement				Non- Implemented				t-value	P-value
	Mean	st.dev	Min	Max	Mean	Srd.err	Min	Max		
FUELCON	986.24	12.93	966	1020	1047.38	59.47	987	1150	125.37	0.000***
MANTCO	5100	520.41	4000	6000	5509	839.58	4500	7500	53.03	0.000***
VEHICLAV	2.04	.538	0	25	2.77	.84	5	26	8.6	0.000***
TRIPNIGHT	1.44	.506	11	14	1.5	.50	13	18	0.4	0.014*
DRIVERSPEED	78.64	.408	70	90	92.41	21.97	60	150	0.6	0.013*

Table 7 OWN Survey result

Contribution of GPS and RFID Implementation in Fuel consumption (Litter)

Nowadays the fuel saving issue is becoming more popular in world. Recent increases in fuel prices have a great impact on global economic changes. The transporters are worried about their fuel consumption according to their monthly budget. Excessive use of petroleum not only increases the budget Carbon Monoxide (CO) and green area gas released into the atmosphere environmental pollution. To protect the vehicle industry also made some attempts to improve vehicle modernization for fuel efficiency and economically viable environment friendly technology GPS and RFID. If we look at the descriptive statistics for the implemented and non-implemented groups, the mean fuel consumption of non- implemented is more than the mean of the implemented (1047.38 versus 986.24). As indicated the mean difference in fuel consumption level between the non-implemented and the implemented 62 Litter. The non-implemented vehicles more consume fuel to avoid excess of fuel GPS and RFID technology can be one of the most effective since manage fuel consumption when, to reduce margins and satisfaction of customers. Implemented vehicles more accurate than non-implemented vehicle used the fuel consume.

Contribution of GPS and RFID Implementation in Maintenance (Birr)

Fleets regular maintenance in to two methods one is time and other is kilometer in this research the all fleets regular maintenance schedule in kilometer. Now a day's vehicle also made some attempts to improve vehicle modernization for maintenance cost using technology GPS and RFID. If we look at the descriptive statistics for the implemented and non-implemented groups, the mean maintenance cost of non- implemented is more than the mean of the implemented (5509 versus 5100). As indicated the mean difference in maintenance cost between the non-implemented and the implemented 409 Birr. The vehicle regular maintenance very essential for

future travel schedule the new technology GPS and RFID one of the quality schedule the vehicle maintenance based on service needed. When a maintenance time or kilometer before near it's send notification via email or SMS. Non- implemented vehicle using manual record may the recorder person missing the regular maintenance the cost of the vehicle increase not only that it will be a cause of serious accident, implemented the technology reducing wasted maintenance expenses.

Contribution of GPS and RFID Implementation in fleet availability

One of the benefits of GPS and RFID technology automatically locate geographical positioning of a vehicle and transmit to central server using Hi-G-Tek software precise the location of the vehicles. If we look at the descriptive statistics for the implemented and non-implemented groups, the mean fleet availability of non-implemented is more than the mean of the implemented (2.77 versus 2.04). As indicated the mean difference in fleet availability the implemented vehicle more available than non-implemented. Non –implemented vehicles fleet managers track vehicles 70% using phone and other 30% used other communication like fax, SMS, human etc… but the implemented fleet managers track the vehicle by internet the fleet manager ensure that the direction of the route and to know traffic conditions so, GPS and RFID technology protect from unwanted time cost and show the right place at the right time. ERCA project manager (ECTS) Ashenafi says ("Electro Cargo Tracking technology (GPS and RFID), this technologies increased productivity in our services. The tracking system and cargo and container enable to see where is? And how it is move? To know the drivers are going through day to day activity on the road. It also help us report to actual location and distance." GPS and RFID technology minimizing driver time using the direction and assuring arriver time this more satisfy the customer generally the if the fleet availability is increased create better customer service.

Contribution of GPS and RFID Implementation in Accident reduction (Trip at Night)

In Ethiopia especially heavy vehicles travel at night time good and bad weather conditions all across the country, most of the accident happened register in traffic office at night time, Traffic death rates are very increase at night time because of at night time vision of our eyes very limited So, the drivers lose the advantage of color and contrast. If we look at the descriptive statistics for the implemented and non-implemented groups, the mean maintenance cost of non- implemented

is more than the mean of the implemented (1.5 versus 1.4). As indicated the mean difference in night driving between the non-implemented and the implemented 0.1 vehicles at night time driving lane and collides with another object, such as a tree beside the road or another vehicles. The driver is often alone, having been driving for some hours, often between midnight and 6am. The consequences of accidents attributed to driver fatigue are often the most serious in terms of death, injuries and property damage because the fatigued driver makes no attempt to avoid the impending crash. Non implemented vehicles a little bit increase than implemented vehicles travel at night time.

Contribution of GPS and RFID Implementation in Accident reduction (over speeding)

The significant reduction in the accident rate is attributed to enhanced driver night time and the drivers on the dangers of speeding which translated into a huge decrease in speed violations. While GPS and RFID fleet tracking system cannot prevent the occurrence of an accident, the details stored on each trip taken by a vehicle and the generated accident snapshots in the event of an accident provide additional evidence for the accident investigations. Trends in accident rates and data on speed violations within a given period have helped to structure relevant fleet operator. If we look at the descriptive statistics for the implemented and non-implemented groups, the mean maintenance cost of non- implemented is more than the mean of the implemented (92.41 versus 78.64). As indicated the mean difference in night driving between the non-implemented and the implemented 13.77 km/hr different. In Ethiopia maximum speed limit is 80km/hr greater than count excessive speeding the GPS and RFID technology more help control the speed of the vehicle by sending alarm. Non implemented vehicle drive above the limited speed this can often a death sentence for everyone involved the driver, passenger and innocent road-user.

Frequently Maintenance Part

	Implementation	Non-Implementation	Percent %
TIRE	14	19	58.93
Braking	11	6	30.36
Motor	0	6	10.71

Table 8 Own Survey result (frequently Maintenance)

Inquiry in to the reasons for vehicular maintenance in October and November of 2017 revealed that 33 (58.93%) of the 56 respondents frequently had to maintain the tires of the vehicles, while problem in the braking system was the most frequent reason for maintenance in 17 (30.36%). The remaining 6 (10.71%) respondents visited the garage most often due to difficulties in the motor of the vehicles. As can be inferred from the table above, the number of vehicles maintained due to problems of the braking system is higher in those who have implemented the cargo tracking system. This can be explained by the frequent use of the brakes when travelling during the day, since the tracking system has prevented travel during the night time.

Propensity score result and analysis

The result of the logistic regression model is used to estimate propensity scores for matching those who have implemented the technology with those who have not implemented it. As indicated earlier, the dependent variable in this model is a binary variable indicating whether the user was a participant in this technology. The model is estimated with STATA 14 computing software using the propensity score matching algorithm developed by leuven and Sianesi (2003). In the estimation data from the two groups; namely implementers and non-implementers were pooled such that dependent variable takes a value 1 for those who have installed the RFID and GPS technology and 2 gives for those who have not. Propensity score matching is a way to "correct" the estimation of treatment effect controlling for the existence of these confounding factors based on the idea that the bias is reduced when the comparison of outcomes is performed using Implementers and Non-Implementers who are as similar as possible. Since matching subject on an n-dimensional vector of the characteristics is typically unfeasible for large n, this method proposes to summarize pre-treatment characteristics of each subject into a single index variable the propensity score matching which makes the matching feasible(Shasure 2009). The extent to which this bias is reduced depends crucially on the richness and quality of non-implementer variables on which the propensity score is computed and the matching performed. To be more precise, the bias is eliminated only if the exposure to implement can be considered to be purely random among individuals who have the same value of the propensity score. The propensity score matching (PSM) model were users to estimate cost improvement effects of focus on fuel and maintenance cost and accident reduction focus on night driving and speed and fleet availability. The logistic regression model was used to estimate

propensity score matching for implemented and non-implemented. As, Results presented the pseudo-R^2 value is 0.223 a fairly low R^2 value shows that program do not have much distinct characteristics overall and as such finding a good match between implemented and non-implemented becomes easier. The pseudo- R^2 indicates how well the regresses explain the participation probability. After matching there should be no systematic differences in the distribution of covariates between both groups and therefore, the pseudo- R2 should be fairly low (Caliendo andKopeinig, 2008).

Outcome Variable	Estimation type	ATT	Std.Err	Z-value	P>/Z/
COST Fuel Consumption	***Inverse – probability weight***	**71.17**	**15.220**	**4.68**	**0.000*** **
	Nearest Neighborhood	**69.03**	**9.208**	**7.50**	**0.000*** **
	Propensity-score Matching	**64.821**	**11.145**	**5.82**	**0.000*** **
COST Maintenance Cost	***Inverse – probability weight***	**476.54**	**105.177**	**4.53**	**0.000*** **
	Nearest Neighborhood	**460.71**	**151.58**	**3.04**	**0.000*** **
	Propensity-score Matching	**451.78**	**92.63**	**4.88**	**0.000*** **
Fleet Availability	***Inverse – probability weight***	**.648**	**.182**	**3.56**	**0.000*** **
	Nearest Neighborhood	**.821**	**.221**	**3.71**	**0.000*** **
	Propensity-score Matching	**.678**	**.104**	**6.47**	**0.000*** **
Accident reduction *(Trip night)*	***Inverse – probability weight***	**.167**	**.114**	**1.47**	**0.142**
	Nearest Neighborhood	**.142**	**.167**	**0.86**	**0.3**
	Propensity-score Matching	**. 285**	**.112**	**2.53**	**0.011***
Accident reduction *(speeding)*	***Inverse – probability weight***	**.168**	**.126**	**1.33**	**0.183**
	Nearest Neighborhood	**.339**	**.161**	**2.10**	**0.036***
	Propensity-score Matching	**.267**	**.112**	**2.37**	**0.018***

Table 9 Matching Methods to Measure contribution of GPS and RFID implementation

Estimation of impact of factor influencing treatment effect (ATT) on fuel consumption

Table 4.10 presents results from the PSM model that was estimated for comparison purposes with the treatment effect model results. Three matching estimators, the inverse probability weights, the nearest neighbor and the propensity-score matching algorithms were employed for all out come variables as robustness checks. The three estimators result

indicates that the use of GPS and RFID tracking system has a significant impact on the average fuel consumption of vehicles. Vehicles who have installed the cargo tracking technology have lower average fuel consumption compared to those who have not. In this respect, the difference between the two groups in terms of fuel cost per trip is significant at 1% significant level. ATT results of these algorithms show that implementation of the GPS and RFID tracking lowered the average fuel consumption of a round-trip between Addis Ababa and Djibouti by 71.17 liters, 69.035 liters and 64.821 liters for inverse probability weights, nearest neighborhood and propensity-score matching respectively. The average fuel saved estimated using the inverse-probability weights matching algorithm is higher than that of the other two matching algorithms. Comparing the results across the different matching methods indicate that the estimated GPS and RFID technology impact is robust.

The new technology's integration into the fuel tank of the vehicles allows it to send data about fuel consumption into the central server using GPRS technology. The data is sent in 2 ways, depending on the model of the vehicle. The technology will either send data about the amount of fuel in the tank, or the consumption of fuel per kilometers (in vehicles manufactured after 2012). In addition, the system allows for the control of the vehicle using draw and setup Geo-fencing, and directing of the route of movement of the vehicle. This helps minimize illegal and unsanctioned journeys, increase the resource utilizing levels, while at the same time controlling service related costs. As shown in the table above, the implement vehicle the implementation of the tracking technology saves fuel consumption by an average of 68.342 L. different this is to convert to birr 1,117.390 birr save the implemented vehicles.

Estimation of impact of factor influencing treatment effect (ATT) on Maintenance Cost

Presents results from the PSM model that was estimated for comparison purposes with the treatment effect model results. Three matching estimators, the inverse probability weights, the nearest neighbor and the propensity-score matching algorithms were employed for all out come variables as robustness checks. The three estimators result indicates that the use of GPS and RFID tracking system has a significant impact on the average maintenance cost of vehicles. Vehicles who have installed the cargo tracking technology have lower average maintenance cost compared to those who have not. In this respect, the difference between the two groups in terms of fuel cost per trip is significant at 1% significant level. ATT results of these algorithms show

that implementation of the GPS and RFID tracking lowered the maintenance cost of a round-trip between Addis Ababa and Djibouti by 476.54, 460.71 and 451.78 for inverse probability weights, nearest neighborhood and propensity-score matching respectively. The average maintenance cost saved estimated using the inverse-probability weights matching algorithm is higher than that of the other two matching algorithms. Comparing the results across the different matching methods indicate that the estimated GPS and RFID technology impact is robust.

The RFID and GPS technology triggers an alert when any vehicle reaches its pre-set manufacturer mileage points and the operator may be reminded to take in the vehicle for servicing, which will reduce the overall maintenance costs. The table above shows that the vehicles who have not implemented the tracking system have an average maintenance cost that is higher than the vehicles who have installed the system. Vehicles without tracking technology used manual maintenance records, which made it impossible to effectively track each unit's servicing mileage intervals. This resulted in many premature breakdowns occasioning high maintenance costs. The GPS alerts act as a tool of compliance to the planned maintenance and help to prevent the premature failure of major vehicle parts. This result has significance to save maintenance costs and increased fleet productivity.

Estimation of impact of factor influencing treatment effect (ATT) on accident reduction

In our consideration of two variables, rate of night trips and speeding, as predictors of accident rate, the table above demonstrates that the rate of unsanctioned night trips in vehicles who have installed the tracking technology is slightly lower compared to those who have not. In this respect, the difference between the two groups is significant at 10% probability level. Results show that installation of the tracking technology reduced the rate of night driving by .285 the result of Propensity-score matching algorithms. The difference between the treatment and control groups in terms of speeding is also significant at 10% probability level. Results show that installation of the tracking technology reduced the rate of speeding by .339, and .267 based on the ATT results of Nearest Neighborhood and Propensity-score matching algorithms respectively.

The RFID and GPS vehicle tracking system is a valuable tool for preventing speeding, preventing night driving violations and recording pre-accident and post-accident data which is critical during investigation of the accidents. Speeding and night driving contributed to an

improvement on the safety records and a reduction in unnecessary accident cost as represented by the strong relationships between speeding, night driving and accident risk; these variables have strong associations with accident rate. Therefore, the possibility of reducing an accident decreases as speeding and driving during the night time are lowered. Conversely, when there is a higher incidence of speeding and night driving violations, the accident risk increases. The two variables have direct relationships. The enhanced monitoring of driving behavior through online GPS and RFID reports have led to improved driving habits and increased safety which reduce the chances of an accident happening. This has translated into a huge reduction in the rate of accidents measured in million kilometers. In the above table the night driving 26% than implemented vehicle it is one of the reason of accident happening.

Estimation of impact of factor influencing treatment effect (ATT) on fleet availability

Table 4.10 shows that participants save more as compared to non-participants. The ATT result of the above three algorithms revealed that availability of the vehicular fleet is significant at 1% significant level. The availability of the fleet in vehicles who have implemented the GPS and RFID tracking is shown to be .648, .821 and .678 based on the ATT results of Inverse-probability weights, Nearest Neighborhood and Propensity-score matching algorithms respectively. This means that fleet availability in the treatment group is higher with these figures compared to control clients.

Improving fleet availability is one way to gain a competitive edge by providing efficient service to premium ERCA customers. As well as it's important to make close relationship supplier with customers. The greatest advantage has been the real-time monitoring and interaction with fleet vehicles to attain high fleet operation and provide a fast response to customer needs. This was largely as a result of enforcing over speeding limit, night driving and good driving habits, an important feature of the RFID and GPS technology. This, in turn, leads to increased productivity because of better safety and operational management decisions. In the above table 64% available installed this technology than uninstalled this increase in the percentage of available vehicles as compared to the total allocated fleet most of the implemented vehicle available than the non-implemented. When consequently increase the vehicle availability increase the revenue generated. This represent a direct financial contribution to the transporter and ERCA more efficient logistic process.

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary of Major Findings

As it has been clearly indicated in the introduction part, the main objective of this thesis was to show assess the practice and identify the challenges in the implementation of the GPS and RFID technology in our logistic system. Therefore, the following major findings were obtained on the basis of the analysis.

- The study revealed that the use of RFID and GPS tracking technology is strongly associated with lower fuel consumption by an average of 62 liters per trip and maintenance cost by an average of 409 birr per regular maintenance interval.
- The average duration of a round-trip between Addis Ababa and Djibouti has decreased from 6 days to 4 days, which has resulted in a higher turnover of trips and generally increased the fleet availability.
- The study also showed that the tracking technology has eliminated unsanctioned trips and illegal night driving.
- It has also been shown that it has prevented drivers from transporting unauthorized goods since the system monitors that the vehicles are not carrying any weight above that is indicated on the manifest.

5.2. Conclusion

The premise of this thesis was the need for assessment of the practice and challenges in the implementation of RFID and GPS technologies in the logistics system. The research process therefore designed appropriate techniques and instruments to establish whether the implementation of the technology is feasible in the vehicles and to explain the possible obstacles and challenges. Since this research is the first ever assessment of the practice of the two technologies on the logistic system in Ethiopia, the practice and challenges encountered during the study, and the suggestions herein will pave way for further studies.

This study demonstrated that the use of RFID and GPS tracking technology is associated with lower fuel and maintenance cost, shorter trip duration and a higher turnover of trips. The tracking

technology has eliminated unsanctioned trips and illegal night driving. It has also been shown that it has prevented drivers from transporting unauthorized goods since the system monitors that the vehicles are not carrying any weight above that is indicated on the manifest. Despite the system's ability to record the speed the vehicles are travelling at, the study shows that it has not prevented the drivers from over speeding.

This study only assessed the practice and challenge of the tracking technology on vehicles transporting goods that are most often transported in cargo containers. The movement of goods in our country is not limited to containers. In fact, most of the vital exports of Ethiopia, such as Coffee, are transported packed on the back of trucks. The impact of the technology on this conventional and wide spread transport of goods is one area that can be explored in future researches.

5.2. Recommendation

- Knowledge and skill transfer from Hi.G.Tek to local service providers and ERCA employees should be encouraged as it will allow solving future technical dificulties with local experts.
- The fact that there is only not more than two service provider currently in the country that, despite its interest to monopolize the sector, lacks the capability to support the system when it goes to implementation has contributed to the delay of the completion of the project. steps need to be taken to ensure greater responsibility in the service provider and hold them accountable should they fail to carry out their duties. In addition, more service providers should enter the sector.
- The transport ministry should educate Transport Associations and drivers about the benefits of implementing the cargo tracking technology. Service providers should also educate their clients about their service, and raise the quality of their operation to increase the level of trust transport companies have on them.
- The stakeholders should work together to make sure all cargo containers have an electronic lock, and those without are excluded from the carrying goods on this route.
- Licensing Agencies should improve their service with a focus on optimizing speed.

- The service providers should either get priority in securing the foreign exchange necessary for purchasing the tracking equipment, or should be given a Franco Valutta licence.
- When service providers import cargo tracking equipments, they should be given priority at the Custom posts so that the import can be facilitated.
- According to the service providers, the 3 MB network capacity currently available is insufficient to support the number of vehicles in the system. Means to increase the capacity should be arranged by establishing communication between Ethiotelecom and the Technology Directorate.
- To allow tracking of the vehicles from their point of departure to their destination, and prevent illegal cargo handling between the port and Dewale/Galafi the coverage area of the RFID and GPS technology should stretch to Djibouti port.
- The shortage of office space at Custom posts must be increase
- To monitor vehicles with a destination away from Custom posts (such as Industry zones) and record the safe arrival of the cargo
- To prevent the migration of skilled man power in ERCA to the private sector, the agency should provide competitive salary and benefit packages to its employees.

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Appendix A

Appendix A1 Estimation of impact of factor influencing treatment effect (ATT) on fuel consumption

```
Treatment-effects estimation                    Number of obs      =         56
Estimator      : inverse-probability weights
Outcome model  : weighted mean
Treatment model: logit
```

FUELCONSM	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT (NONIMPLMENT vs IMPLMENTED)	71.17091	15.22074	4.68	0.000	41.33882	101.003
POmean						
PARTSPANT IMPLMENTED	986.3081	2.428351	406.16	0.000	981.5486	991.0676

```
. teffects psmatch (FUELCONSM) (PARTSPANT AGE MARTSTA  CHILDREN EDUCATION WORKPOS MODEL MANYEAR FUELINBIRR)

Treatment-effects estimation                    Number of obs      =         56
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Treatment model: logit                                         max =          1
```

FUELCONSM	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT (NONIMPLMENT vs IMPLMENTED)	64.82143	11.1451	5.82	0.000	42.97744	86.66542

```
Treatment-effects estimation                    Number of obs      =         56
Estimator      : nearest-neighbor matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Distance metric: Mahalanobis                                   max =          1
```

FUELCONSM	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT (NONIMPLMENT vs IMPLMENTED)	69.03571	9.208238	7.50	0.000	50.9879	87.08353

Appendix A2 Estimation of impact of factor influencing treatment effect (ATT) on maintenance cost

```
Treatment-effects estimation                    Number of obs     =         56
Estimator      : inverse-probability weights
Outcome model  : weighted mean
Treatment model: logit
```

MAINCOST	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT (NONIMPLMENT vs IMPLMENTED)	476.5429	105.1772	4.53	0.000	270.3995	682.6864
POmean						
PARTSPANT IMPLMENTED	5072.951	82.66904	61.36	0.000	4910.923	5234.98

```
. teffects nnmatch (MAINCOST AGE MARTSTA  EDUCATION WORKPOS  MANYEAR) (PARTSPANT)

Treatment-effects estimation                    Number of obs      =         56
Estimator      : nearest-neighbor matching      Matches: requested =          1
Outcome model  : matching                                   min =          1
Distance metric: Mahalanobis                                max =          1
```

MAINCOST	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT (NONIMPLMENT vs IMPLMENTED)	460.7143	151.5863	3.04	0.002	163.6107	757.8179

```
Treatment-effects estimation                    Number of obs      =         56
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                   min =          1
Treatment model: logit                                      max =          1
```

MAINCOST	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT (NONIMPLMENT vs IMPLMENTED)	451.7857	92.63064	4.88	0.000	270.233	633.3384

Appendix A3 Estimation of impact of factor influencing treatment effect (ATT) on Fleet Availability

```
Treatment-effects estimation                    Number of obs     =         56
Estimator      : inverse-probability weights
Outcome model  : weighted mean
Treatment model: logit
```

VHIAVALABLE	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT						
(NONIMPLMENT vs IMPLMENTED)	.6488473	.1820989	3.56	0.000	.2919401	1.005754
POmean						
PARTSPANT						
IMPLMENTED	2.047693	.0712481	28.74	0.000	1.908049	2.187336

```
. teffects nnmatch (VHIAVALABLE AGE MARTSTA CHILDREN EDUCATION WORKPOS MODEL MANYEAR ROUNDTRIP) (PARTSPANT)

Treatment-effects estimation                    Number of obs     =         56
Estimator      : nearest-neighbor matching      Matches: requested =         1
Outcome model  : matching                                   min =         1
Distance metric: Mahalanobis                                max =         1
```

VHIAVALABLE	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT						
(NONIMPLMENT vs IMPLMENTED)	.8214286	.2212756	3.71	0.000	.3877364	1.255121

```
Treatment-effects estimation                    Number of obs     =         56
Estimator      : propensity-score matching      Matches: requested =         1
Outcome model  : matching                                   min =         1
Treatment model: logit                                      max =         1
```

VHIAVALABLE	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT						
(NONIMPLMENT vs IMPLMENTED)	.6785714	.10486	6.47	0.000	.4730496	.8840932

Appendix A4 Estimation of impact of factor influencing treatment effect (ATT) on Accident reduction (trip night)

```
Treatment-effects estimation                    Number of obs     =         56
Estimator      : inverse-probability weights
Outcome model  : weighted mean
Treatment model: logit
```

TRIPNIGHT	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT						
(NONIMPLMENT vs IMPLMENTED)	.1679927	.1142886	1.47	0.142	-.0560089	.3919942
POmean						
PARTSPANT						
IMPLMENTED	1.435721	.0764997	18.77	0.000	1.285784	1.585658

```
. teffects nnmatch (TRIPNIGHT AGE MARTSTA CHILDREN EDUCATION WORKPOS  MANYEAR) (PARTSPANT)

Treatment-effects estimation                    Number of obs     =         56
Estimator      : nearest-neighbor matching      Matches: requested =         1
Outcome model  : matching                                   min =         1
Distance metric: Mahalanobis                                max =         1
```

TRIPNIGHT	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT						
(NONIMPLMENT vs IMPLMENTED)	.1428571	.167061	0.86	0.392	-.1845764	.4702907

```
Treatment-effects estimation                    Number of obs     =         56
Estimator      : propensity-score matching      Matches: requested =         1
Outcome model  : matching                                   min =         1
Treatment model: logit                                      max =         1
```

TRIPNIGHT	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT						
(NONIMPLMENT vs IMPLMENTED)	.2857143	.1129843	2.53	0.011	.0642692	.5071594

Appendix A5 Estimation of impact of factor influencing treatment effect (ATT) on Accident Reduction (Over speeding)

```
Treatment-effects estimation                    Number of obs     =         56
Estimator      : inverse-probability weights
Outcome model  : weighted mean
Treatment model: logit
```

DRVSPEED	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT (NONIMPLMENT vs IMPLMENTED)	.1681125	.1261564	1.33	0.183	-.0791494	.4153745
POmean						
PARTSPANT IMPLMENTED	1.181024	.0787717	14.99	0.000	1.026635	1.335414

```
. teffects nnmatch (DRVSPEED AGE MARTSTA CHILDREN EDUCATION WORKPOS MODEL MANYEAR MAXSPEED) (PARTSPANT)

Treatment-effects estimation                    Number of obs     =         56
Estimator      : nearest-neighbor matching      Matches: requested =         1
Outcome model  : matching                                   min =         1
Distance metric: Mahalanobis                                max =         1
```

DRVSPEED	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT (NONIMPLMENT vs IMPLMENTED)	.3392857	.1615918	2.10	0.036	.0225717	.6559997

```
Treatment-effects estimation                    Number of obs     =         56
Estimator      : propensity-score matching      Matches: requested =         1
Outcome model  : matching                                   min =         1
Treatment model: logit                                      max =         1
```

DRVSPEED	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
PARTSPANT (NONIMPLMENT vs IMPLMENTED)	.2678571	.1129198	2.37	0.018	.0465383	.489176

Multinomial logistic regression

Number of obs	=	56
LR chi2(8)	=	17.22
Prob > chi2	=	0.0279
Pseudo R2	=	0.2236

Log likelihood = -29.886614

PARTSPANT	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
IMPLMENTED						
AGE	.0845483	.0946367	0.89	0.372	-.1009362	.2700328
MAXSPEED	-.0775373	.0307523	-2.52	0.012	-.1378107	-.017264
MARTSTA	.1600416	.5484104	0.29	0.770	-.9148231	1.234906
CHILDREN	1.538126	1.096508	1.40	0.161	-.6109911	3.687243
EDUCATION	1.375389	.7442679	1.85	0.065	-.0833494	2.834127
WORKPOS	-.0191152	.1059631	-0.18	0.857	-.2267992	.1885687
MODEL	-.5927784	1.150466	-0.52	0.606	-2.847649	1.662093
MANYEAR	-.0975022	.15314	-0.64	0.524	-.3976511	.2026466
_cons	194.6349	308.9332	0.63	0.529	-410.8632	800.1329
NONIMPLMENT	(base outcome)					

Appendix B

ST.MARY`S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

PROJECT MANAGEMENT.

December, 2018

THE PRACTICE AND CHALLENGES IN IMPLEMENTING GPS AND RFID TECHNOLOGIES: THE CASE OF CONTAINER AND CARGO HANDLING IN ERCA

Dear respondent,

This study is being conduct as a part of MBA in project management by school of St.Marry University. For my final project I am asses the practice and challenges of implementation GPS and RFID technologies: the case of container and cargo handling in ERCA

because you are one of the participant in this project I select different section from different company, I am inviting you to participate in this research study by completing the attached survey.

The following questionnaire will require approximately 10-15 minutes completing. There is no compensation for responding nor is there any known risk. In order to ensure that all information will remain confidential, please do not include your name, please answer all questions as honestly as possible and return the completed questionnaires via Email, post or physically. If you have any questions or concerns about completing the questionnaire, about being in this study, or to receive a summary of my findings you may contact me at via email or phone. Thank you for taking the time to assist me in my education endeavor.

Sincerely,

Demographic Data

1. Gender

   1. Female ☐ 2. Male ☐

2. How old are you----------Years
3. Marital status

   1. Single ☐ 2. Married ☐

   3. Widow ☐ 4. Divorced ☐

4. Do you have a children

   1.Yes ☐

   2.No ☐

5. What is your educational level

   1. primary …… ☐

   2. secondary ☐

   3. diploma ☐

   4.degree ☐

   5. masters and above ☐

6. How Long you stayed in your work Position----------Years
7. What Types of the model ☐ ☐

   1. IVECO 3. VOLVO

   2. MAN 4. Marche dies

8. Manufacture year of the vehicle ----------

“COST

1.. On average, how long does it take for the vehicle to make a round trip from Addis Ababa to Djibouti?

----------Days

2.. How much is the average fuel consumption of the vehicle on a round trip from Addis Ababa to Djibouti?

----------Liters

3. On what basis does the vehicle undergo regular maintenance?

1) Time

2) KM

4. How does the overall cost of running the vehicle after the installation of the RFID and GPS technology?

1) It has increased

2) It has decreased

6. Which car part requires the most frequent maintenance?

1) Tires

2) Brake and its components

3) Motor

ACCIDENT REDUCTION

1. Do you frequently make trips during the night?

1.Yes

2. No

2. Do you drive the vehicle above the speed limit of 80km/hr?

1. Yes

2. No

If you answer Yes how much it is_____--

3. Does the RFID and GPS technology give you a warning when you drive above the speed limit?

1. Yes

2. No

4. What is the top speed of the vehicle?

_____Km/Hr

TRIP

1. Do you believe the vehicle always travels in its predetermined route?

    1. Yes
    2. Doubtful
    3. No

2. Does the vehicle frequently arrive at its destination before its predicted arrival time?

    1. Yes
    2. No

3. Has the implementation of the RFID and GPS technology given you comfort and ease of mind in your travels?

    1. Yes
    2. No

4. If No, please explain why it has failed to do so.

SECURITY AND MONITORING

1. Have you received a complaint from your clients about missing cargo?

    1. Yes
    2. No

2. How do you communicate to find out where the vehicle has reached?

    1. Phone
    2. Fax
    3. SMS
    4. Internet

3. Has the vehicle available in the same period between implement and non-implement

    1. Both are available
    2. Implemented fleet always available
    3. Non-Implemented fleet not available
    4. Both are not available

How much did the redistribution of resources to companies in different parts of the country affected the duration of the project period

---

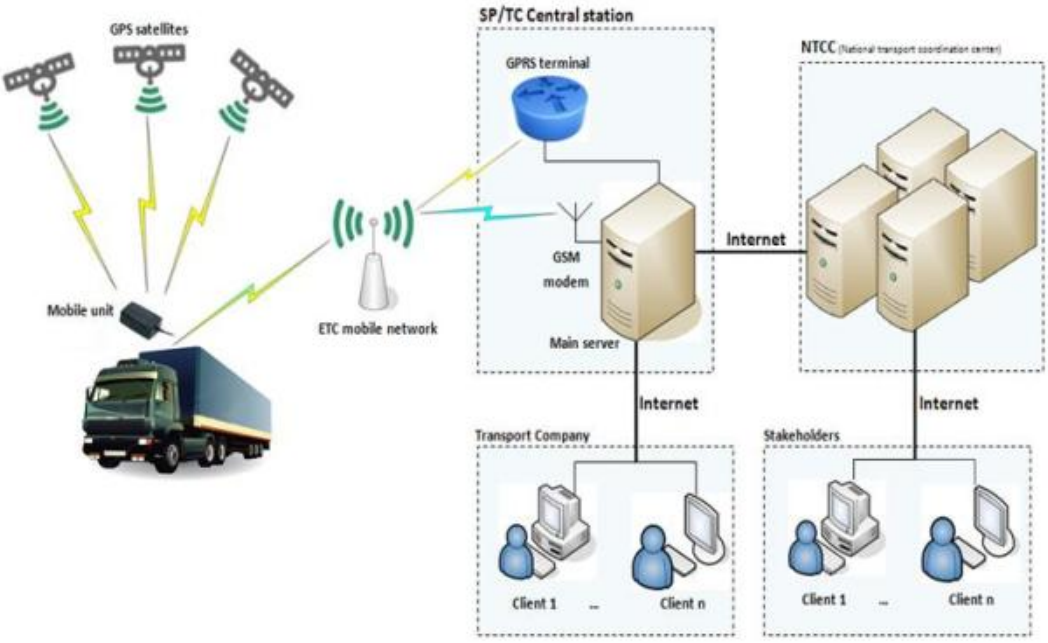
Was the project affected by changes in the organization during the project time (e.g site weathers, managerial changes, expertise withdrawal etc…

To what extent was the project given high priority compared to other projects running at the same time?

Interview

1. What was the goal of the Electro cargo tracking implementation?
2. Has the new technology system led to a higher need for change of the organization and process?
3. What was the project period and costs? Actual and Estimated?
4. Were there any changes from original scope, Costs and schedule?
5. Did you promote the electro cargo tracking technology?
6. Did you have enough professional? if you have NO how do we increase new technologies expert ?
7. What are the challenge for the implementation of the project ?
8. Do you believe there is an adequate communication framework b/n ERCA and others?
9. What are the benefits gained from the implementation of ECTS?

Appendix C



system architecture

LOGIN PAGE

SPFMS
SERVICE PROVIDER

Home | About Us | Log In

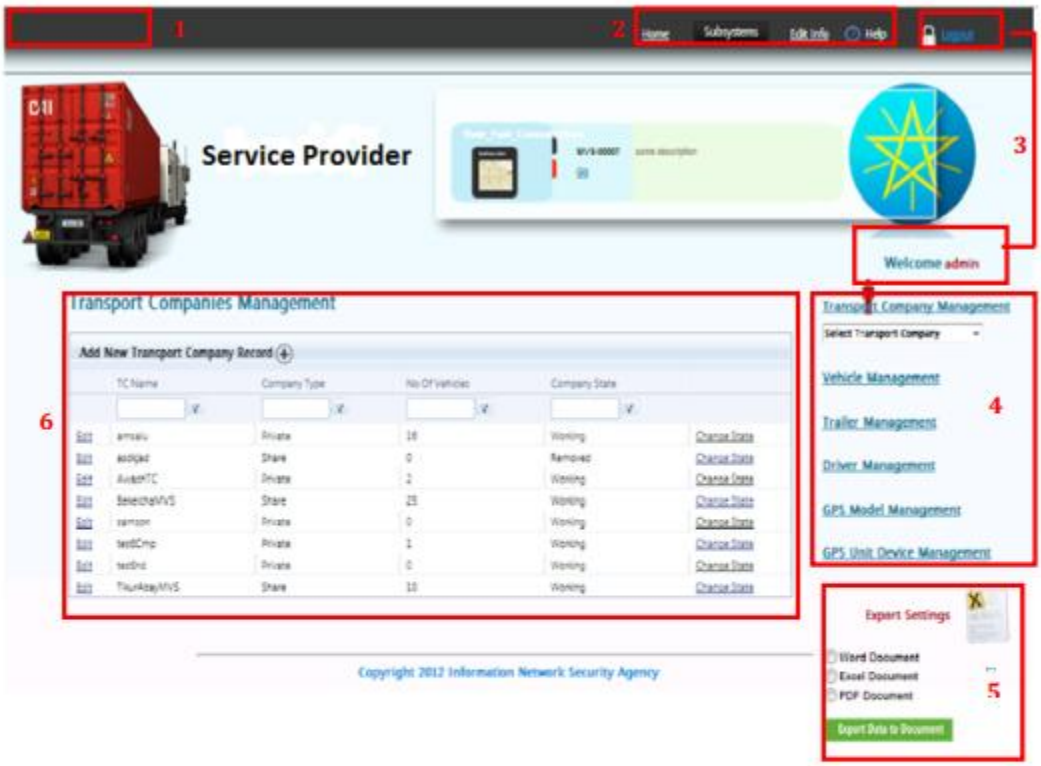
Log In

User Name:

Password:

Remember me next time.

Log In



The SPFMS application interface can be divided into six parts.

1. Language Selector
2. Navigation Menu
3. Logging Information
4. Subsystem's links
5. Export setting
6. Work Window

Appendix D

Declaration

I Amha Tesfaye declare that this thesis conducted under the title the contribution of GPS and RFID technologies to efficient container and cargo handling: the case of ERCA is my original work, prepared under the guidance of Dr. Maru Eshete (Assoc Professor). All the sources of materials used for thesis have been full acknowledged. I further confirm that the study has not been submitted in part or in full to any other higher learning institutions for the purpose of earning a degree.

Amha Tesfaye _____

St. Mary's University, Addis Ababa January, 2017

Endorsement

This thesis has been submitted to St. Mary's University, School of Graduate Studies for examination with my approval as university advisor.

Dr.Maru Shete (Assocc. Professor) _____

St. Mary's University, Addis Ababa January, 2018