WEB-BASED FREIGHT FORWARDING SYSTEM FOR LOGISTICS MANAGEMENT: CASE STUDY OF TRUELINE AFRICA LIMITED IN KAMPALA, UGANDA

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A Project Report Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science in Embedded and Mobile Systems of the Nelson Mandela African Institution of Science and Technology

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ABSTRACT

Freight forwarding sector is moving from manual handling of freights to electronic freight because of the ever-changing needs of technologies. The study aimed to develop a freight forwarding web-based information system to manage logistics by automating manual processes that enable electronic data exchange, accelerate processes, improve communication, facilitate easy access to and retrieval of documents, enhance customer service, and drive efficiency and profitability. In order to collect the data, the author employed both qualitative and quantitative techniques, as well as the Extreme Programming (XP) system development methodology. The developed system was tested and assessed using unit testing, integrated testing, and system testing. By creating a survey questionnaire and distributing it to the system's end users, the system was validated using the TAM with Trust. The verdicts showed that perceived usefulness, perceived ease of use, and system acceptance are all influenced by trust, which is believed to be a key component. Furthermore, it has been found that system usage and perceived utility are greatly enhanced by perceived ease of use. The creation of this system has reduced errors, work overload, operating expenses, and the likelihood of on-time item delivery. The author advises using the Global Positioning System (GPS) for cargo tracking and visibility in additional investigations, as well as integrating it with customs systems for compliance checks and guaranteeing adherence to legal standards to lower the danger of fines and delays.

DECLARATION

I, Siama Marry, do hereby declare to the Senate of the Nelson Mandela African Institution of Science and Technology that this project report is my original work and that it has neither been submitted nor being concurrently submitted for a degree award in any other institution.

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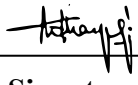
Dr. Maranya Mayengo		06/08/204
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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by the Nelson Mandela African Institution of Science and Technology, a project report titled **"A web-based freight forwarding information system for logistics management: Case study of TrueLine Africa Limited in Kampala, Uganda"** in partial fulfillment of the requirements for the degree of Master of Science in Embedded and Mobile Systems of the Nelson Mandela African Institution of Science and Technology.

Prof. Shubi Kaijage		6th Aug 2024
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DEDICATION

This dissertation is devoted to my spouse, Sebit Silvano Lino, who has been an unwavering source of encouragement and support during my academic career. This piece of work is also dedicated to my dear parents, who have taught me to always work hard via their unwavering love and support. I will always be grateful to my sisters for standing by me and assuming my position in the family.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND SYMBOLS

ASPs	Application Service Providers
C-DFP	Cloud-based Digital Freight Forwarder's Platform
CRUD	Create Read Update and Delete
CSS	Cascading Styling Sheet
DHL	Dalsey Hillblom Lynn
EMoS	Embedded and Mobile System
FIATA	Federation of International of East African Freight Forwarders
GPS	Global positioning system
HTML	Hypertext Markup Language
ICT	Information and Communication Technology
NM-AIST	Nelson Mandela African Institution of Science and Technology
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
PU	Perceived Usefulness
RIA	Rich Internet Applications
SDLC	System Development Lifecycle
TAM	Technology Acceptance Model
TOGAF	The Open Group Architecture Framework

CHAPTER ONE

INTRODUCTION

1.1 Background of the Problem

Effective logistics administration in an organization can greatly assist in cost reduction and service improvement (Nyameboame & Haddud, 2017). As a result, organizations are pressured to look for other means of creating value and pass it on to their prospective customers (Porter & Kramer, 2018). For successful logistics within and across international borders requires prospective freight forwarders who have good knowledge of domestic and international trade law (Arvis *et al.,* 2018), customs services and procedures, and a solid understanding of shipping methods and insurance, as well as a good grasp of overseas markets and regulations (Kaye, 2020). Therefore, freight forwarding is the process of offering logistical services on behalf of shippers in delivering goods from a specific location and moving them to the final destination using a single or multiple carriers (Wang & Sarkis, 2021).

On behalf of local or international shippers, they offer services such as air, ocean or inland freights, freight rate negotiations, cargo tracking, customs documentation, customs clearance, warehousing and distribution, and cargo insurance, among other tasks (Azim, 2016). The freight forwarding industry often involves several parties such as the local and international forwarders, shippers, consignees, carriers, co-loaders, insurers among others (Lalith, 2018). For the supply chain to be benefited from the freight industry, it must execute with efficiency (Waters, 2021) as a result, the forwarders are compelled to search for cost savings strategies by investing in and adopting information technology in order to achieve efficiency and effectiveness to stand competition in today's global logistics (Sudan & Taggar, 2021).

In the year 2020, the global market for this industry was measured at about 161 billion euros and by the year 2025, it is expected to rise by 207 billion euros as shown on Fig. 1. The examples of companies that are leading in this industry are Kuehne+ Nagel, Panalpina and DHL. The regions of North America, Asia Pacific and Europe dominate the freight forwarding market with 86% counts. According to Millar (2017), there is global market opportunity with 57 billion of dollars for all sizes of freight forwarders. The rising of the international e-commerce is stimulating change and innovation in the freight forwarding industry (Lafkihi *et al.,* 2019) and the current generation of digital devices such as smart phones, tablets among others and availability of the internet has enabled the freight forwarding industry to thrive in

the era of e-commerce (Taneja, 2021) in facilitating both local and international transport (Van-Asch *et al.,* 2020). With the fastest growing market of the freight forwarding industry, there is more opportunities if players can embrace technologies in order to increase sales and efficiency of their business operations (Attaran, 2020). Having a strong global network is very advantageous to the companies for competitive advantage and huge transformation hence improving customer experience (Mazareanu, 2021)

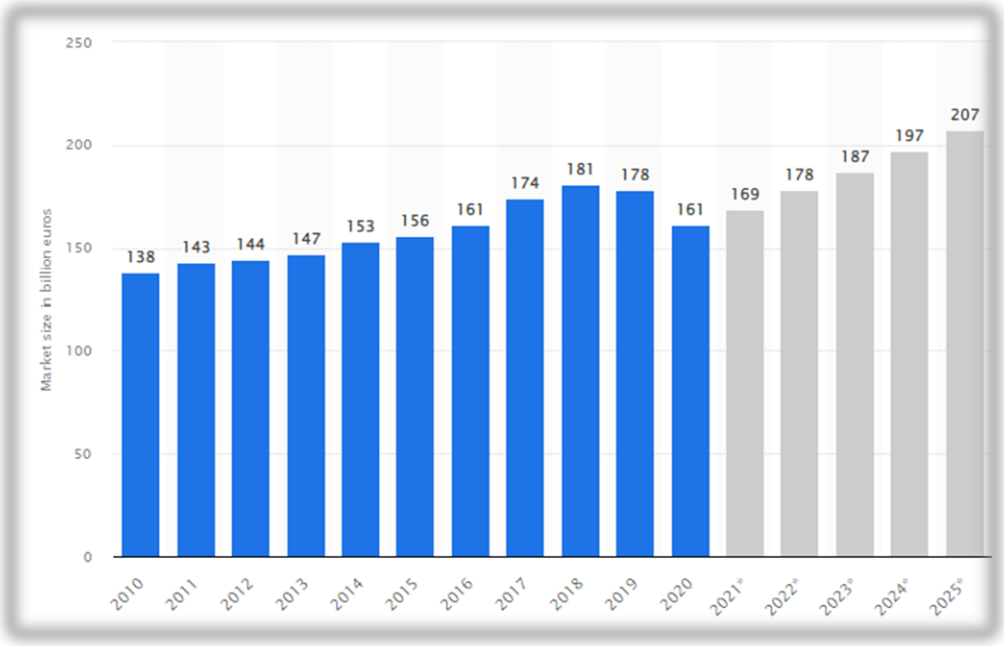

Figure 1: Worldwide freight forwarding market size (Statista, 2022)

The freight forwarding industry is thriving in the continent Africa because Africa has elevated to eminence with investment opportunities due to the existing natural resources readily available over the past few years. Logistics and transport play so the role of transportation and logistics which has taken on greater significance. Exporters and importers often require efficient, safe and cost-effective transportation of their merchandise (Ruske & Kauschke, 2013). In some countries in Africa, digitalization of the industry has improved, however, most of the digital systems in place lack communication systems acting as a hub for the efficient flow of information and operations (Fromhold-Eisebith *et al.,* 2021). This is due to a shortage of digital transformation in the industry. The transport network in Africa steps to improve have been put in place. For instance, in Nigeria, the transport is under reconstruction (Kuteyi & Winkler, 2022).

In East Africa, there is an increase in the use of computers and other digital devices plus the availability of the internet has provided faster and cheaper services and is more widely available (Haleem *et al.,* 2022). The management of the company has been forced to investigate various concepts, technologies, and techniques of information management and automation as a result of freight forwarders using technology for effective and sophisticated logistics. The use of Information technology systems in the freight forwarding industry is highly needed in order to speed in the movement of exports and imports procedures for submission of documentation, risk assessment, accreditation, pre-shipment inspection and many other aspects of the logistics facilitation process.

Like most sectors, the freight forwarding industry in Uganda has experienced significant growth and attracted both local and foreign investments, with over 231 licensed freight forwarding companies. Numerous businesses, big and small, are united under the global auspices of FIATA (Federation of International Freight Forwarders Association), as well as other regional associations such as Federation of East African Freight Forwarders (FEAFFA), whose principal objectives are, among other things, to unite all the stakeholders in this sector in the regions in which it functions, to represent, promote, and safeguard the industry's interests (Zailani, 2017).

There are various practical ramifications of developing this system. Firstly, by lowering the time and expense of transportation, enhancing inventory control, and raising customer satisfaction, it can assist freight forwarding operations become more efficient (Aziz *et al.,* 2018). Secondly, the system provides a wide range of data-driven service capabilities that can help with managing logistics (Heinbach *et al.,* 2022). It boosts competitive performance by connecting all internal activities and external stakeholders (Andry, 2018).

1.2 Statement of the Problem

Greatest number of freight forwarders handle their daily transactions using a paper-based system, according to Twesige (2014) E-Fright survey. For instance, offline quotation and booking processes are lengthy and cumbersome, document filling and document conveying is tedious, time-consuming, prone to errors and there is a high risk of tare and deterioration, documents mismatch and misplacing leading to delay in the clearing process, loss of documents, high costs and custom penalties, generally, the paper-based processes are less efficient (Huber, 2021).

There is high customer demand and expectation due to rapid change in the logistics industry both locally and internationally. For instance, customers expect faster delivery of goods in a flexible manner and at a low cost. With the recent trend in technology, most customers expect to receive updates of their cargo in a real-time (Tipping & Kauschke, 2016).

Many tasks of the freight forwarder relate to communication of information yet most of the means of communication are still tradition through the use of personal massagers, telegram, telephone, telex and telefax which has triggered traditions and habit. In the freight forwarding industry, most data are connected continually between the diverse stakeholders/parties: creating, receiving, capturing, manipulating, forwarding and taking act based on it (Manyika *et al.,* 2017). With automated technology that captures information, accelerate its flow and enable sharing has a vital impact on the shipping progression.

Information systems have become a common place for freight forwarders in order to increase efficiencies hence improving logistics. This has pressed freight forwarders to explore numerous ideas, technologies, methods for data management and automation. Nonetheless, freight forwarders are finding difficulties in choosing systems which are flexible and meeting business needs. Already existing off-the-shelf systems are in place; however, they are not suitable to the purpose of the freight forwarder, some having malfunctions, unnecessary functions and bad interfaces not customized by and large.

The proposed system justified the need to understand and develop a freight forwarding application that suites the needs of a particular firm for efficient and effective performance. From the result of the questionnaire, the respondents strongly agree to the expansion of the system in order to improve quality of service, ensure secure movement of cargo, reduce cost of operation and increase productivity of the staff.

1.3 Rationale of the Study

The modern era of international trade is increasingly complex because there are interactions between people. Trade has become a 24/7 business and good performance in trade requires connectivity along not only roads, rail, and sea, but in telecommunications, financial markets and information-processing, having inefficient or inadequate systems of transportation, logistics and trade-related infrastructure can severely hamper a country's ability to compete on a global scale.

1.4 Objectives of the Study

1.4.1 General Objective

The key objective of the study is to develop a web-based freight forwarding information system for logistics management that will improve customer experience, reduce operational costs, eliminate errors, and increase employee productivity.

1.4.2 Specific Objectives

(i) To determine the system needs for a web-based logistics management freight forwarding information system.

(ii) To create a web-based logistics management freight forwarding information system.

(iii) In order to verify the application.

1.5 Research Questions

At the end of the study, the following questions will be established:

(i) What are the necessities that will be used to develop the web-based freight forwarding information system?

(ii) Which technologies will be considered ideal on developing the web-based freight forwarding information system?

(iii) Will the evaluation results of the system confirm the users' acceptance of the outcome of the system?

1.6 Significance of the Study

The application will provide freight forwarding stakeholders with an understanding of the best practices and mechanisms on how the freight forwarding business operates. The stakeholders will be able to draw lessons on the criteria for the freight forwarding business process. The study will help the companies to understand the best way to collaborate with the different stakeholders involved in the business process.

1.7 Delineation of the Study

The project aims to create an online freight forwarding information system with the purpose of enhancing logistics management. A web application was the most sensible choice for the system's construction. Users of the system, including administrators, shippers, consignees (receivers), and freight forwarders, were taken into account in the study. Air, land, train, and maritime transportation were all taken into consideration. Since the system is responsive per the developer's definition, users can access it online whenever they have an internet connection and through a smartphone while online. According on the information gathered from users, the system can do the following tasks: user registration, request for a quote, uploading and downloading documents, asynchronous communication, notification, payment, report printing, and so on. The system considered Technology Acceptance Model to elevate the system.

CHAPTER TWO

LITERATURE REVIEW

2.1 Definition of Terms

2.1.1 Web-Based Information System

The web-based information system uses internet web technologies in order to deliver information and services to users and other applications (Lashkari *et al.,* 2017). Databases are used as the back end and web browser interfaces as the front end (Ullah *et al.,* 2016). Web technology has improved significantly over the past decades and it is advantageous over the tradition-based software systems because it provides multiple interactions of users (Widjojo & Gunawan, 2020) at the same time, governments have improved services to the people through publishing information through the web (Gasova & Stofkova, 2017), the education sector has provided online learning and information to the students through the use of the system (Nusa & Faisal, 2020).

2.1.2 Logistic Management

Logistics management involves functions such as customer service, production planning and scheduling, sourcing and procurement, packaging and assembly (Ghoumrassi & Tigu, 2017). It is the governance of the supply chain functions which organizations use to plan, manage and implement the processes to move and store goods (Saberi *et al.,* 2019). It also integrates with other functions such as marketing, human resource planning, sales, manufacturing, finance and information technology (Akyurt *et al.,* 2020). Logistics management is very vital because it facilitates the movement of goods at the lowest cost, safest, most efficient and prompt (Ahmad, 2016). When logistics are not managed well, the damage is way far than one can be imaged (Rushton *et al.,* 2022). One runs the risk of losing clients, experiencing damage to and delays in freight movement, as well as having to return items (Xu *et al.,* 2020). Therefore, logistics management must be handled efficiently to avoid these situations by having a correct plan, choosing the right software, handling resources appropriately, and selecting outsourced contractors appropriately (O'Donnell, 2018).

2.1.3 Freight Forwarding

Freight Forwarding is the process of coordinating the movement of goods from both local and international borders, however, other tasks are warehousing and distribution, cargo insurance, customs clearing, project removal, rate negotiation, consolidating fright (Poliak & Šimurková, 2017). The freight forwarding principles are zeroed to the efficient and cost-effective movement of goods while maintaining them in a good condition throughout the journey (Makarova *et al.*, 2020). This can be achieved easily through by having knowledgeable freight forwarders in managing logistics which can reach timely and without damage and having the right tools at your disposal (Bäuml & Hausmann, 2018). For any freight forwarder to succeed, s/he needs to have the right people who are committed to offer excellent service to satisfy their customers by ensuring that goods reach their destination in a timely and in an efficient manner (Melovic *et al.,* 2015).

2.2 The Basic Steps in the Freight Forwarding Process

2.2.1 Export Haulage

In this step, the goods to be transported at the shipper's location are moved to the freight forwarder's facility. Moving the goods may require a truck or rail depending on the distance, location or the type of the goods.

2.2.2 Items Checkpoint

After the goods reach the premise of the freight forwarder, they are thoroughly checked for any problem like damage or if the goods are ok to ship to the destined location.

2.2.3 Export Customs Clearance

After the freight forwarder has approved the shipment, they are validated by the customs authorities of the exporting country by submitting cargo information and any supporting documentation. At this stage, the freight forwarding works very closely with the clearing agents and submit payments on behalf of their clients.

2.2.4 Import Customs Clearance

Similarly, after the goods have reached the importing country, the customs authorities need to validate the goods before they are released to proceed to its destination. The freight forwarder can perform the clearing process or it can hire customs brokers to clear on their behalf.

2.2.5 Destination Arrival and Handling

In this stage, the destination freight forwarder receives the documentation from the origin freight forwarder. This helps to review the documents and submit carrier's bills.

2.2.6 Import Haulage

From this stage, the goods are moved from the warehouse to the receiver in the intended location. However, based on the agreement on delivery, the recipient can directly pick up the goods (Raita, 2017).

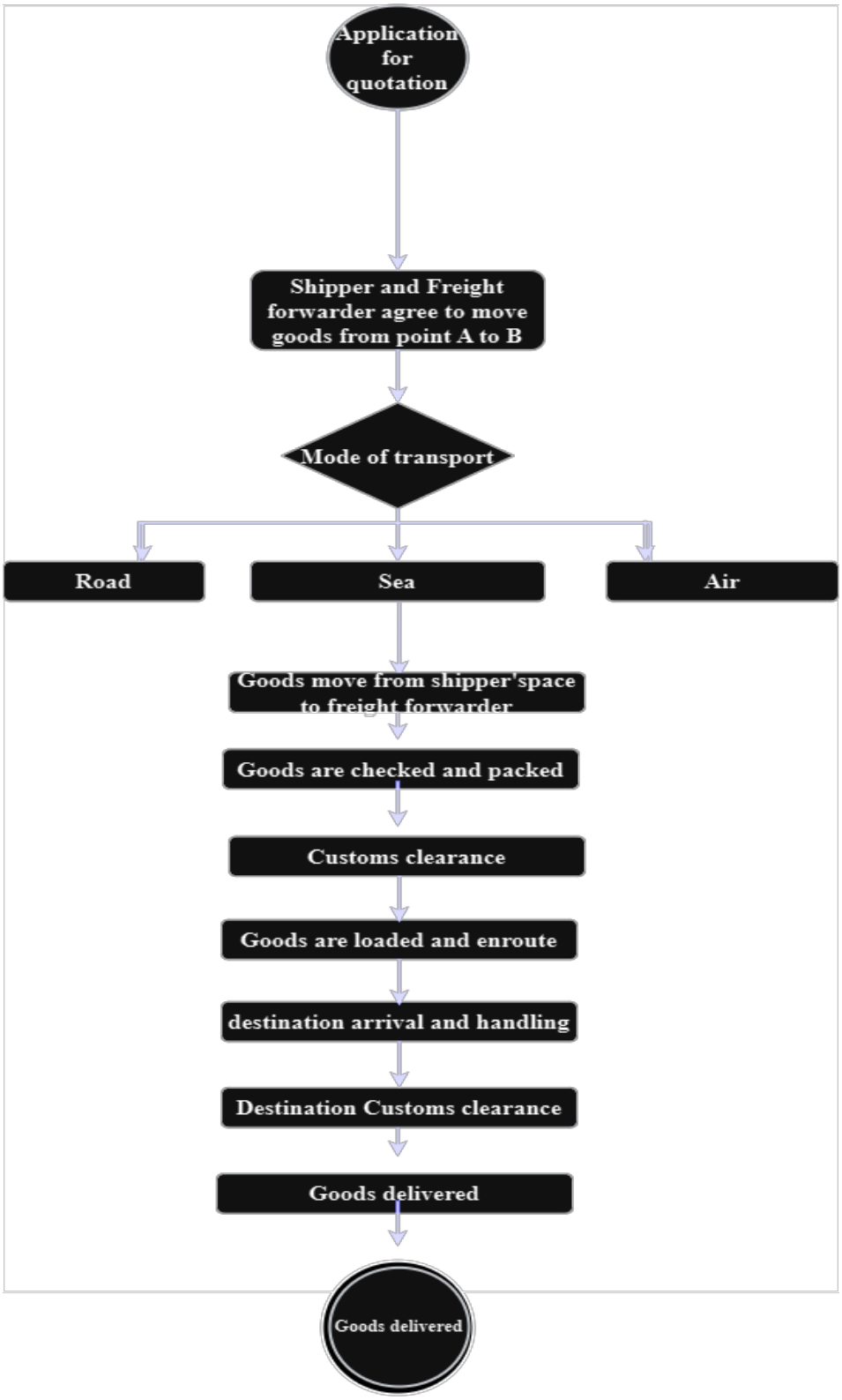

Figure 2: Flow diagram to illustrate freight forwarding process

2.3 Related Literature

For better use of information systems for logistics management, many literatures recommend features that include cargo quoting, real-time updates of information concerning cargo location, instant communication and document storage should be considered. Below are the existing systems that relate to the proposed project.

2.3.1 E-Freight: Implementation of Electronic Documents in a Paper-Based Environment

This study claims that the system updates the location and status of trucks and cargo using real-time technology. The reason behind this system was to eliminate the use of paper documents and provide data exchange across the system, making the entire transport cycle precise and transparent and reducing the usage of carbon footprint, which is not cost-effective or environmentally good.

2.3.2 Freight Forwarders' Cloud-Based Platform with Usability Features

Lim (2018) from China created a cloud-based platform for freight forwarders with usability. He employed a cloud-based digital freight forwarder's platform (C-DFP) model design for his research, which looked at five features of existing platforms with 30 features. The findings show that data integration and services from transportation providers will let digital forwarders offer and manage premium items on the network. The idea of a cloud-based platform offered advantages over the traditional shipping method in terms of competition. Future work on developing system features that involve shippers is encouraged by the author. The features should be validated using a prototype by providing examples of real-world usage and applicability findings.

2.3.3 Agile SDLC is Used in the Development of Freight Forwarding Information System

Andry (2017), an Indonesian, suggested creating freight forwarding information systems using an agile software development life cycle. The software development life cycle, which comprises requirement collecting, analysis, design, coding, and testing, was used as part of the research methodology. The system consists of three actors; the consignee, the freight forwarder and carrier. The SDLC method was used during the research in order to produce high-quality

software capable of meeting the customer expectation, and completes within time and cost. According to the outcome of the research, the developed system achieved real-time overall business process, reduction in time for data acquisition and order automation and increased quality of information and service.

2.4 Research Gaps

Table 1: The research gaps

References	Problem addressed	Proposed solution	Limitation of the study
Lim (2018)	Legacy system	Cloud-based freight forwarder application with usability	Limited system interaction by Suppliers
Andry (2017)	Manual processes	Information systems of freight forwarding with Agile SDLC	User credentials visible on browser.
Twesige (2014)	Manual processing of documents	E-Freight: implementation of electronic documents in a paper-based environment.	Single transport legs. Manages only documents.

2.5 Research Gaps of the Already Existing Systems

Recent technical development, worldwide events like the pandemic, and changing industry dynamics are the main causes of the research gap in the system's development. The growing complexity of global logistics, shifting customer expectations, and the requirement for supply chain resilience all contribute to the importance of this research gap. Filling these gaps will enable businesses to survive in a constantly shifting environment.

Based on the related works identified in freight forwarding, there has been a number of limitations to the developed system as discussed.

Firstly, the other research gap is the fact that the supplier did not have direct interaction with the system and there was no virtualization of the number of shippers, customers and partners who had interacted with the system (Lim, 2018). This prolongs processes hence causing delays and cumbersome. Therefore, the study will consider interactive environment between the different stakeholders. Secondly, there is issue of the security on the information of customers

and user credentials of employees which are exposed in the browser. This is a privacy issue which can temper with user credentials exposing them to hackers (Andry, 2017). The study will consider to apply encryption to protect individual names on the browser. Lastly, technology such as Rich Internet Applications (RIA) was not familiar to agencies, meaning, the technology is not well known and agencies are not used to it. The proposed system will consider the simple system.

2.6 The System Architecture Flow of Information of the Proposed System

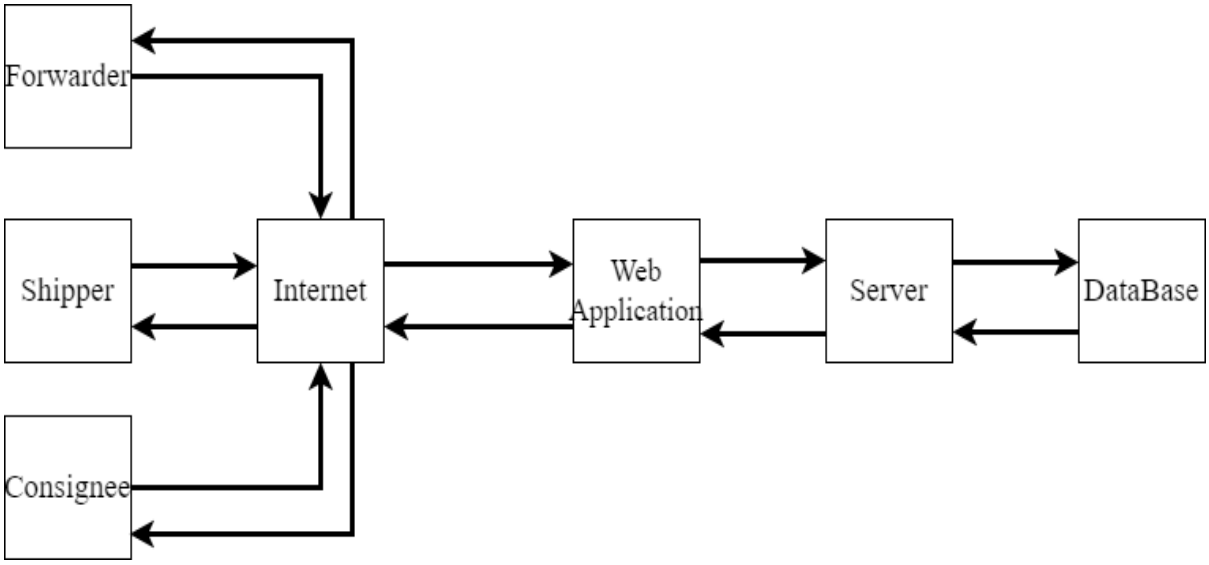

Figure 3: The system architecture flow of information

2.7 The Concept of the Features of the Developed System

The designed system functions as follows: in order to transfer products from one place to another, the shipper must first register a user account via the login interface. Following a successful login, the freight forwarder provides an invoice detail to the shipper, who then submits a real-time request for quotation. The shipper then makes payments and he/she shares the details of the shipment with the consignee who is the receiver of the goods at the destination location. Through the feature of communication, the shipper can send instant messages and receive messages too. The system allows the shipper to store the documents online for quick access in case of need. The system allows the upload and download of documents.

The developed system consisted of four users namely; the freight forwarder, shipper, the consignee and the administrator having the following functions.

2.7.1 Freight Forwarder

This user is responsible to manage all quotes, send notifications, generate reports.

2.7.2 Consigner

This user has access to the system as the sender of goods. He/she can request quotes, communicated, upload and download document, send the shipment details with the consignees, change password.

2.7.3 Consignee

The consignee is the receiver of the goods, from the system, he/she can login into system with the provided username and password through email. He/she can view the shipment details, communicate dan upload and download documents.

2.7.4 Administrator

This user manages all the system users by performing create, read, update and delete operations too. He/she has the overall rights access to the system.

2.8 The Application of the Proposed System

(i) The system can be used in a multimodal transport system.

(ii) The proposed system is applicable in warehousing and distribution.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Project Case Study

At TrueLine Africa Limited, which is based in Kampala, Uganda, the project was completed. Both forwarding services are offered by TrueLine Africa Limited to its clients. The business supports its clients' internal and international logistical needs through road, air, and sea transportation for clients in East Africa and internationally. With approximately 150 employees, it has other branches in Busia, Malaba, Gatuna, Juba, Nimule, Elegu, and Aliwara. It also has overseas offices in Asia and Europe that act as its affiliated freight forwarding brokers. The business offers its clients a variety of transportation and logistical services, including road, rail, air, and ocean freight as well as cargo insurance, customs clearance, project cargo logistics, and warehouse and distribution. The company's customers include retailers, manufacturers, corporate entities, and governmental bodies as well as traders and warehouse owners. The company was chosen for the case study because its management and staff have extensive experience and are fully knowledgeable about the business model of freight forwarding and its procedures. The company also has expertise in local and international trade regulations, allowing for in-depth analysis and the extraction of requirements.

3.2 Research Methods

To enhance comprehension of the local logistics industry and obtain concepts for the system's architecture, the project employed a combination of qualitative and quantitative methods for data gathering.

Data from the top management of TrueLine Africa, the personnel, and certain chosen customers were gathered through interviews, document analysis, and questionnaires. In Appendix 1, the interview guide is displayed. The document analysis included reading articles, books, and strategic plans and reports from various peer-reviewed journals. As illustrated in Appendix 2, the questionnaire procedure involved structuring questions and distributing them to the chosen clients.

3.3 Target Population

The freight forwarder and their selected clientele are the study's target demographic.

3.4 Sampling Technique and Size

During the study, we chose purposive sampling technique because it was believed that the staff and the customers of the company are already well verse of both local and international freight forwarding process. Purposive sampling is a non-probability sample chosen according to the study's goal and the characteristics of the population (Sharma, 2017). It is the intentional selection of informants based on their ability to explain a specific theme, concept or phenomenon (Shaheen, 2019).

A total of 150 respondents were chosen to participate in answering the questions although a sample size 90 was considered legitimate and the remaining sample were not returned and others not fully answered.

We used Yamane's formula for computing the sample size, which is the given total population, assumes 90% of confidence level and ±10% maximum variability (precision).

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

Where: n=Sample Sze

N=Total Population

e=Margin of error

Therefore: n=900/1+900(0.

n=900/1+900(0.01)

n=900/1+9=900/10=90

n=90

Therefore, 90 samples size was considered best fit for the study as per the equation.

3.5 Data Collection Tools

The process of gathering and organizing data has a big influence on how the study is carried out. During the study, the data were collected using interviews, literature and questionnaire for the project.

3.5.1 Questionnaire

This questionnaire was chosen because it gathers enormous sums of information from ample sample capacities (Riazi, 2017). For thorough results, it works well for gauging subject behaviors, intentions, attitudes, opinions, and preferences (Patel & Joseph, 2016). The respondent is comfortable answering the questions since their information are kept anonymously and are not subject to stressful time constraints hence feeling relaxed and encouraging truthful responses.

In this technique, the data was gathered by distributing questionnaires to respondents by email and physical delivery. These respondents in this study include, the staff of TrueLine Africa limited, some freight forwarders and customers of the company.

The questions mostly were scaled with a range of 1-5 which include 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for strongly agree as shown in Appendix 2. This scale was chosen because it is simple to understand and respondents are not overwhelmed because they have many options to choose from (León-Mantero *et al.,* 2020). In addition, the 5 Likert scale tends to produce better distribution of data and it also increases the response rate and quality (Amidei *et al.,* 2019).

3.5.2 In-Depth Interview

The management and staff of the company were interviewed in order to get their views on the proposed system. Guiding questions were structured out based on the system requirements and it involved one on one engagement to get their perceptions on the topic of study (West *et al.,* 2018). Interviews were considered best fit because this may offer the opportunity to understand the potential need of information technology in freight forwarding for logistics management by obtaining in-depth information regarding their beliefs and motivation. The Interview guiding questions are found in Appendix 1.

3.6 Data Analysis

Content and descriptive analysis was used to analysis the collected data. The data collected from the respondents was analyzed using the SPSS® 23 and NVivo then virtualized in frequency tables, pie charts and graphs.

3.7 System Development Approach-Extreme Programming

Extreme programming is one of the numerous agile frameworks applied by information technology companies. The concept holds great significance since it promotes customer participation over contract negotiation, interactions over processes and instruments, and adaptability over rigidity (Dat22). During the study, the system development phases shown on the Fig. 4 were followed such as, Planning, designing, coding and testing.

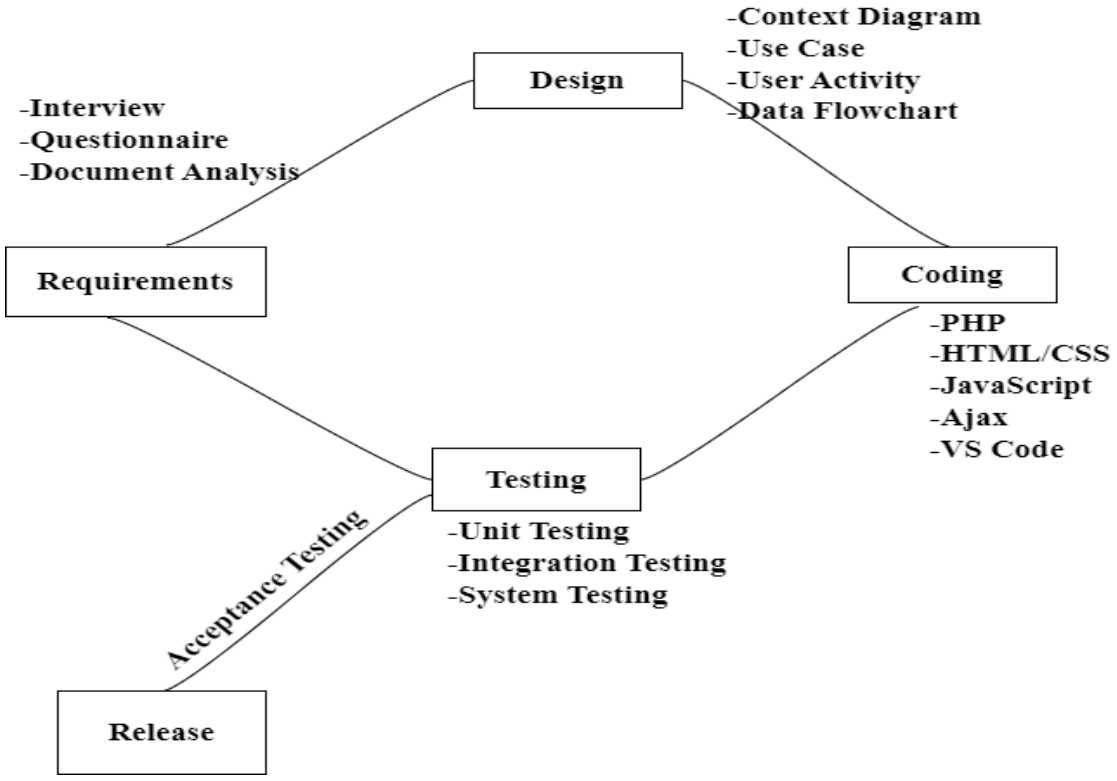

Figure 4: The extreme programming model

3.8 System Design

From the system design, we considered looking at the flowchart diagram, usecase diagram and context diagram and activity diagram.

3.8.1 Context Diagram

It is employed to simulate the system's boundaries and context. It stands for both the internal and external components of the system as well as the interaction with outside forces (Bograin, 2017). In this project, we defined and clarified the freight forwarding system's boundaries using the context diagram as shown in Fig. 5.

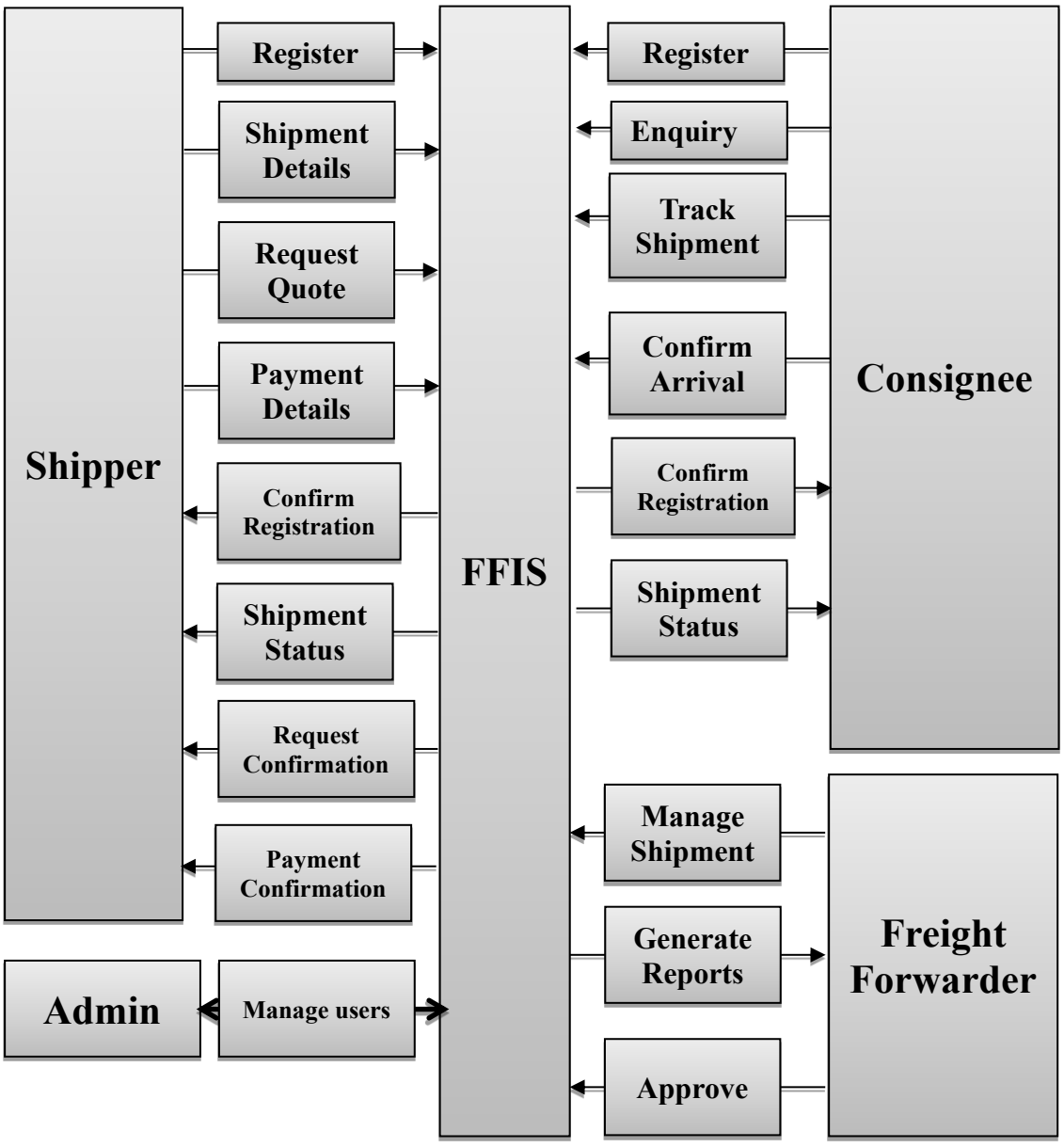

Figure 5: Context diagram of the application

3.8.2 Activity Diagram

This method, which is frequently used in business process modelling, depicts the virtual activities or flow of control in a system. Through its flow control, one action is drawn to the next to describe the dynamic elements of a system (Ahmad *et al.,* 2019). In this project, the activity diagram was used to illustrate the individual steps in activities as well as the order in which they are presented as seen in Fig. 6.

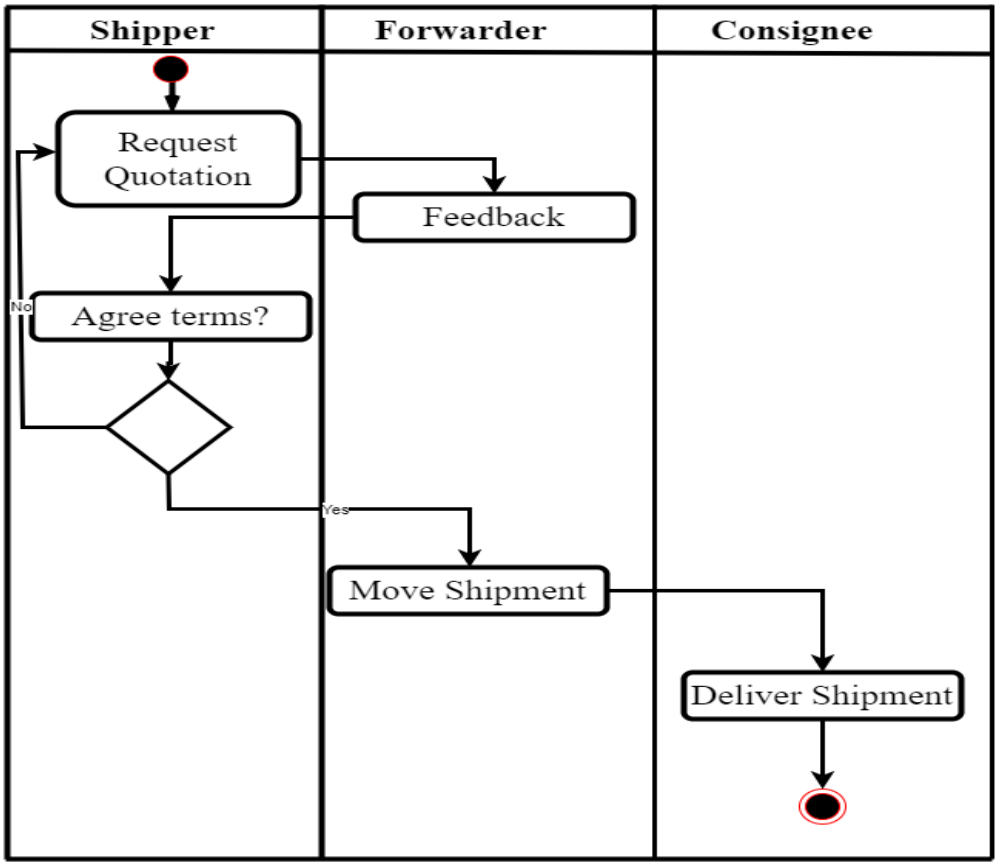

Figure 6: Activity diagram of the system

3.8.3 User Case Diagram

Use case diagram illustrates how the system behaves, which aids in capturing the system requirements (Kaur & Vig, 2018). Use case diagrams are typically employed to describe a system's high-level functionality and domain of application (Van-Cam-Pham *et al.,* 2017). It is employed to determine how the system and its actors interact (Jebril *et al.,* 2018). The use case can be used to illustrate and define the context and requirements of either specific part of the system or some important part of the system as shown in Fig. 7.

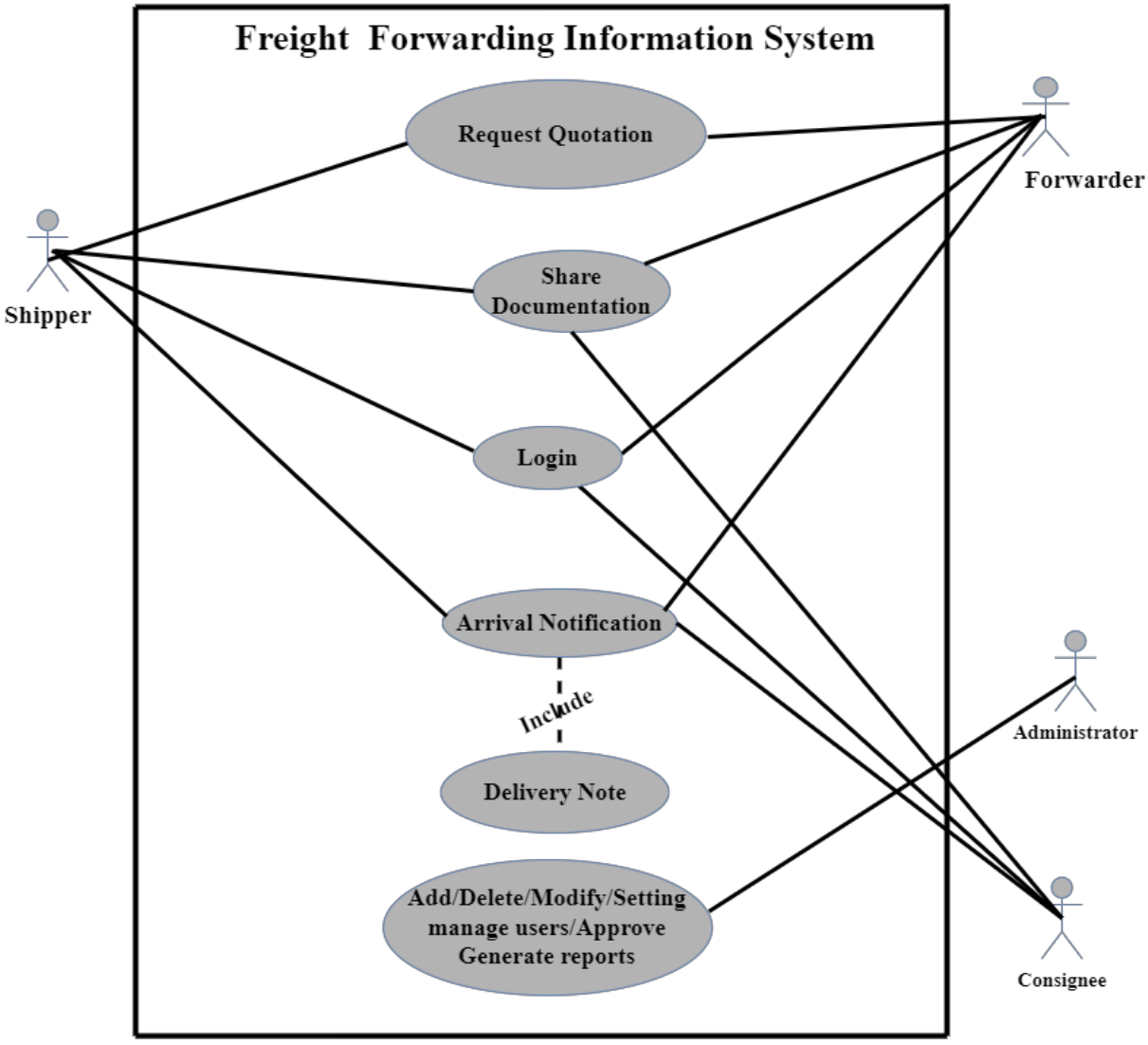

Figure 7: Freight forwarder use case

3.8.4 Flowchart Diagram

A flowchart diagram shows us the different stages of a system procedure in chronological sequence, indicating that the procedures are carried out methodically (Bahill *et al.,* 2017). You cannot leave a current process and start a new step. A flowchart diagram is a genetic tool that can be used to explain a wide range of processes, including project plans, administrative or service processes, manufacturing processes, and more (Kramer & Kramer, 2017). A flowchart may contain elements for services entering or exiting the process, as well as a series of operations (Penin, 2018), decisions that need to be taken, parties involved, amount of time spent at each stage, and/or process metrics. It use interconnected symbols to show how information and processing move through it (Rahul *et al.,* 2019) as seen in Fig. 8.

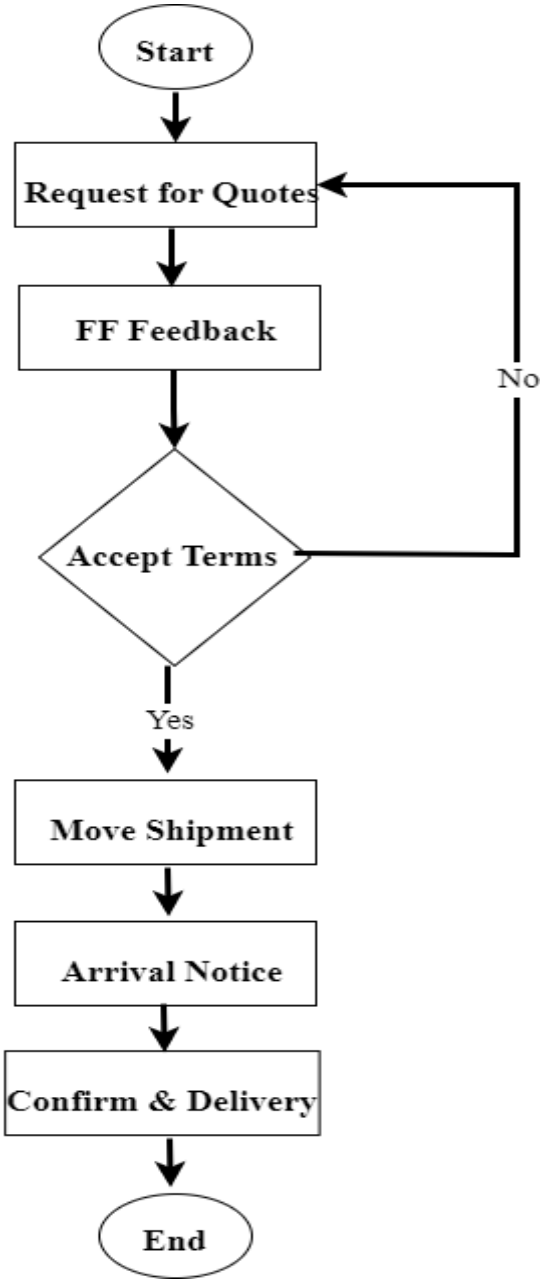

Figure 8: The flowchart of the developed system

3.9 System Development

The system development involves the necessary tools and technologies (Anwar, 2017). These tools and technologies can be categorized into hardware and software.

3.9.1 Software Technologies

The software requirements of the developed system include the programming languages and other software requirements that make the development of the system a success (Allgöwer *et*

al., 2019). The next section discusses the software requirements for creating the logistics management information system for freight forwarding.

(i) Hypertext preprocessor

Hypertext preprocessor (PHP) is a free-source scripting language suitable for web design and development in a fast, flexible and pragmatic way and it is normally embedded into HTML (Haruna & Lame, 2021). The PHP code is executed in the server which then generates HTML then the running script is sent and is received by the client (Xu *et al.,* 2020). Figure 8 shows the working of the phpMyAdmin area.

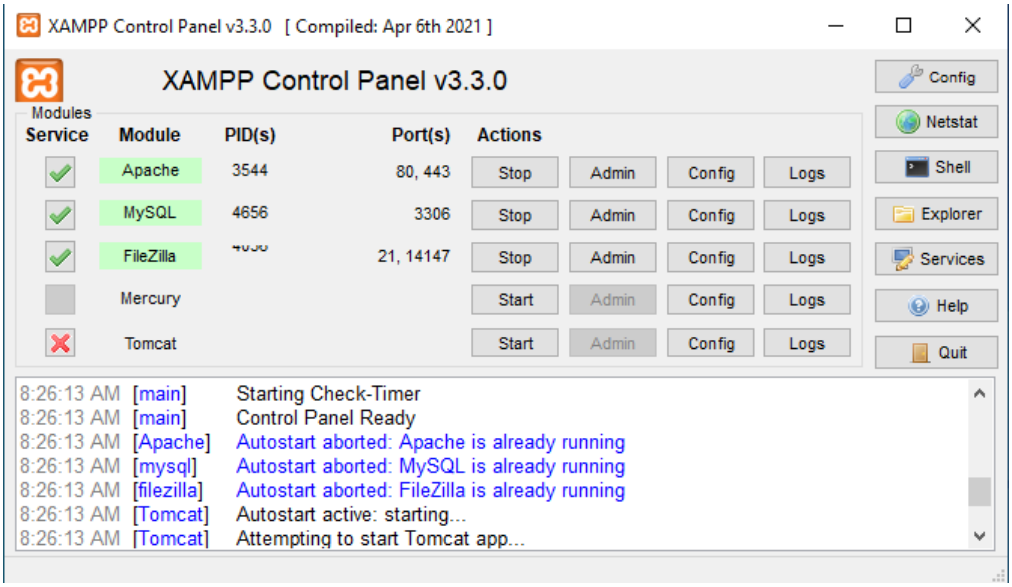

Figure 9: The XAMPP control panel

(ii) Hypertext Markup Language

It is used in formatting and organizing of structure of a web page and display its content (Mumtaz & Shahzad, 2021). The pages are created and structured into sections, paragraphs and links using the building blocks such as tags and attributes. It is widely used, flexible and it's an open source (Siegle *et al.,* 2017).

(iii) Cascading styling sheet

Cascading styling sheet (CSS) is a modest design language that enables system developers to define the format and the content of the web page how it looks (Shahzad, 2017). With the use of CSS, the system used it as a tool used to control the layout of a webpage for better performance and easier maintenance (Khder, 2021).

(iv) My structured query language

This is a free-to-use source database that facilitates effective management of databases by connecting them to the software (Madyatmadja & Adora, 2019). It is a stable, reliable and powerful solution with advanced features (Vanier *et al.,* 2019). In this project, we used it specifically for data security and reliability for database management system (Dawodi *et al.,* 2019).

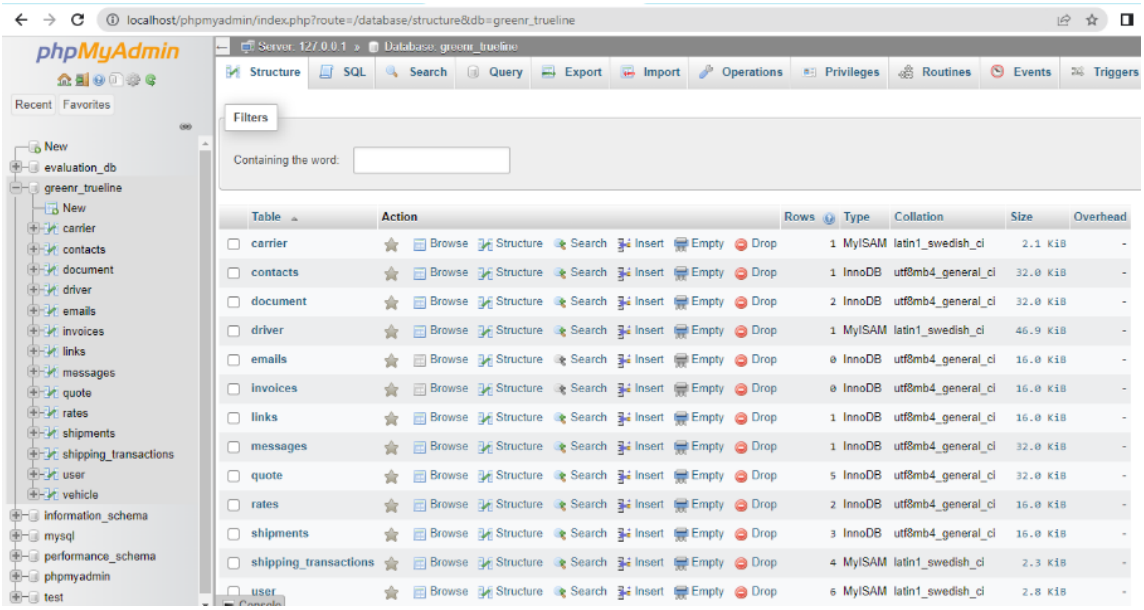

Figure 10: The working area of the phpMyAdmin

(v) JavaScript

Programming language that allows implementation of complex features on a web page is very important in software development because it is very fast to run immediately within the client-side browser, it is popular language and can be used everywhere on the web.

(vi) Bootstrap

It's a front-end framework with features that support the interface of the forms (Aryal, 2019). In this project, it was used to develop the system front-end features of the interfaces of the forms.

(vii) AJAX

Its support dynamic creation of the web pages. We used it to create the different webpages of the system.

3.10 Application Testing

Testing is an activity that is done throughout the development process on increment bases (Maalem & Zarour, 2016). Testing is used to reflect the system functionalities in helping to uncover faults before the system implementation (Grieves & Vickers, 2017). Testing is an assurance that the intended requirements are fulfilled (Freeman *et al.,* 2021). Testing is done in four stages (Zhao *et al.,* 2019). that may need to be accomplished before a program is ready for use as mentioned below;

3.10.1 Unit Testing

In this type, it tests a program as a component in incrementing bases. During the testing, the system processes are used to assess functionalities in order to identify errors such that they are fixed concurrently. The unit testing aims at examining the smallest unit of the system software in order to detect faults (Fontes *et al.,* 2021).

3.10.2 Integrated Testing

This basic testing is the logical combination of two or more components which consisted of previously two-unit testing modules (Modi, 2021). Integration means uniting all the modules developed separately to ensure that the system components work very well as required (Sanchez *et al.,* 2020). By integrating the different system components help to verify and identify any errors during the integration process (Jain *et al.,* 2018).

3.10.3 System Testing

Viewed more broadly, system integration is the engineering process of fusing disparate parts into a single, coherent architecture in order to guarantee that the many parts of a developed system work together as a whole (Rademacher *et al.,* 2017). The components may consist of all the data that is stored in software, applications and databases. The system testing aims to verify the system as a whole in order to ascertain the compliance of the product with the functional and technical requirements and its quality standard (Lewis & Veerapillai, 2017). The primary reason for system integration is to ensure that all systems work together in harmony to boost productivity and enhance the quality of day-to-day operations (Langenwalter, 2020). The goal of the system integration is to streamline and simplify communication between the different modules in order to accelerate the outflow of information as expected within the

developed system (Knox *et al.,* 2018). This test is normally done within the proximity of the business environment to ensure the system works as expected.

3.11 Validation Using Technology Acceptance Model with Trust

While validating the system, we chose Technology Acceptance Model (TAM) which uses two factors of perceived utility (PU) and perceived easy use (PEOU) developed by Davis *et al.* (1989) and combined with trust as a factor. Due to its simplicity, soundness, and ability to apply to any technology, it is regarded as the most ideal model for researching how people utilize technology (Salloum & Al-Emran, 2018).

We defined the constructs that govern and formed the factors that influence technology acceptance. A questionnaire was designed to collect the data from respondents. We sampled 50 respondents who are the staff of TrueLine Africa limited and some selected customers. We used 5 points Likert rating scale in collecting the data, this scale was chosen due to its simplicity and rich in insight, it's easy to virtualize and interpret (Thammasitboon *et al.,* 2018).

The data was sorted and out of the 50 copies distributed, only 26 copies were considered legitimate and the remaining copies were abandoned since they were not filled correctly. The data was recorded in a SPSS software for statistical analysis, and it was presented in tabular form depicting total responses on the Likert scale of 1 to 5 and calculated mean of the different constructs to validate the system.

For the result, we used descriptive data analysis and hypotheses to understand the relationship of the different constructs considered.

3.12 Ethical Consideration

During the data collection, ethical considerations were put in place to protect the respondents. Factors such as voluntary participations, informed consent, anonymity, and confidentiality were considered as an assurance to the participants of their identity and privacy. During the study, the data protection and privacy act 9 of 2019 of Uganda in Appendix 6 was used as a guide in obtaining data which protects the right of participants in providing information.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Results from the Questionnaire

A total of 150 self-administered questionnaires were distributed to the respondents physically and via email. Out of the 150 questionnaires, 90 copies were returned and were considered legitimate and have all met the required information while the remaining copies were not fully filled as requested. The below statements explain the result of the questionnaire.

4.1.1 Response Rate of the Questionnaire

The percentage of respondents who finished the questionnaire relative to the total number of respondents in the sample was used to calculate the response rate:

$$\frac{\text{No. of responses to your survey}}{\text{No. of people you have sampled}} \times 100 \qquad \text{(Equation 1)}$$

According to the data collected, the results of the response rate of the respondents are presented in the Appendix 4 and Fig. 11.

Table 2: Depicting the response rate

Sample	Target	Actual	Rata (%)
Staff	70	50	55.5%
Management	15	7	7.8%
Customers	65	33	36.7%
Total	**150**	**90**	**100%**

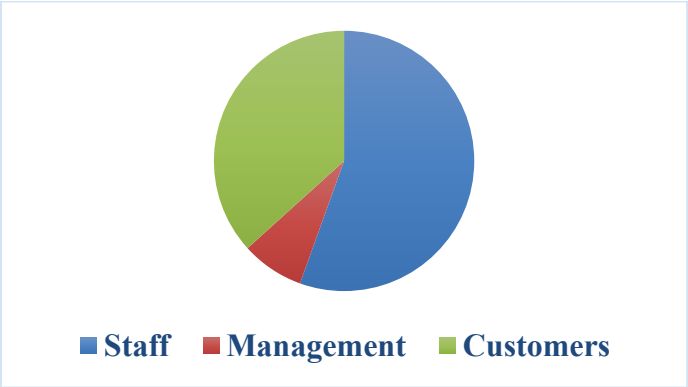

Figure 11: The rate response for the survey

4.1.2 The Demographic of the Survey

During the study, the gender characteristics observed are shown on Fig. 12. The respondents' gender was 67% male compared to women with 33% representation. According to the findings, the freight forwarding industry employs both men and women and the number of men is more because generally in the labor force, more men are employed compared to women. Despite the gender difference shown, the study considered the representation is well balanced.

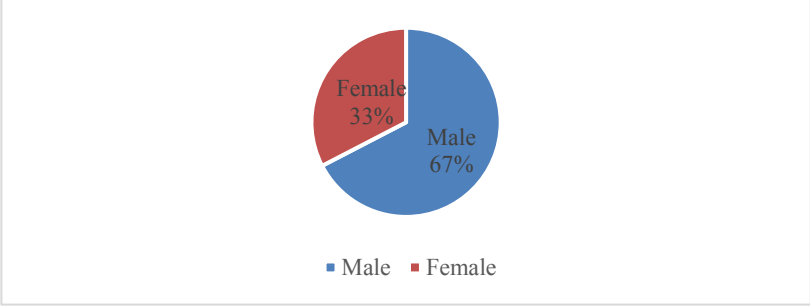

Figure 12: Showing the gender of the respondents

4.1.3 The Age Group of the Respondents

According to the findings, the respondents between the age range of 30-39 and 40-49 have the highest percentage. This is believed so because it is assumed that this age bracket has the viable information for this study as shown on Fig. 13.

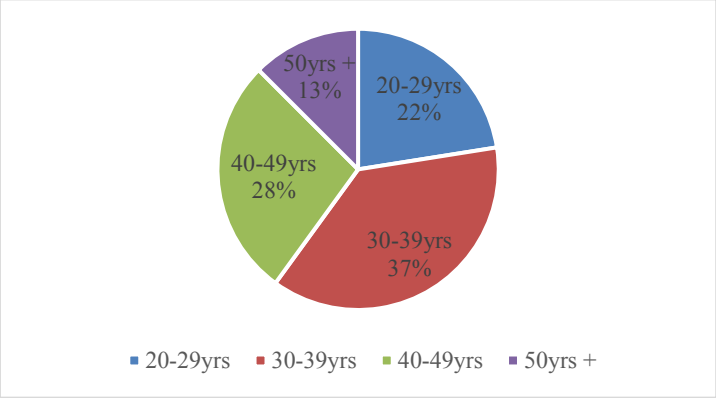

Figure 13: The age of the respondents

4.1.4 The Level of Education

Based on the result, those with bachelor's degree has the highest number while primary education has the lowest number. It is believed that those with bachelors and diploma are mostly likely to acquired job in the freight forwarding industry. Meanwhile those at the lower level are few but since has gained much knowledge in the freight forwarding industry.

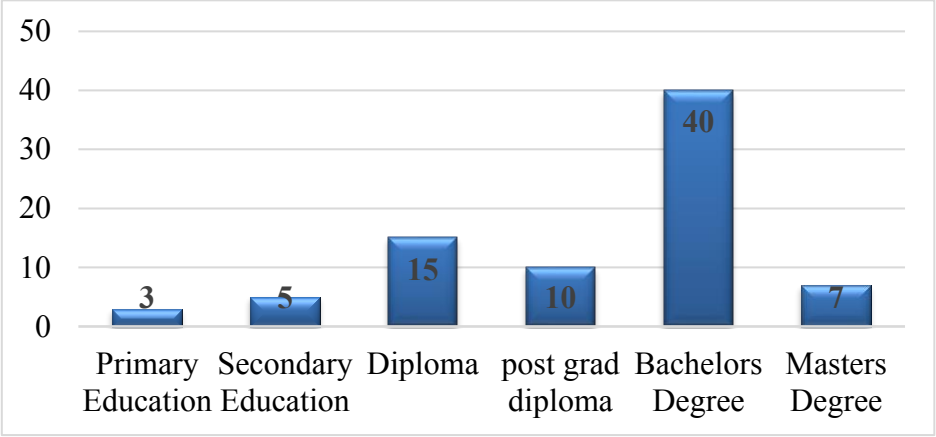

Figure 14: The level of education of the respondents

4.1.5 People's Perception on the Effects of Using Manual Processes in the Freight Forwarding Industry

The aim was to determine the challenges the people face while doing business in the freight forwarding industry. According to the results, 6% of the people strongly disagreed that the manual processes cases delays, high costs and increase corruption and theft. While 56% agreed that the manual process has negative effects when doing business. Meanwhile 7% disagree, 10% of the people are neutral and 22% strongly agree.

From the Fig. 15, the findings shown that 56% of the people agreed that manual process in doing business has far more negative effects. According to Robertson *et al.* (2018) the manual process is tedious and is subject to making errors. As stated by Dalal and Sharma (2019), manual process in doing business leads to delayed services which in turn can cause social division and is a playground for corruption and fraud, additionally, it leads to bribery before service is offered to the people (Saxena & Sharma, 2012). From the above challenges stated by the different authors, there is need to improve the freight forwarding industry in dispensing their work.

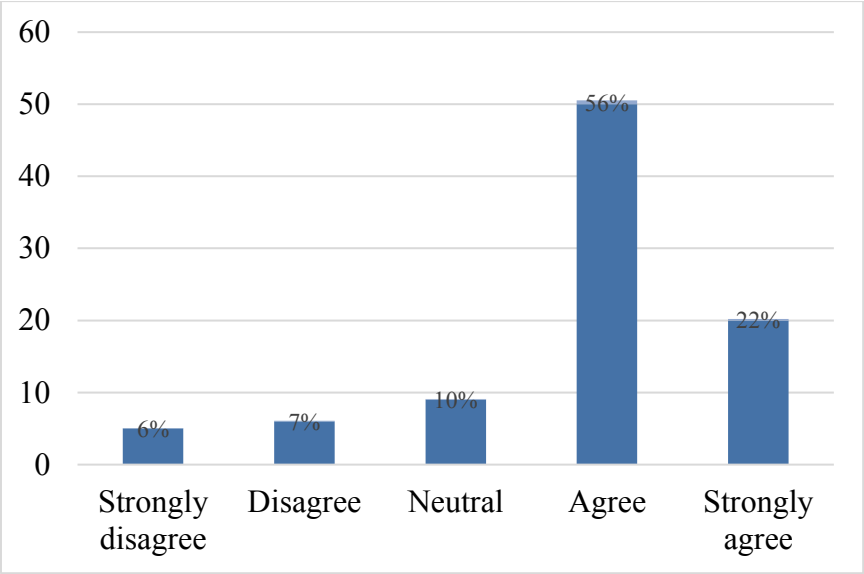

Figure 15: People's perception on the effects of using manual processes

4.1.6 People's Perception on the Development of the Freight Forwarding System

The objective was to find the opinion of the people concerning the impact of the proposed system while executing their business, 2% of the people strongly disagree and 4% of them disagree. Meanwhile 8% of the people are in neutral state and 36% agree and 50% strongly agree on their perception to the proposed system.

Based on the findings shown on the graph, the people strongly agree that the proposed system has positive impact such as: reduce cost, increase productivity, customer satisfaction and minimized human errors.

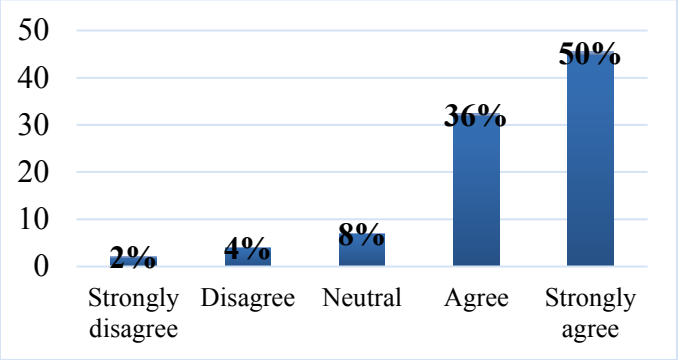

Figure 16: People's perception on the positive impact of using the freight forwarding system

4.2 The Findings of the Interview

During the study, 2 directors and 3 managers from different units were interviewed. The results were coded thematically using NVivo software and the results were displayed on Table 3. According to the results, the highest percentage represents the response from the interview, indicating the recommendation and the need of freight forwarding system in streamlining business processes in order to overcome the mentioned challenges.

Table 3: The results from the interview

Theme-Code	Theme Description	No of interviewees	Percent (%)
Tcode1	The respondent was well experienced in the processes of moving goods from one location to another	5	100%
Tcode2	willingness to use freight forwarding information system to manage logistics?	4	90%
Tcode3	The system's utility in organizing the transportation of goods from one place to another	5	100%
Tcode4	Online payment is preferred	3	80%
Tcode5	customers should be notified in real time of their shipment	5	100%
Tcode6	IT system was preferred in managing the movement of your goods	4	90%
Tcode7	Data secured by storing were locked in cabinets	5	100%
Tcode8	Channels of communication customers prefer are email, WhatsApp, over the phone	3	80%
Tcode9	Hard copy document management is preferred	1	10%

4.3 The Requirements of the System

System requirements are the functionality which is needed by a system in order to satisfy the needs of a customer's requirements. The system requirements are the most effective way of meeting the user's needs and reducing the cost of implementation (Kisielnicki & Misiak, 2017). They explain exactly what the customer wants and how they want it (Bahill, 2017). System requirements are classified in to functional and non-functional requirements.

4.3.1 Functional Requirements

These requirements define the specific behavior, responses, information, rules for the solution specifically addressing the features the system will support, the data validation rules and how they will be managed and the interaction between different users within the system (Shaofan, 2019). In this study, the functional requirements address the issues of business requirements (Bartolini *et al.,* 2018), that include information that the company and its customers suggest, specifically include how freight forwarders provide logistics services and support to its customer by moving goods from its source and to its destination by handling quotes for rates, document management, shipment management and close collaborations with customers and partners.

Table 4: The functional requirements

Functional Requirements	Description
Document	Users shall be able to create/generate, upload and download, share documents in different format
Communication	Users shall be able to communication both within the company and outsiders using email, social media
Automate Quotation	Customers shall be able to make quote through the widget and the company shall receive instantly
Reports	Users shall be able to view, download reports in pdf, excel or csv form
Notifications/pre-alerts	Users shall receive notifications regarding the shipment.
Shipment pick-up schedule	The system shall be able to accept schedule for shipment pick-up
Payment automation	The system shall be able to automate payment for shipments
Print	The system shall direct documents for print

4.3.2 Non-Functional Requirements

These needs of an application define the environment in which the solution will operate (Sotelo *et al.,* 2018). The qualities a solution must or constraints within which it must operate smoothly.

Table 5: Non-functional requirements

Non-Functional Requirements	Description
Security	The technology will accept users to authenticate using an encrypted password.
Usability	The developed system will be simple to use.
Portability	The system shall operate in different environment
Scalability	The system shall be able accept growth as the company expands.

4.3.3 Technical Requirements

Table 6: Technical requirements

Hardware	Operating System	Web Browse
Personal Computers	Windows 10 onwards	Google Chrome
Tablets	Mac	Safari
Smartphones	Linux	Torch
		Internet Explorer
		Mozilla Firefox

4.4 System Design

The developed system consisted of several modules which were accessed using web technology and the customer fills in information, which is sent to the database for processing and storage. In the admin portal, customers get replies for their quotations, when quotations are approved, payment is made and the forwarder organizes with the carrier on the movement of the goods from its source to its destination. The shipments are tracked by receiving email notifications regarding the shipment until it is delivered to the owner. Furthermore, the system consists of instant communication, generates report, online document storage.

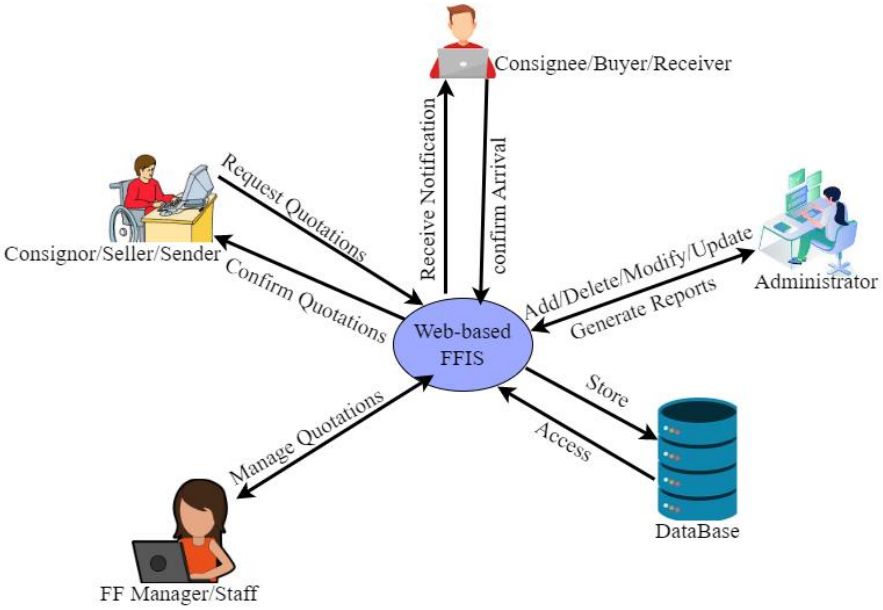

Figure 17: Architecture of the application

4.5 System Development

On the second research question and the specific objective, it is majorly looking at the development of the system.

4.5.1 The Developed System

The application was developed and following were considered; the login screen page: In this page a user can login, register new user, the menu board: shows the various module for the application. The system collects information input by the user and it is stored in the database. The application consists of different users with different privileges and modules. The user has the option to edit user's password, telephone number and email address. On the portals, the username is displayed which shows the person who logged in the system.

(i) Login page of the developed system

Figure 18 shows the login page of the application. On this page, registered users are required to input their email addresses and password. However, there is options to register as a newcomer to the application and if they have forgotten the password, the user has the option to reset it.

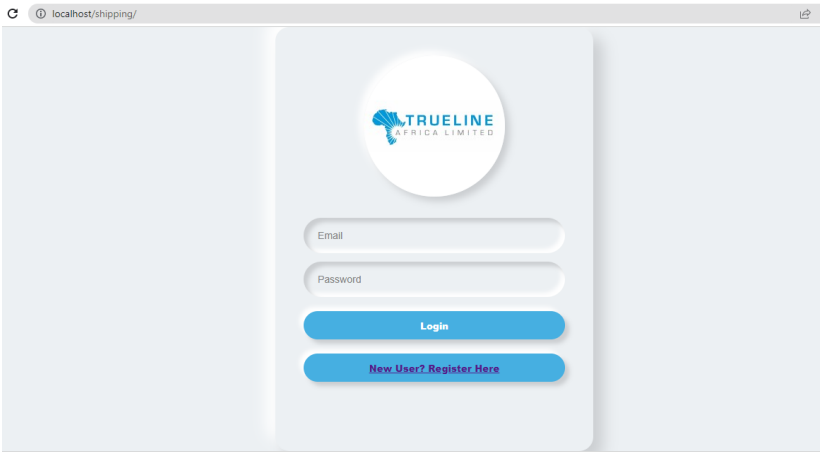

Figure 18: The login page

(ii) The dashboard of the freight forwarder

The dashboard is on the first page. In this page, it displays the various menus and quantifies the total number of customers, users, transactions, freight and vehicles (Fig.19).

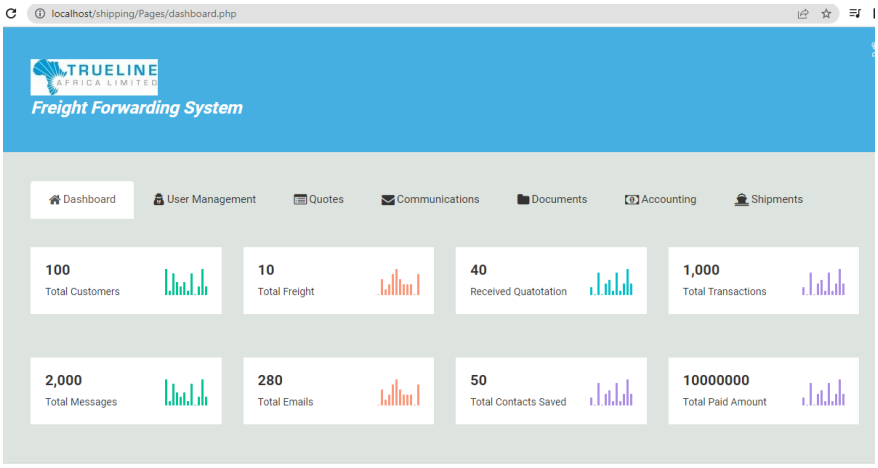

Figure 19: Dashboard

(iii) The quote page

In this page, the customer requests a quote and the information is sent instantly to the admin portal for consideration. The admin checks the quote and replies with details on the pricing. The customer then decides to pay or rejects the quote. Figure 20 shows the quote page.

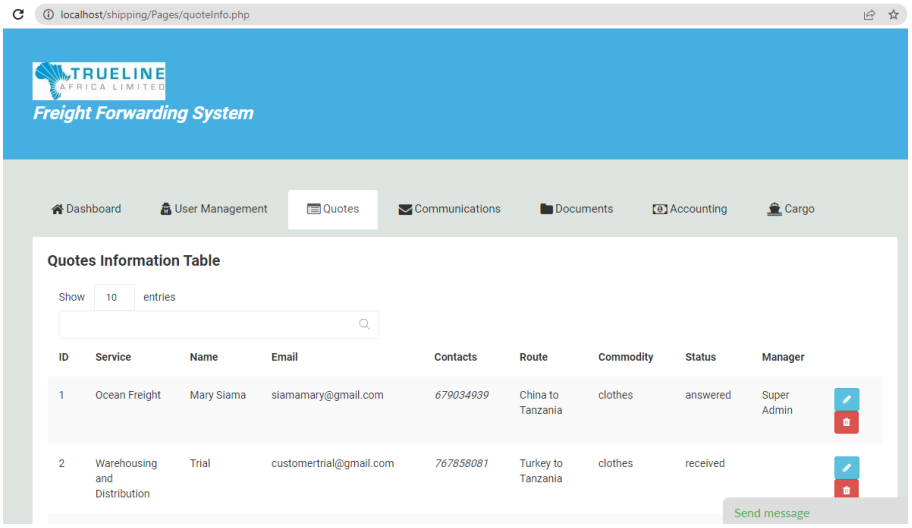

Figure 20: The quote request page

(iv) The accounting page

The accounting page consists of the shipment rates, invoices, transactions and reports. The page mostly depicts financial transactions. It helps the admin/manager to manage all the financial information within the application. Figure 21 shows the accounting page.

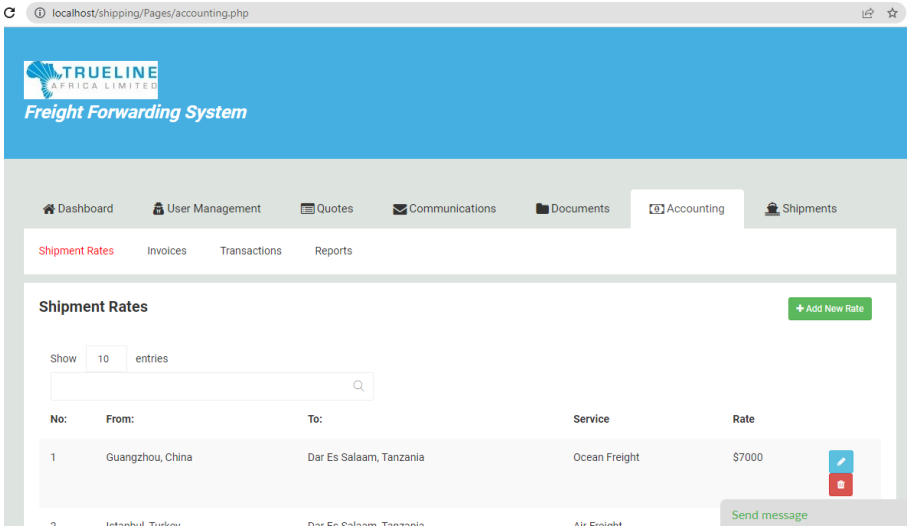

Figure 21: The accounting page

(v) The communication page

In the communication page, the admin/manager manages all the communication. The page consists of submenus such as the Message, emails, emails, contacts and reports (Fig. 22).

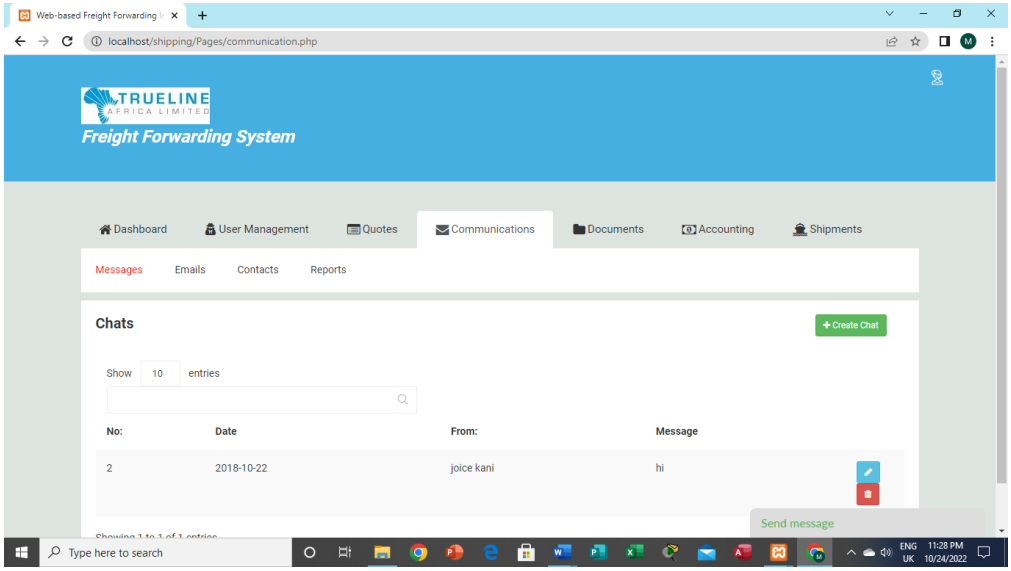

Figure 22: The communication page

(vi) The document page

In this page, the user is able to download and upload. Documents to be shared and for fast access of the documents as shown on Fig. 23.

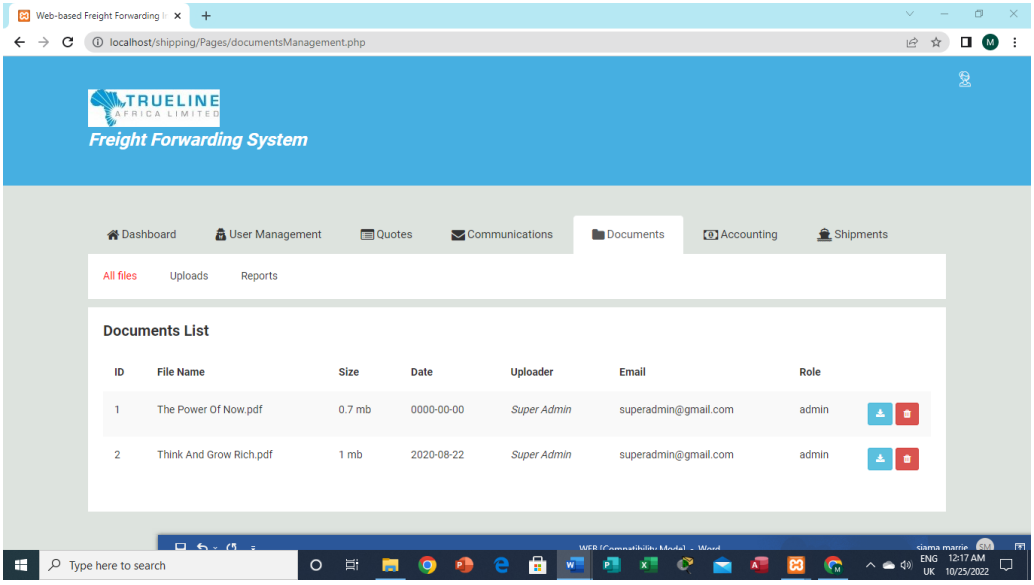

Figure 23: The document page

(vii) MySQL database page

The MySQL consists of 14 tables contenting all the features for the system. Every information that a user inputs in the web application, the information is reflected in the database. The super

administrator has all the privileges in managing the database such as adding, delete, modify data. Figure 24 shows the MySQL database.

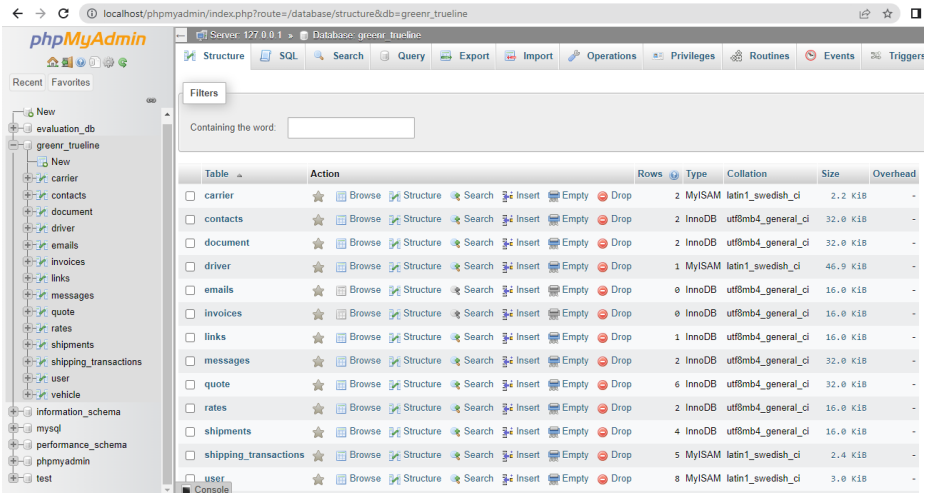

Figure 24: MySQL database of the application

(viii) The consignee portal

The consignee is the receiver of the goods. s/he receives the details of the shipment and s/he could use the system to view, enquire and receive notification regarding the status of the shipments.

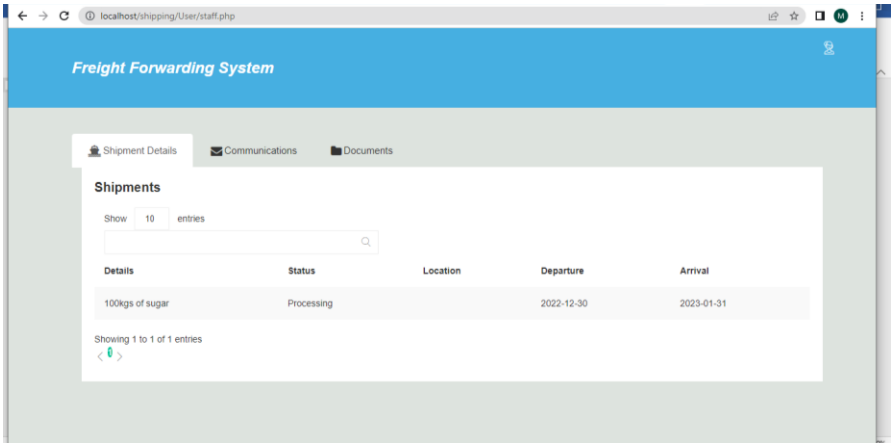

Figure 25: The consignee portal

(ix) The consigner's portal

The shipper referred to the sender of the goods and s/he is responsible in requesting quotes from the Freight forwarder and make all the necessary requirements in moving the goods as shown in Fig. 26.

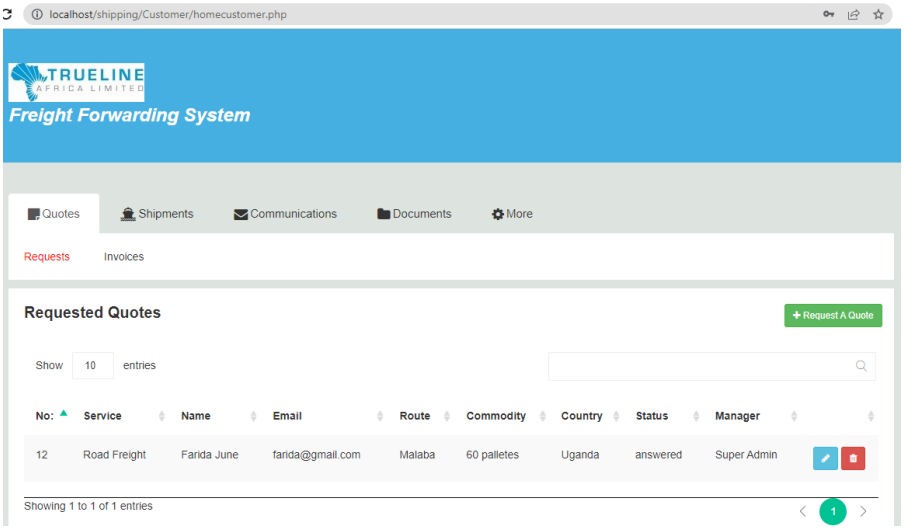

Figure 26: The shipper portal

4.6 Prototype Validation

The system was tested using the V-model; the details of each testing technique are provided below;

4.6.1 Unit Testing Results

The first step in any application's test life cycle is unit testing (Essebaa & Shantit, 2018) and it involves the testing of the different individual components of the application. The unit testing was chosen because it ensures that the quality standard of the code is met before deployment and it also ensures that the individual components of the system is working well as its supposed to work. Table 7 shows the unit testing applied on the system.

Table 7: The unit testing result of the application

Test Areas	Unit Testing Outcome	Result
Login	User with right credentials is given access	Success
	User with wrong credentials is denied access	Success
Registration	Successful user registration with all the required details	Success
Logout	The users are able to logout successfully	Success
User management	The Administrator can add, delete, modify and update user in the application	Success

4.6.2 Integration Testing Results

With this type of testing, the unit tested segments are combined in order to ensure the integrated parts work properly as expected and to check defects during the process of integration (Delli & Chang, 2018). Table 8 shows some of the integration tests carried out.

Table 8: The integration test scenarios

Test Areas	Integration Testing Outcome	Result
Login/Homepage	The homepage should appear after a person logs in and enters their credentials.	Pass
Quote Request	When a user requests quote, the request is reflected on the homepage of the admin/manager	Pass
Logout/Login	When user logs out, the login page is displayed.	Pass
Registration/Login	When a user has successful registered, its directed to the login page.	Pass

The system testing involves testing all the components when all are integrated in order to verify if the system works as expected or not (Jan *et al.,* 2016). System testing is done after integration in order to deliver high quality product. Some testing scenarios seen in Table 9.

Table 9: The system testing scenarios

Test ID	System Testing Descriptions	Result
T01	The user can register, login and logout	Pass
T02	The system allows customer to request quotes	Pass
T03	The system allows users to upload and download documents	Pass
T04	Users are able to extract reports.	Pass
T05	The system allows customers to make payment in real time	
T06	The database updates, data queries and data medication	Pass
T07	The system allows instant communication	Pass

4.6.3 Validation of the Developed System Using Acceptance Technology Model with Trust

(i) The constructs and their factors

According to the technique previously mentioned, TAM was used to assess users' perceptions of the developed system's utility and simplicity of use after they had used it, with a combination of external factors, including trust.

A modification of the psychology's theory of reasoned action called the "Technology Acceptance Model" was created expressly for simulating system user approval. It employs two constructs, including perceived utility and perceived usability.

Any IT system's acceptance is said to be influenced by its perceived usefulness and ease of use, and perceived ease of use refers to how much a person thinks using a given system won't have any negative physical or psychological impacts. We came up with the hypotheses as shown in Appendix 3 and 5 constructs of the model and each construct have its factors as shown in the Table 10.

Table 10: Constructs and their factors

Construct	Factors
Perceived usefulness-PU	PU-A: The system increases productivity
	PU-B: The system saves time
	PU-C: The system enhances my efficiency
Perceived ease of use	Pe-A: I feel that the system is easy
	Pe-B: I feel that the system is convenient
	Pe-C: Getting information from the system is easy
Trust	SU-A: I will pay for all my consignment online
	SU-B: I will recommend others to use the system
	SU-C: The system is safe to use

(ii) Findings of the prototype validation: The Demographic results

Table 11 shows the anticipated descriptive analysis of the participant's demographic information. It is obvious that 65% of the participants were male responders, with the remaining participants being female respondents. The bulk of respondents (42%) are between the ages of 29 and 39, followed by those between the ages of 40 and 49, 20 to 29 (23%), and people beyond the age of 50 and above (4%), respectively. In terms of educational background, a degree comes in front with 46% of the total, followed by certificates with 27%, master's degrees with 15%, PhDs with 8%, and others with 4%.

Table 11: The demographic data of the respondents

Variables	Items	Frequency	Percentage
Sex	Male	17	65%
	Female	9	35%
Age group	20-29	6	23%
	30-39	11	42%
	40-49	8	31%
	50 - >	1	4%
Level of education	Diploma	7	27%
	Degree	12	46%
	Masters	4	15%
	PhD	2	8%
	Others	1	4%

(iii) The finding of the hypotheses

According to the technology acceptance model, system acceptance behaviors are primarily influenced by perceived usefulness and ease of use (Revythi & Tselios, 2019; Davis, 1989; Salloum, 2016).

Any information technology system's user acceptance is largely determined by perceived usefulness (Ambalov, 2021). It is stated that the most important factor influencing system

acceptance is perceived utility, underlining the significance of including the necessary functional capabilities in new systems (Almaiah & Alismaiel, 2019).

As a result of the anticipation that the other party would carry out a certain action that is crucial to the trust, or regardless of the ability to monitor or control that other party, a party is willing to be vulnerable to the acts of another party (Swärd, 2016). This is referred to as trust. Trust is important because it increases users' willingness to conduct online transactions through electronic channels. In light of the previous literature, trust was found to have a positive relationship with perceived usefulness, perceived ease of use, and the behavioral intention to accept a system. As a result, trust is regarded as an important construct as far as this study is concerned in studying the system. The formulated hypothesis is displayed:

- **H-B:** Perceived usefulness benefits from trust.
- **H-A:** Perceived ease of use benefits from trust.
- **H-C**: The aim to use the system is positively impacted by trust.

Our results show that perceived ease of use is also a significant factor that influences perceived utility and system acceptability. The intention to accept the system has a strong positive association with perceived usefulness. According to the argument, people will be more likely to use a system if it is more useful, which will result in the following assumptions.

H-E: The intention to accept the system is positively impacted by the perceived utility of the system.

Perceived usability and perceived utility have been confirmed to be highly connected. it is argued that the more user-friendly a designed system is, the more valuable the system will be, which leads to the following hypothesis.

H-D: Perceived usability benefits from perceived utility.

Additionally, it has been demonstrated in numerous research that the desire to embrace a system has a favorable link with perceived ease of use. According to the argument, people will be more likely to use the developed system if it is easier, which leads to the following hypotheses.

H-F: The intention to embrace the system is positively impacted by perceived ease of use.

(iv) The result of the constructs

Table 12 shows the results from the questionnaire distributed and the calculated mean score of the final combined data. Trust has the highest mean score of 4.25 followed by perceived usefulness with mean score of 4.15 and the lowest mean score was scored by percieved ease of use.

Table 12: System validation results

Construct	Strongly disagree	Disagree	Neutral	agree	Strongly agree	Mean
Perceived usefulness-PU	0	0	2	18	6	4.15
Trust	0	0	2	16	8	4.25
Perceived ease of use	0	0	4	17	5	4.04

Table 13 shows the mean score interpretation that is used to compare trust, perceived usefulness and perceived ease of use in determining the user's willingness to use a system.

Table 13: Interpretation of the mean score

Mean score	Interpretation
4.30-5.00	Strongly valid
3.50-4.29	Valid
2.70-3.49	Neutral
1.90-2.69	Invalid
1.00-1.89	Strongly invalid

4.7 Discussion

The creation of an online freight forwarding information system for logistics management is the project's main goal. By streamlining processes, enhancing visibility, enhancing communication, lowering costs, and promoting international trade, the system considerably benefits the logistics and transport sector (Banerjee, 2018). It is essential for managing the complexity of modern supply chains and ensuring smooth transportation of goods both locally and internationally. The system uses a web-based application which allows interaction between the management of TrueLine Africa and its customers.

According to the results of the questionnaire, when people were asked how they felt about the proposed system, a large majority of them said they strongly agreed that it was worthwhile to implement because it would lower costs, boost productivity, improve customer satisfaction, and reduce the likelihood of human error (Richards, 2017).

On validation of the system, the findings showed that perceived usefulness, perceived ease of use, and system acceptance are all influenced by trust (Salloum, 2018), which is believed to be a key component. Additionally, it has been discovered that perceived simplicity of use significantly improves perceived usefulness and system usage. Finally, perceived utility has a big impact on how the technology is used. The findings showed that customers thought the system was reliable, practical, convenient, and simple to use.

The study had certain restrictions. To strengthen the generalizability of the findings, additional research should be conducted in other countries of East Africa and abroad, rather than focusing just on gathering data from Uganda. Second, the system was validated using the Technology Acceptance Model (TAM) with one factor: Trust. It is necessary to look at further studies with different factors in order to comprehend their effects.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

A web-based application was developed in this project which has simplified processes that offers real time quoting, document sharing, end-to-end communication, user management and to provide shipment status updates and notifications information. The system implemented all air, sea and road/rail freight operations. The aim was to eliminate paper use, increase responsiveness and to operate more efficiently. Mixed methods were used to collect the requirements. The model for the system implementation was agile in particular extreme programming. The system was tested for usability and utility using Technology acceptance model (TAM) with trust. In the findings, trust, perceived usefulness and perceived ease of use have positive effect on the system acceptance.

In order for the company to compete in the market, digital application is extremely important due to the growth in international trade and electronic business. Any organization that wants to thrive and compete in this market against the fierce competition brought on by tremendous digital growth must use digital processes (Nicolas, 2022).

5.2 Recommendations

5.2.1 Implications to the Policy Makers

The developed application bridges the gap between practice and education by enhancing user's competencies and personal qualification in order to ensure them that they are ready to meet the demand of their future profession. The application helps policy makers to identify effective policies and steps to successfully implement it in the freight forwarding industries at both national and regional level.

5.2.2 Implications to the Practitioners

The industry can benefit from this application by offering online quotations and storage of documents for different purposes for fast access hence improving service delivery, and instant communication with their clients for faster movement of goods. In addition, it provides users

with instant notification regarding their shipment hence giving the customers the hope of receiving their goods on time and are not scared of the loss of their goods.

5.2.3 Future Work

The work that needs to be done in the future is to integrate the application with the customs department's system for early declarations, which helps with quicker border crossings for timely delivery. As an added benefit for improved security, the application's security can be increased by adding two-factor authentication. Finally, we advise integrating Global Positioning System (GPS) to track moving vessels in real-time and from any location.

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APPENDICES

Appendix 1: Interview Guiding Questions

1. **Section A: Opening Questions**

(a) Dear sir/Madam, are you comfortable having the interview contacted in office or you prefer somewhere else?

(b) Kindly can you briefly introduce yourself and what is your core task in this company?

2. **Section B: Introductory Questions**

(c) Kindly explain experience working for this company?

(d) Mention the steps of how goods move from one location to another?

(e) Mention the requirements needed while moving goods from one location to another?

(f) Which method do you prefer in managing the movement of your goods (Flat files, Paper or IT system)?

3. **Section C: Key Questions**

(g) How do store your data?

(h) How do you keep the data secured?

(i) How do customers access your services?

(j) Which channels of communication do you and your customers prefer (email, WhatsApp, over the phone etc.)?

(k) How do you handle your documentations (soft copy or hardcopy)?

(l) How do customers notify of their shipments?

(m) Which mode of payment do you prefer in this business?

4. **Section C: Concluding Questions**

(n) Do you think the information System will be useful in managing the movement of goods from one location to another?

(o) Are you willing to use freight forwarding information system to manage your logistics?

(p) Do you have something that you would to share before we conclude the interview?

Appendix 2: Survey Questionnaire

Project Title: Web-based Freight Forwarding Information System for Logistics Management.

Dear Participant,

I am a final year Master's student at The Nelson Mandela African Institution of Science and Technology, Arusha-Tanzania and I invite you to participate in this survey.

The aim of this survey is to identify requirements to develop freight forwarding information system for logistics management that will streamline customer experience and improve logistics services resulting to cost reduction, secure movement of cargo, increase employee productivity, and improve quality of service. You have been identified as a potential key participant in this survey because of the number of years you have worked in the freight forwarding unit. This survey will take about 5 to 10 minutes of your time. The participation of this survey is voluntary. Your responses will be kept confidential in a secured database and only be used for academic purposes. The findings of this study will be published in an academic journal.

If you have any queries with regards to this study, please contact the researcher: Siama Mary via email: siamam@nm-aist.ac.tz , Mobile Phone number +255 765667628, at the School of Computational, Communication Science and Engineering, The Nelson Mandela African Institution of Science and Technology, Arusha-Tanzania.

Note: Deadline to receive your response is 27th May, 2022.

We appreciate you for your valuable time and active participation

Consent:

By clicking Yes, you consent that you are willing to answer the questions in this survey.

Yes ☐

No ☐

Instructions: This questionnaire is divided into three sections. Section A covers general profiles of the respondent (demographics), Section B includes information on the perception of people of the manual business processes in the freight forwarding industry and section C includes the perception of people on the use of web-based freight forwarding management system. Please select ☒ where appropriate.

SECTION A: BACKGROUND DATA

Please tick the checkbox representing the most appropriate responses for you in respect of the following;

1.What is your sex: a) Male ☐ b) Female ☐

2. What is your age group a) 20-29 ☐ b)30-39 ☐ c) 40-49 ☐ d) 50 and above ☐

3.What is your highest level of education?

a) Post Grad Diploma b) Bachelor's Degree c) Master's Degree d) Doctorate e) Others (specify)…….

SECTION B: People's perception of the manual business operations in the freight forwarding industry

S/N	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1	High operational costs	☐	☐	☐	☐	☐
2	Delay in service delivery	☐	☐	☐	☐	☐
4	Corruption and theft	☐	☐	☐	☐	☐

SECTION C: People's perception of the use of web-based freight forwarding management system.

S/N	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1	Reduce costs	☐	☐	☐	☐	☐
2	Increase productivity	☐	☐	☐	☐	☐

3	Customers are always satisfied	☐	☐	☐	☐	☐
4	Minimize human errors	☐	☐	☐	☐	☐

Thank you for your participation

Appendix 3: User Acceptance Test Questionnaire

Project Title: Web-based Freight Forwarding Information System for Logistics Management

Dear Participant,

I am a final year Master's student at The Nelson Mandela African Institution of Science and Technology, Arusha-Tanzania and I invite you to participate in this survey.

The aim of this survey is to assess the developed system if it has met the expectation of the user. You have been identified as a potential key participant in this survey because of your role and experience in the freight forwarding industry. The time spent in the answering the questions will not be more than 15minutes. The participation of this survey is voluntary. Your responses will be kept confidential in a secured database and only be used for academic purposes. The findings of this study will be published in an academic journal.

If you have any queries with regards to this study, please contact the researcher: Siama Mary via email: siamam@nm-aist.ac.tz , Mobile Phone number +255 765667628, at the School of Computational, Communication Science and Engineering, The Nelson Mandela African Institution of Science and Technology, Arusha-Tanzania.

Note: Deadline to receive your response is 15th.Nov. 2022.

Thank you in advance as you participate in this survey.

Consent:

By clicking Yes, you consent that you are willing to answer the questions in this survey.

Yes ☐

No ☐

Instructions: This questionnaire is divided into two sections. Section A covers general profiles of the respondent (demographics), Section B includes information on the various constructs and their factors that will determine the user acceptance of the developed system. Please select ☒ where appropriate.

SECTION A: BACKGROUND DATA

Please tick the checkbox representing the most appropriate responses for you in respect of the following;

1.What is your sex: a) Male ☐ b) Female ☐

2. What is your age group a) 20-29 ☐ b)30-39 ☐ c) 40-49 ☐ d) 50 and above ☐

3.What is your highest level of education?

a) Certificate b) Diploma c) Degree d) Masters d) Doctorate e) Others (specify)…….

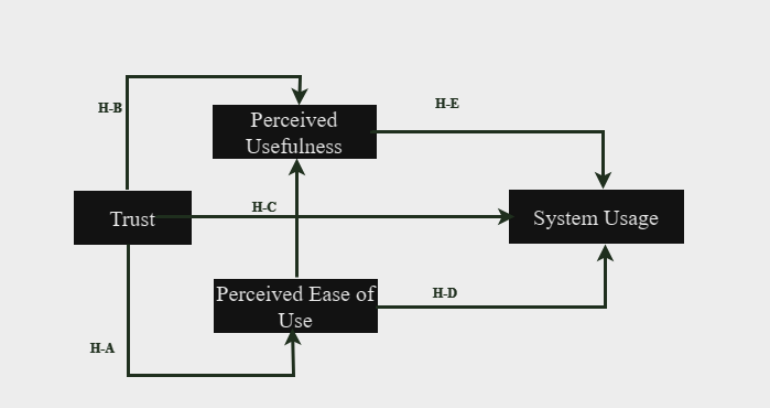
SECTION B: The variables that determine users to accept the developed system

Construct	**Factors**	**Disagree**	**Not Sure**	**Agree**
Trust	EF-A: I will pay for all my consignment online	☐	☐	☐
	EF-B: the system is safe to use	☐	☐	☐
	EF-C: I find all the information I need from the system	☐	☐	☐
Perceived usefulness-PU	PU-A: the system increases productivity	☐	☐	☐
	PU-B: the system saves time	☐	☐	☐
	PU-C: the system enhances my efficiency	☐	☐	☐
Perceived ease of use	Pe-A: I feel that the system is easy	☐	☐	☐
	Pe-B: I feel that the system is convenient	☐	☐	☐

	Pe-C: Getting information from the system is easy	☐	☐	☐
Trust	SU-A: I will use the system to order for my goods	☐	☐	☐
	SU-B: I will recommend others to use the system	☐	☐	☐
	SU-C: I will use the system regularly	☐	☐	☐

Thank you for your time

Appendix 4: Developed Hypotheses



Appendix 5: Data Protect and Privacy Act No.9 of 2019 of Uganda

Data Protection and Privacy Act 2019 | National Information Technology Authority - Uganda (NITA-U)

Appendix 6: Poster Presentation

WEB-BASED FREIGHT FORWARDING SYSTEM FOR LOGISTICS MANAGEMENT

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Introduction

Freight forwarding is the process of offering logistical services on behalf of shippers in delivering goods from a specific location and moving them to the final destination using a single or multiple carriers. On behalf of local or international shippers, they offer services such as air, ocean or inland freights, freight rate negotiations, cargo tracking, customs documentation, customs clearance, warehousing and distribution, and cargo insurance, among other tasks.

The practical ramifications of developing this system.
-Lowers the time and expense of transportation,
-Enhances inventory control,
-Raising customer satisfaction,
-Effective operations.
-Provides a wide range of data-driven service capabilities..
-It boosts competitive performance.

Problem Statement

The industry is faced with,
-frequent use of paper work
-uncoordinated and traditional way of communication
-unsuitable off-the-shelf software

Problem Statement Cont....

Which has resulted into;
-wear and tear.
-delays.
-penalty by the authorities.
-increased cost of operations.
-errors, malfunctions and unnecessary interfaces.
-loss of data

Objectives of the Study

Main objective

The objective of study is to develop a web-based freight forwarding information system for logistics management that will improve customer experience, reduce operational costs, eliminate errors, and increase employee productivity

Specific objectives

(a)To identify system requirements.
(b)To develop the system.
(c)To validate the system.

Significance of the Study

(a) Provides best practice mechanisms on the frieght forwarding processes.
(b) Stakeholders collaboration.
(c) Stakeholders draw lessons on how to improve frieght forwarding industry.

Results

Figure 1: Depicts the architecture of the application

The developed system consisted of several modules which were accessed using web technology and the customer fills in information, which is sent to the database for processing and storage. In the admin portal, customers get replies for their quotations, when quotations are approved, payment is made and the forwarder organizes with the carrier on the movement of the cargo from the place of origin to its destination. The shipments are tracked by receiving email notifications regarding the shipment until it is delivered to the owner. Furthermore, the system consists of instant communication, generates report, online document storage.

Results

With the development of this system, processes are streamlined, communication is enhanced, leading to efficiency and effectiveness hence lowering costs and increased productivity