

**THE IMPACT OF ROUTING AND SCHEDULING ON SERVICE DELIVERY IN
PRIVATE COMPANIES :A CASE STUDY OF JUMIA**

DANIEL OLINGA

S21B12/010

**A DISSERTATION SUBMITTED TO THE SCHOOL OF BUSINESS IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF BACHELOR OF
PROCUREMENT AND LOGISTICS MANAGEMENT OF UGANDA CHRISTIAN UNIVERSITY**

September, 2024




**UGANDA CHRISTIAN
UNIVERSITY**

A Centre of Excellence in the Heart of Africa

DECLARATION

I **DANIEL OLINGA** declare that this work is my own doing and has never been submitted to any institution for preview and the only work used was from various scholars and publishers.

Signature.....

Date.....

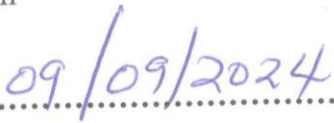
DANIEL OLINGA

S21B12/010

APPROVAL

This research report titled “The impact of routing and scheduling on service delivery in private companies” has been submitted by OLINGA DANIEL REG NO. S21B12/010 for approval with my sincere supervision

Signature.....

Date.....

Supervised by

Mrs. TUMUHAMYE COMFORT

DEDICATION

I dedicate this piece of work to my dear beloved parents Mrs. Akurut Samalie and Mr. Omoding Samuel who have been there for me and have ensured that I get all the required needs for the respective completion of this dissertation report. Not forgetting my brothers and sisters who have also provided words of guidance towards achieving the current goal and objective in the research report.

ACKNOWLEDGEMENT

I would love to take this opportunity to thank the Almighty God for guiding me through this period when I was conducting my research study and who has brought me this far in my academic journey.

I am very special way and remarks, I want to thank my supervisor Mrs. Tumhamye Comfort for her unwavering support in supervision and guidance through my research period, also not forgetting my dear friends that helped me with some advice that contributed to the accomplishment of my dissertation.

ABSTRACT

This dissertation was aimed at finding out the impact of routing and scheduling on service delivery in Jumia Uganda as a private organization. The study was mainly aimed at acquiring information about route optimization impact on service delivery. The study objectives included the challenges of route optimization, the importance of route optimization and the relationships between route optimization and service delivery. The ultimate goal of the study was to generate ideas which could lead to the improvement of logistics and procurement operations so as to enhance efficiency, mitigate risks and optimize costs.

The research study employed both qualitative and quantitative techniques. Simple random sampling was used to select 31 participants from a population of 34 aimed at including all characters of the population in the sample. Both primary and secondary data was used consisting of data collection instruments such as questionnaire, interview and observation. Pie charts and bar graphs were used to ensure data reliability and validity.

Findings indicated that Jumia is one of a significant player in Uganda's e-commerce business with increased internet commerce which offers accessible and reliable means to purchase goods and services. Whereas Jumia tried to improve its client's ways of living in Uganda through simplified acquisition of goods and services, Jumia faced notable challenges such as logistical issues and competition.

It was therefore recommended that implementation of environmental sustainability practices such as eco-friendly routing options (EVs), adoption to flexible logistical solutions, monitoring and analysis of key performance indicators could enable Jumia enhance route optimization and ensure real time data in delivery

TABLE OF CONTENTS

DECLARATION	I
APPROVAL	II
DEDICATION	II
ACKNOWLEDGEMENT	IV
ABSTRACT.....	V
CHAPTER ONE	1
1.0. INTRODUCTION	1
1.1. BACKGROUND OF THE STUDY	1
1.2. PROBLEM STATEMENT	3
1.3. PURPOSE OF THE STUDY	4
1.4. SPECIFIC OBJECTIVES	4
1.5. RESEARCH QUESTIONS	4
1.6. SCOPE OF STUDY	4
1.6.1. CONCEPT SCOPE.....	4
1.6.2. GEOGRAPHICAL SCOPE	4
1.6.3. TIME SCOPE	4
1.7. SIGNIFICANCE OF THE STUDY	5
1.8. LIMITATIONS.....	5
1.9. CONCEPTUAL FRAME WORK	5
CHAPTER TWO	6
2.0 INTRODUCTION	6
2.1 KEY DEFINITION ON VARIABLES	6
2.1.1 ROUTING AND SCHEDULING	6
2.1.2 SERVICE DELIVERY	7
2.2 IMPORTANCE OF ROUTE OPTIMIZATION	9
2.3. CHALLENGES OF ROUTE OPTIMIZATION	12
2.4. THE RELATIONSHIP BETWEEN ROUTE SCHEDULING AND SERVICE DELIVERY.....	14
CHAPTER THREE	17
3.0 INTRODUCTION	17
3.1 RESEARCH DESIGN	17
3.2 SAMPLING TECHNIQUE	17
3.3 DATA COLLECTION SOURCE.....	18

3.3.1 PRIMARY SOURCE.....	18
3.3.2 SECONDARY SOURCE	18
3.4 SAMPLE SIZE	19
3.5 DATA COLLECTION INSTRUMENTS	19
3.5.1 QUESTIONNAIRE	19
3.5.2 INTERVIEW	20
3.5.3 OBSERVATION	20
3.6 DATA COLLECTION PROCEDURES	20
CHAPTER FOUR.....	21
DATA ANALYSIS, INTERPRETATION AND PRESENTATION OF DATA FINDINGS.....	21
4.0. INTRODUCTIO N	21
4.1. FINDINGS ON THE DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS	21
4.1.1. Gender Distribution of the respondents	21
4.1.2. Age Distribution of the Respondents	22
4.1.3. Level of Education.....	22
4.1.4. Length of Service at the Organization	23
4.1.5. Department of Operation	24
4.3. CHALLENGES OF ROUTE OPTIMIZATION	28
4.4. THE RELATIONSHIP BETWEEN ROUTE SCHEDULING AND SERVICE DELIVERY.....	31
CHAPTER FIVE	36
DISCUSSIONS, SUMMARY, CONCLUSION AND RECOMMENDATIONS OF THE FINDINGS.	36
5.0. INTRODUCTION	36
5.1. DISCUSSION OF THE FINDINGS	36
5.1.1. THE IMPORTANCE OF ROUTE OPTIMIZATION IN JUMIA UGANDA..	36
5.1.3. THE RELATIONSHIP BETWEEN ROUTE SCHEDULING AND SERVICE DELIVERY.....	38
5.2. SUMMARY OF THE FINDINGS	39
5.3. CONCLUSION.....	40
5.4. RECOMMENDATIONS.....	40
REFERENCES	42

APPENDIX.....	44
QUESTIONNAIRE	44
INSTRUCTIONS.....	44
SECTION A.....	44
Bio-data.....	44
INSTRUCTIONS.....	46
SECTION B: IMPORTANCE OF ROUTE OPTIMIZATION.....	46
SECTION C: CHALLENGES OF ROUTE OPTIMIZATION.....	47
SECTION D: RELATIONSHIP BETWEEN ROUTE OPTIMIZATION AND SERVICE DELIVERY	48
LETTER OF ACCEPTANCE	49

CHAPTER ONE

1.0. INTRODUCTION

This chapter gives a detailed description and explanation of the background of the research topic of study where it outlines the various problems solved by the research findings. It also shows the various objectives that the researcher needs when carrying out the research and also lays the scope of study and its different significance.

1.1. BACKGROUND OF THE STUDY

Route scheduling is the process of efficiently planning and organizing transportation routes to ensure timely delivery of goods or services. This process was usually accountable for factors such as delivery addresses, delivery time windows, vehicle capacities, traffic conditions and other logistical constraints. The term Routing refers to determining the most efficient route(s) for the movement of resources in order to reach their destinations taking into account of factors like distance, traffic conditions and time whereas on the other hand, Scheduling is the assigning of specific tasks to resources within a given period of time and ensuring the tasks are completed in a timely manner in accordance to priority. So, in simple words, routing dealt with transportation aspect and scheduling deals with the aspect of allocating resources, tasks or services in a time frame

Bruce L. Golden and Arjang A. Assad state that the international workshop on current and future directions in the routing and scheduling of vehicles and crews, sponsored by the National Science Foundation, was held at the University of Maryland and was attended by about 50 experts from around the world in 1979. As far as my research about routing and scheduling was concerned, I realized that most writers and authors mainly focused on the problems involved in routing and scheduling. For example, a paper by Schrage (1981) was presented at the workshop held at the University of Maryland and it contained a list of issues that arise in more complex and realistic routing problems. The list mainly focused on the different aspects or practical considerations such as time windows, time-dependent travel times, different vehicle types and capacities, split deliveries, uncertain demand and messy cost functions.

According to Taniguchi et al. 2001, Vehicle Routing and Scheduling provided the core for modelling city logistics. Once the facilities, or the City Logistics Centers had been located, and the demand nodes had been allocated to each facility the next step was to

decide the efficient use of fleet of vehicles that would make a number of stops to pick up and deliver passengers or products. Taniguchi et al 2001, went on to state that the problem required the specification of which customers would be serviced by each vehicle and in what order so as to minimize the total cost subjected to a variety of constraints such as vehicle capacities, delivery time restrictions, etc.

Globally, routing and scheduling in regards/ relation to service delivery, played a critical role in the efficient movement of goods across various/vast distances reaching different locations and destinations, often involved multiple modes of transportation which included air, sea road and rail. Most global logistics companies and supply chains such as Amazon, Unilever, Paragon, Trimble, to mention but many, relied heavily on sophisticated routing algorithms and scheduling techniques to optimize delivery routes, minimize transportation costs, and meet customer demands efficiently while considering factors like distance, time constraints, fuel consumption, and regulatory requirements. There were also various technologies embraced by those logistics companies globally such as Global Positioning System (GPS) for tracking, real-time data analysis, and predictive modeling which played a significant role in enhancing security, efficiency and responsiveness in global logistics operations worldwide.

According to the African perspective of routing and scheduling, logistics faced unique challenges due to the continent's vast size, diverse geography, inadequate infrastructure and often underdeveloped transportation networks. Routing and scheduling in the African perspective involved/required various innovative approaches and ideas to overcome different challenges including the use of alternative transportation modes like waterways and unconventional routes to reach remote/underdeveloped or landlocked regions. Scheduling was a very crucial and efficient factor in the optimization of limited resources and to mitigate issues and challenges like congestion, unreliable supply chain routes and delays caused by regulatory barriers and political instabilities. In Africa, collaborative efforts among the different governments, private stakeholders and international partners are so essential at improving the logistics infrastructure and fostering regional trade integration and development respective to the different blocks of leadership and governance in Africa.

In East Africa with a consideration of countries like Uganda, Kenya, Tanzania, Rwanda, Burundi and those that currently joined the block such as Congo, South Sudan, Somalia, etc. faced specific challenges and opportunities. The region's landlocked countries relied heavily on transportation corridors connecting them through to major seaports

like Mombasa and Dar es Salaam in Kenya and Tanzania, making efficient routing and scheduling critical which played a crucial role in facilitating trade and economic development. Cross border logistics operations required coordination among multiple stakeholders involved in the different countries of the block to streamline customs procedures, reduce transit times and distances and also to ensure smooth flow of goods across borders. Infrastructure investment and development such as roads and railway networks and adoption of technology-driven solutions were key priorities to enhance and embrace logistics efficiency in East Africa.

In Uganda accordingly, as a landlocked country in East Africa, logistics played a vital role in supporting the economy and facilitating international trade. Efficient routing and scheduling were essential for overcoming infrastructure constraints, such as inadequate road networks and limited access to major ports, which could result into huge transportation costs and delays. Currently in Uganda, improving logistics efficiency involved addressing challenges such as poor road conditions, congestion at border crossings and regulatory bottlenecks. Enhanced coordination among government agencies, investing the renovation and upgrade of infrastructure, promoting private sector participation and leveraging technology solutions like digital tracking systems currently being embraced by transportation companies like Kiira motors, Global bus transportation company, etc., and mobile applications could help optimize routing and scheduling processes, reduce logistics costs and enhance competitiveness in various parts and regions of Ugandan market.

Jumia Uganda is an e-commerce platform that operates in various parts and locations in Uganda offering wide range of products including electronics, fashion goods, groceries, beauty and cosmetic products, etc. Jumia being an online market, it usually connects sellers with customers and also facilitates transactions and deliveries of goods and services around Uganda. In reference to routing and scheduling, Jumia Uganda applies various sophisticated logistics and supply chain management systems to ensure the effective and efficient supply and delivery of customer's orders.

1.2. PROBLEM STATEMENT

In today's competitive business environment, service delivery is a critical determinant of customer satisfaction and business success. For many private business firms ensuring timely and accurate delivery of products is essential for maintaining a competitive edge. However, insufficient routing and scheduling has been noticed to be a key challenge to

many firms due to the increased operational cost and diminished customer satisfaction associated with it. Melynk et al. (2014) emphasized that inefficiencies in routing and scheduling impacted on operational cost and customer satisfaction. The author asserted that advanced routing algorithms could enhance delivery efficiency and reduce delays thus improving service quality. Additionally, Goh and Chong (2017) argued that accurate scheduling not only helped in managing customer expectations but also reduced operational disruptions. Despite the various challenges associated with routing and scheduling, several efforts such as use of advanced algorithms and software, real time-data integration, automated systems, and demand forecasting have been employed to enhance service delivery. However, the solutions still leave many pending gaps such as poor quality and data integration, high cost and accessibility barriers, inaccurate real time information and resistance to new systems enhance the need for the study.

1.3. PURPOSE OF THE STUDY

To assess the role of routing and scheduling in service delivery in Jumia as a private organization.

1.4. SPECIFIC OBJECTIVES

- 0) To examine the importance of route optimization to Jumia
- 0) To assess the challenges of route optimization at Jumia
- 0) To examine the relationship between route scheduling and service delivery at Jumia

1.5. RESEARCH QUESTIONS

- 0. What is the importance of route optimization to Jumia?
- 0. What are the challenges of route optimization to Jumia?
- 0. What is the relationship between route scheduling and service delivery at Jumia

1.6. SCOPE OF STUDY

The scope of study covers the conceptual scope, geographical scope and the time scope

1.6.1. CONCEPT SCOPE

This conceptual scope was limited to the role of routing and scheduling on service delivery with a case study of Jumia.

1.6.2. GEOGRAPHICAL SCOPE

The study was conducted in Bugolobi at Jumia Uganda Luthuli Avenue, Kampala.

1.6.3. TIME SCOPE

The study was carried out for a period of four month from May-August 2024 and it was mainly aimed at generating objectives and meaningful data.

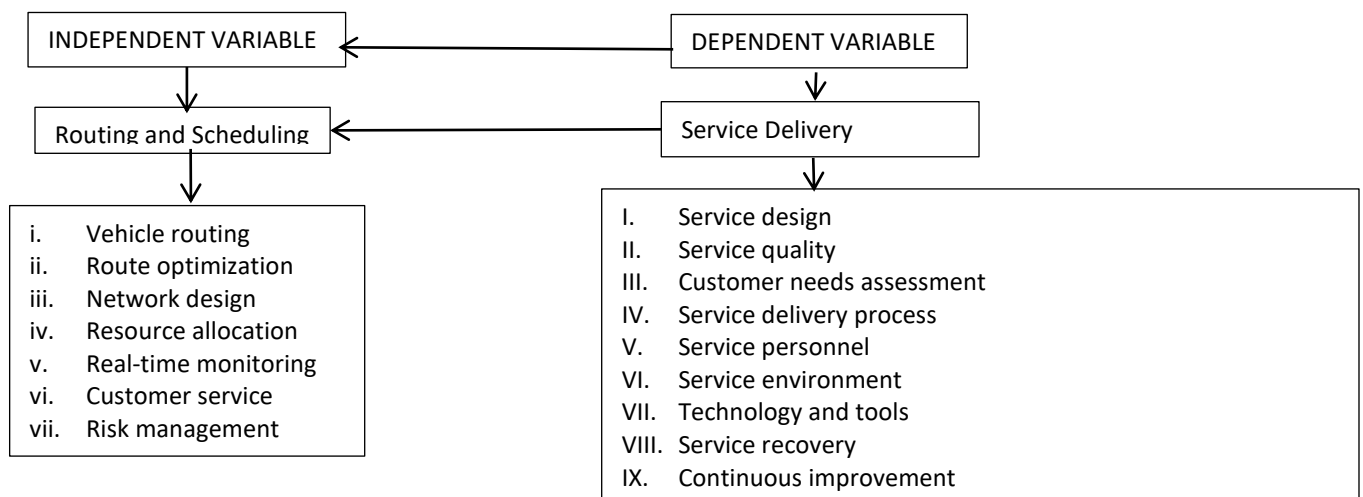
1.7. SIGNIFICANCE OF THE STUDY

- The study will help the researcher in acquiring current issues challenges and trends involved in the routing and scheduling operations
- The research will also enable the researcher to develop a way of thinking, analyzing and solving problems in the field of logistics and procurement as far as route scheduling is concerned.
- The research was significant in the way that it will enable the researcher to contribute knowledge basing on his/her findings to the already existing literature.
- The study will help the researcher to generate ideas which can lead to the improvement in logistics and procurement practices and operations, enhancing efficiency, reducing costs and mitigating possible risks in the organization of study.

1.8. LIMITATIONS

- Limitations in data collection such as privacy concerns, confidentiality which may restrict the researcher from acquiring certain information due to ethical considerations.
- Inaccurate and incomplete data challenges also can restrict the researcher from carrying out my research appropriately as expected of me.
- Bias due to encounter of unrepresentative data and information which can be misleading from the basis/field of study

1.9. CONCEPTUAL FRAME WORK



CHAPTER TWO

2.0 INTRODUCTION

This chapter presents reviewed literature on the impact of routing and scheduling on service delivery in private entities with particular emphasis on the following objectives.

2.1 KEY DEFINITION ON VARIABLES

2.1.1 ROUTING AND SCHEDULING

There are various definitions of routing and scheduling as far as various scholars are concerned, I managed to understand that routing and scheduling is the process of determining the most efficient routes for the transportation or movement of goods and services from the various suppliers to their desired or final destinations such as warehouses, distribution centers, and customers. Scheduling involves allocating comes with allocation of different resources within a given period of time and ensuring the tasks are completed in time. Various scholars have defined routing and scheduling differently respective to their own perspectives.

David Simchi-Levi, Phillip Kaminsky and Edith Simchi-Levi (Designing and managing the supply Chain: Concepts, Strategies, and case studies, 2007) define routing as the process of planning the paths that delivery vehicles will take to transport goods. They emphasize the importance of route optimization in reducing transportation costs, improving service levels and enhancing overall supply chain efficiency. The scholars went ahead to explain various routing algorithms and their real-world scenarios where they look at routing and scheduling algorithms and how they are used in reality to determine the most efficient paths for transportation vehicles, aiming to minimize costs, travel time, and distance while meeting delivery constraints and improving service delivery. For example, exact algorithms like branch and bound and dynamic programming which are used to find optimal solutions for small problems encountered during routing and scheduling, heuristic algorithms which provide good and near optimal solutions within a reasonable computational time. Etc.

Stock and Lambert describe scheduling as a critical logistics function that involves the detailed planning of activities to ensure the right products are delivered at the right time. They also emphasize the role of scheduling in achieving operational efficiency and customer satisfaction.

Martin Christopher (Logistics and Supply Chain Management, 2016), defines scheduling as the coordination of logistics activities to optimize the use of resources and meet customer requirements. He highlights the importance of scheduling to reducing lead times and improving supply chain responsiveness.

2.1.2 SERVICE DELIVERY

Service delivery is the process that involves the efficient and effective movement and management of goods, services and information from suppliers to the end customers/users. The process of service delivery is made up of various activities such as transportation, warehousing, inventory management, order fulfillment and customer service. And as far as service delivery is concerned, there are key components that are applied when carrying out service delivery and most scholar explain service delivery in reference to the components as below;

Bowersox, Closs and Cooper (Supply Chain Logistics Management, 2002) define service delivery in logistics as the performance of all supply chain activities to meet customer requirements effectively. This means the scholars look at service delivery as a process that involves transportation of goods and services to the respective customers in the required time by the customer and also ensuring that the products contain accurate information for easy usage by the customers ensuring high levels of satisfaction.

Martin Christopher (Logistics and Supply Chain Management, 2016) defines service delivery as the orchestration of logistics activities to provide timely and accurate deliveries to customers. He goes on to highlight the importance of agility and responsiveness in service delivery, particularly in today's fast paced market environments where customer's expectations keep evolving continually. This explains Christopher's perspective that service delivery must go hand in hand with the various customer desires and expectations in order to ensure efficient and effective service delivery in the day today growing and developing markets that come with very many factors of change. Martin mainly focuses on flexibility as a component of service delivery that looks at the ability of logistics systems to adopt to changes in customer demands, market conditions and supply chain disruptions. This includes rerouting shipments, managing inventory dynamically and adjusting delivery schedules.

As far as Mentzer, Flint, and Hult, in their article "Logistics Service Quality as a Segment-Customized Process", published in the journal of Marketing, describe service delivery as a critical component of logistics service quality. They go ahead to argue that

service delivery should be based or tailored to the various needs as specified by the different customers, and this requires the deep understanding of customer's expectations and customize logistics services accordingly. This also ensures that the customers' needs and expectation are well meet.

Lastly but not the least, according to Ellram and Carr's research on procurement's role in the supply chain, define service delivery in procurement as the process of ensuring that the acquisition of goods and services meets the required specifications, quality, and timing. They still insist that effective service delivery in logistics is essential for maintaining operational efficiency and supporting overall business goals. They also look at timeliness, accuracy and cost efficiency and their understanding of service delivery focuses on the time frame which involves the lead time, accuracy that focuses on right products, information, quantities, conditions etc. and cost efficiency that ensures that high service maintenance costs

2.2 IMPORTANCE OF ROUTE OPTIMIZATION

Route optimization is a crucial aspect in logistics and procurement management because it involves finding out the most efficient routes for the transportation of goods and services mainly with a n aim of minimizing costs, enhancing customer satisfaction, reducing delivery/lead times and the improvement of overall operations during routing and scheduling. Different scholars discussed the importance of route optimization in their articles showing the various importance associated in routing and scheduling/route optimization.

David Simch-Levi, Phillip Kaminsky and Edith Simch-Levi (Designing and Managing the supply chain: Concepts, Strategies, and Case Studies, 2007) emphasize the role of route optimization in reducing transportation costs. They state that optimizing delivery routes can lead to significant cost savings by minimizing the distance covered and fuel consumed. They further discuss the importance of routing and scheduling in their comprehensive textbook “Designing and Managing the Supply Chain”. where they talk about the different aspects such as cost efficiency and this is crucial for reducing transportation costs by finding the most efficient routes, companies can minimize fuel consumption, labor costs and vehicle wear and tear, Service levels that ensures timely deliveries which is essential for maintaining high service levels. This is important mainly in industries where just in time (JIT) delivery is crucial for perishable goods, high tech goods and fragile goods with tight production schedules, Resource utilization which is another aspect that talks about the importance of optimizing routes that helps in better utilization of available resources including vehicles and drive. This results to fewer vehicles on the road and leads to reduced need of overtime and better alignment with delivery windows. They go on to talk about complexity also as an aspect and importance of route optimization, here modern supply chains are complex with multiple constraints and variables such as delivery time and windows, etc and that route optimization helps in the management of this complexity, providing solutions that can satisfy multiple criteria simultaneously.

Sunil Chopra and Peter Meindl (Supply Chain Management, 2012) define the importance of routing and scheduling in enhancing delivery reliability and customer satisfaction and this can be scored by ensuring that goods are delivered to customers on time and through the most efficient routes. They still emphasize that companies dealing

in service delivery can improve service levels and meet customer expectations more consistently through the following key aspects;

Cost reduction; this is one of the primary benefits of route optimization that ensures that there is reduction of transportation costs such as fuel costs, vehicle maintenance costs, and decrease labor expenses. Sunil Chopra and Peter emphasize this aspect by explaining that determining the most efficient routes, companies dealing in service delivery can lower fuel consumption, reduce vehicle maintenance costs etc.

Improved customer service and care; improved routing and scheduling enables more reliable and time deliveries which enhance customer satisfaction and they still feel cared for. Most customers expect prompt deliveries and if a company meets these expectations, that can lead to higher customer loyalty. Effective routing and scheduling lead to enhanced customer satisfaction by ensuring timely and reliable deliveries. Customers expect prompt service, and meeting these expectations can significantly boost customer loyalty. According to a study on technician routing and scheduling, improving these aspects leads to higher field service quality, which directly impacts customer satisfaction positively (Haugen & Hill, 1999).

Reduced environmental impact; this mainly focuses on sustainability in service delivery and the scholars explain that route optimization leads to sustainability by minimizing the distances travelled or covered and the time spent by the vehicles on the roads which reduces carbon prints and emission levels. They further explain that sustainability in route optimization results in lower greenhouse gas emissions and a smaller carbon print which helps organizations and companies dealing in service deliveries to meet environmental preservation goals. Route optimization plays a crucial role in sustainability by reducing the distances traveled and time spent on the road, which in turn lowers carbon emissions. Research shows that efficient vehicle routing can minimize greenhouse gas emissions and help organizations meet their environmental preservation goals. For instance, studies on green vehicle routing models highlight the importance of optimization in achieving lower emissions and a smaller carbon footprint (Li, Lim, & Tseng, 2019; Fathollahi-Fard et al., 2018).

Flexibility and responsiveness; in dynamic supply chain environments where demand fluctuates and unforeseen events can occur, optimization of routes allows companies to be more flexible and responsive in a way that makes them to be agile in order to maintain service levels and adapting to changes that come up abruptly. In dynamic supply chain environments, route optimization enables companies to be more flexible

and responsive to fluctuating demands and unforeseen events. This adaptability helps maintain service levels and quickly adjust to changes. Research in the field emphasizes that optimized routing allows companies to be agile and maintain high service standards even in unpredictable conditions (Golden et al., 2002; Gendreau et al., 1996).

Risk management; through route optimization, companies can manage risks better associated with transportation for example delays, traffic congestion, and accidents during delivery time. Route optimization helps companies manage risks associated with transportation, such as delays, traffic congestion, and accidents. By optimizing routes, companies can mitigate these risks and ensure timely deliveries. Studies have shown that optimization algorithms can significantly reduce the likelihood of such issues, enhancing overall delivery reliability (Pillac, Gueret, & Medaglia, 2013; Liu et al., 2019).

Therefore, as much as this research is concerned, I have realized that Chopra and Meindl emphasize mostly that route optimization/ routing and scheduling is not just about finding the shortest route but also about considering a variety of factors such as balancing costs, efficiency, sustainability and risk management, service levels, etc. that make service delivery a crucial component of effective supply chain. Bowersox, Closs and Cooper 2002 in *Supply Chain Logistics Management*, underscore the environmental benefits that come hand in hand with routing and scheduling. They go on and explain that route optimization can lead to reduced carbon foot prints and emissions and low fuel consumption leading to more sustainable logistics operations.

2.3. CHALLENGES OF ROUTE OPTIMIZATION

Route optimization / routing and scheduling also presents various challenges when offering numerous benefits in logistics and supply chain management and these challenges have been identified and discussed by various scholars, emphasizing the different complexities involved in the achievement of optimal routing and scheduling solutions and these are as explained below by the scholars in their own perspectives.

In *Designing and Managing the Supply Chain*, Simchi-Levi, kaminsky, and Edith Simchi-Levi (2007), discuss the inherent complexity of route optimization problems where they explain in detail about the various problems like the (VRP) Vehicle Routing Problem, and its variants are computationally intensive, complex and difficult to solve optimally within a reasonable period of time, especially for large scale circumstances. Dynamic and Stochastic Environments, this involves dynamic and stochastic / random elements for example fluctuating demand, unpredictable weather, and varying traffic. These uncertainties can make or hinder the planning process of routes in advance. For example, a route that is optimal can end up being sub-optimal due to a challenge brought up by traffic congestion which usually happens unexpectedly. Such a challenge necessitates the development and implementation of a robust and adaptive routing algorithms that can respond to real-time information and adjust routes on the fly (Simchi-Levi et al., 2008). However, they talk more about other challenges such as constraints like vehicle capacity limitations, driver working hours regulations, specific customer requirements such as delivery time and windows, etc., Scalability this is when small and medium enterprises may not or are not effective for large scale enterprises with extensive delivery / supply networks, Technological advancement which comes with change in operations and require robust data processing and analytic capabilities which is a hurdle because it requires dealing with large volumes of data in real-time. Martin Christopher (2016) in *Logistics and Supply Chain Management*, highlights mainly on the various challenging factors when carrying out the route optimization plan for example unpredictable customer demand, transportation delays, and supplier reliability lead to complications which affect the route optimization efforts. He goes on to highlight that one significant challenge is the Dynamic nature of demand and the need for agile supply chains. Traditionally, forecast driven supply chains often fall short in responding to the rapid changes and uncertainties in markets.

Additionally, Christopher still emphasizes the complexity of balancing cost efficiency with service levels. Optimized routes must not only minimize costs but should also meet strict delivery windows, customer needs and expectations. These require sophisticated algorithms and real-time data integration which involve use of advanced technologies and systems.

Herbert Kopfer et al., 2012, one of the primary challenges discussed by Kopfer and Bierwirth is the inherent complexity of the route optimization problem, often classified as NP-hard which means the number of destinations increases, the number of possible routes grows exponentially making it computationally infeasible to solve the problem / challenge within a reasonable time for large instances. Also, in their study on the impact of traffic congestion on the various distribution and supply chain processes, they discuss that such a challenge of traffic congestion brings about uncertainty and variability.

In the book “Supply Chain Management: Strategy Planning and Operation, (2012)” by Sunil Chopra and Peter Meindl provide a detailed explanation of dynamic factors that seem to be a challenge in routing and scheduling for example traffic congestion, weather changes and last-minute customer requests which require real-time data analysis and adjustment to routing plans. They explain traffic congestion as a challenge that affects transportation efficiency which results to delays in delivery due to congested roads thus leading to last deliveries, this impacts customer and the overall performance of the supply chain performance. They also came up with the possible ways on how such challenges can be mitigated for example use of real-time data by delivery companies such as Jumia, route optimization algorithm and contingency plans to reroute vehicles in-case of traffic conditions. Weather changes such as heavy rains, storms, extreme heat, etc. can also disrupt the delivery processes and activities, affect safety and damage goods in delivery.

2.4. THE RELATIONSHIP BETWEEN ROUTE SCHEDULING AND SERVICE DELIVERY.

According to Taha (2017). *Operations Research: An Introduction*. McGraw-Hill Education. Route scheduling is a critical component of many service delivery systems, including transportation networks, logistics, and supply chain management. Optimal route scheduling can significantly impact the efficiency and effectiveness of service delivery, as it affects the time and cost of completing tasks. In this document, we will explore the relationship between route scheduling and service delivery, highlighting the importance of optimal route scheduling in minimizing travel times and costs.

The Problem of Route Scheduling involves determining the most efficient order in which to visit a set of locations or customers, given a set of constraints such as travel time, distance, and resource availability. The problem becomes more complex when there are multiple vehicles or drivers involved, as each vehicle or driver has its own constraints and limitations. The goal is to find a route schedule that minimizes total travel time or distance, while also satisfying the service requirements of each location or customer. Whereas the primary objective of service delivery is to provide goods or services to customers in a timely and cost-effective manner. In transportation networks, this means minimizing the time it takes to deliver goods from a central warehouse or depot to customers. In logistics and supply chain management, it means ensuring that products are delivered to retailers or end-users in a timely and cost-effective manner.

However, there are various ways Route Scheduling impacts and relates with Service Delivery through various aspects such as; Travel Time Reduction which involves optimizing routes in order to reduce travel times by minimizing the distance traveled and reducing the number of vehicles on the road. This can lead to faster delivery times and improved customer satisfaction. Cost Savings Optimal route scheduling can also reduce costs by minimizing fuel consumption, reducing vehicle wear and tear, and decreasing labor cost. With optimized route schedules, drivers can complete more deliveries in a given time-frame, increasing productivity and reducing the need for additional resources.

According to Bodin and Golden (1981), the efficient scheduling of routes is a crucial component of effective service delivery, as it allows organizations to optimize the allocation of resources, minimize travel time and distance and ensures timely and reliable service delivery to the respective customers (Collins et al., 2023).

According to Toth, P., & Vigo, D. (2014), effective route planning can lead to cost savings, reduced environmental impact and improved on-time performance for the service providers. Optimized route planning can significantly improve service delivery efficiency by minimizing travel time, fuel consumption and labor costs.

Route scheduling allows service providers to quickly adapt to changes in customer needs / demands for example the last-minute urgent needs (Pillac et al., 2013) so by incorporating dynamic routing capabilities, service providers can reschedule routes for the vehicles and personnel to accommodate for unexpected customer requirements thus improving customer loyalty and satisfaction. Responsive route scheduling can also help service providers to effectively manage peak demand periods and unexpected events thus ensuring timely service delivery.

Coordination and communication as a route scheduling and service delivery aspect ensures that there is effective communication between dispatchers, drivers and customers which is an essential for a successful route scheduling and service delivery (Ghiani et al., 2003). coordination ensures that all parties are informed of any updates that come up to the schedule like delays, rerouting or service completion. Clear and effective communication helps in the management of customer expectations and also reduces the possible risk of misunderstandings and dissatisfaction.

Capacity management must also be considered which involves the number of vehicles, personnel and equipment used during service delivery, this ensures that there is efficient delivery of goods and services (Laporte, 2009). over committing resources can lead to delays while under-utilization of resources can result into inefficiencies and lost revenue. Therefore, effective capacity management allows service providers to balance supply and demand thus optimizing the use of resources and maximizing service delivery.

Adaptation to changing conditions, route scheduling should be flexible enough to adapt to unexpected events such as traffic congestion, weather conditions, vehicle breakdowns in order to minimize disruptions that hinder service delivery (Pillac et al., 2013). Therefore, incorporation of real-time data and dynamic routing capabilities can help service providers to quickly respond to the unexpected changes and reroute vehicles as needed and it helps maintain a high level of service quality and customer satisfaction even in the face of unforeseen circumstances.

Leveraging technology which comes as a result of integration with Technology such as GPS tracking, route optimization software and mobile apps can enhance the efficiency and accuracy of route scheduling and service delivery (Ghiani et al., 2003)

CHAPTER THREE

3.0 INTRODUCTION

This includes data collection sources, instruments needed during data collection, instruments, procedures, reliability and validity of data, sampling techniques and limitations of the research study.

3.1 RESEARCH DESIGN

Both qualitative and quantitative research designs were necessary and important when carrying out research because it creates or they created room for a more holistic understanding of a research problem. Here is how each was utilized in the field of research. Qualitative research designs focus on exploring and understanding phenomena in-depth, often using non-numerical data. The goal was to gain a rich, detailed understanding of individual's experiences, behaviors, and perspectives. And it mainly involved the Phenomenological design that is usually examines the subjective experienced individuals or groups. Grounded theory design which helped in the development of a theory or framework based on data collected through observations, interviews, and other methods. Case study design and this goes In-depth analysis of a single case or a small number of cases to understand complex phenomena. Content analysis design which was used to analyze texts, images, or other forms of communication to identify patterns and themes.

Quantitative research designs were mainly focused on measuring and analyzing numerical data to test hypotheses and generalization. The goal was to quantify relationships between variables and make predictions about populations. Quantitative research designs typically involved experimental design that manipulated independent variables to measure their effects on dependent variables. Survey design which collected self-reported data from a sample of participants using standardized instruments. Correlational design that also examined the relationship between two or more variables without manipulating any variables. Quasi-experimental design and this one compared groups or conditions without random assignment.

3.2 SAMPLING TECHNIQUE

Simple Random sampling is a non-probability sampling technique where every element in the population has an equal chance of being selected as a sample. It is a method of selecting a subset of units (e.g., individuals, organizations, or objects) from a larger

population to participate in a study. In simple random sampling, each unit had an equal probability of being selected, and every selection was independent of the others. Random simple sampling technique ensured that the sample was representative of the population. Since every unit had an equal chance of being selected, the sample was likely to reflect the characteristics of the population, simple random sampling eliminated bias in the selection process. Each unit was selected independently, without any knowledge of its characteristics or potential outcomes, it a could also be less expensive than other sampling methods, as it did not require extensive knowledge of the population or complex selection procedures and also data from a simple random sample was easier to analyze, as it followed a normal distribution and was less prone to outliers. It was the most appropriate because it was complex that is to say it was often used when the population was large and difficult to access. When there was limited knowledge about the population or its characteristics, simple random sampling provided a fair and unbiased approach. The results from a simple random sample could also be generalized to the larger population with greater confidence, as the sample was representative and unbiased.

3.3 DATA COLLECTION SOURCE

These are sources or origins from which data is generated or obtained for research. And those sources include primary and secondary sources.

3.3.1 PRIMARY SOURCE

Primary sources of data are original, firsthand pieces of information collected directly by the researcher for a specific study or research question. This data had not been previously published or analyzed. This source was the most appropriate to use because the primary data was tailored to the specific research questions or hypotheses being investigated, ensuring relevance. Researchers had direct control over data collection processes, leading to more accurate and reliable results. Primary data reflected current trends and conditions, making it valuable for studies needing up-to-date information. Collecting data firsthand allowed researchers to gain detailed insights and context that secondary sources lacked.

3.3.2 SECONDARY SOURCE

Secondary data sources refer to information that has already been collected, analyzed, and published by other researchers or organizations. This data was used to support or contrast primary research findings. For example, academic articles, books, and studies

that provide background information on a topic, government Reports, databases like from pre-existing datasets from research institutions or organizations and media Sources such as news articles and reports that discuss relevant issues. Secondary data source was appropriate to use because of its cost-Effectiveness that is to say using existing data could save time and resources, as eliminated the need for primary data collection. Secondary data often provided a wider context or historical background, enriching the understanding of a research topic. It could also offer access to large datasets that would be impractical or impossible to collect independently. In cases where primary data collection was difficult (e.g., large populations, sensitive topics), secondary data could provide valuable insights.

3.4 SAMPLE SIZE

A study population of 34 people would be used during the study of the phenomena. To determine the sample size, slovin's Formula would be used to determine the sample size in the study. In Slovin's formula, sample size is considered as (n), population size as (N) and margin of error (e). It's computed as $n = \frac{N}{1 + N(e)^2}$.

N=Population size

n=Sample size

e=Level of significance of error assumed to be 0.05

Therefore; $n = \frac{34}{1 + 34(0.05)^2}$

$$n = \frac{34}{1 + 34(0.0025)}$$

$$n = \frac{34}{1.085}$$

$$n = 31$$

3.5 DATA COLLECTION INSTRUMENTS

Data collection instruments are tools used by researchers when gathering information for research purposes. There are various types of data collection instruments like surveys and questionnaires, interviews, observations, experiments, focus groups, case studies.

3.5.1 QUESTIONNAIRE

A questionnaire is a research data collection instrument that consists of sets of questions and various prompts designed to gather information from respondents. The reason as to why questionnaire was the best data collection to be used is because it was cost effective especially for large scale samples, it was scalable because it could reach a large number

of people, it was anonymous because it encouraged honest responses and it ensured all respondents received the same questions in the same order.

3.5.2 INTERVIEW

An interview is a data collection instrument /method used by researchers to gather detailed and in-depth information directly from individuals

3.5.3 OBSERVATION

This method of data collection focused at the researcher systematically watching, listening and recording behaviors and events as they occurred in their natural setting

3.6 DATA COLLECTION PROCEDURES

A letter of introduction would be obtained from UCU Business department requesting for permission on behalf of the student to enter the organization of study.

3.7 RELIABILITY AND VALIDITY OF DATA

The researcher would check the reliability and validity of data through coding, use of line and bar graphs, pie charts.

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND PRESENTATION OF DATA FINDINGS

4.0. INTRODUCTION

This chapter presents the data findings that were collected from the field of research basing on the three objectives.

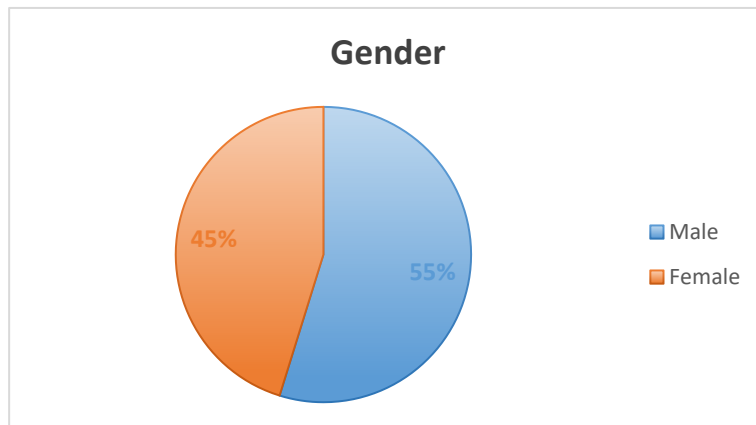
Importance of route optimization, Challenges of route optimization, Relationship between route optimization and service delivery

4.1. FINDINGS ON THE DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

Data was collected from 31 respondents, comprising stakeholders such as customers, distributors, managers etc. and suppliers of Jumia Uganda through the questionnaire. The main aim of collecting demographic data about the characteristics of respondents was to generate appropriate opinions about the research findings and these are the various demographic characteristics of the respondents below:

4.1.1. Gender Distribution of the respondents

Figure 1: Showing the gender distribution of the respondents

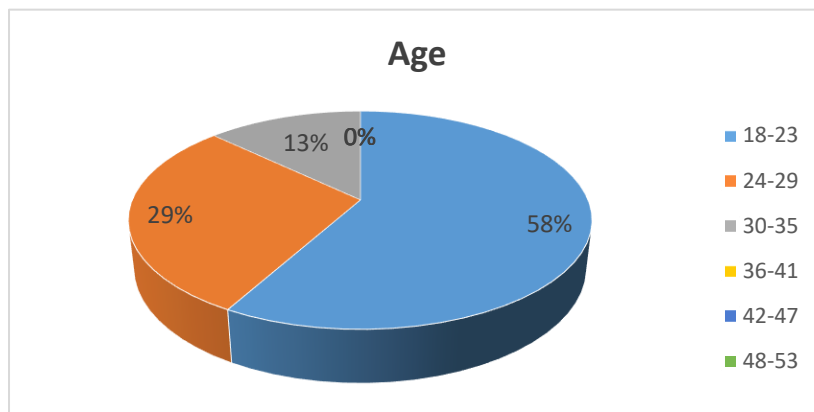


As evidenced from the figure above, gender was a crucial aspect when collecting demographic data because it provides the researcher with an understanding about how different individuals respective of gender perceive various aspects in service delivery. Whereas, the findings on gender distribution of the respondents show that the majority were male with a total of 17 making a percentage of 55% and females totaling to 14 at a percentage rate of 45%. Men being the majority indicates that the male gender is the

most dominant compared to their female counterparts. This shows that males play a variety of roles in the various routing and scheduling processes of Jumia as far as service delivery is concerned.

4.1.2. Age Distribution of the Respondents

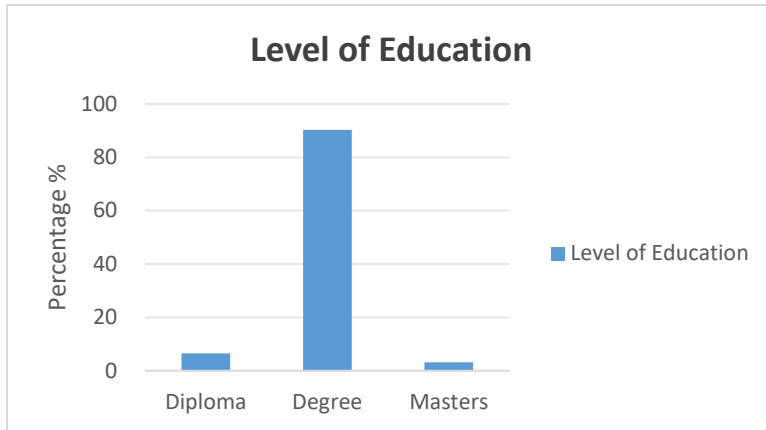
Figure 2: Showing the age distributions of the respondents



The various age distributions of the respondents are displayed in figure 2 above and most cases, age is considered in an organization or most organizations because it goes hand in hand with experience and also how various individuals respective of age are allocated to various tasks. Jumia mainly operates with different individuals having the age of 18-23 years being the majority with 18 respondents at a percentage rate of 58.1%, followed by those from 24-29 years at a rate of 29% with 9 respondents, 30-35 years reaching a total of 4 respondents with a percentage of 12.9%, meaning that individuals aged 18-29 are considered to be well experienced and solve various tasks assigned to them respectively such as delivery, software development, customer care services, etc. at Jumia.

4.1.3. Level of Education

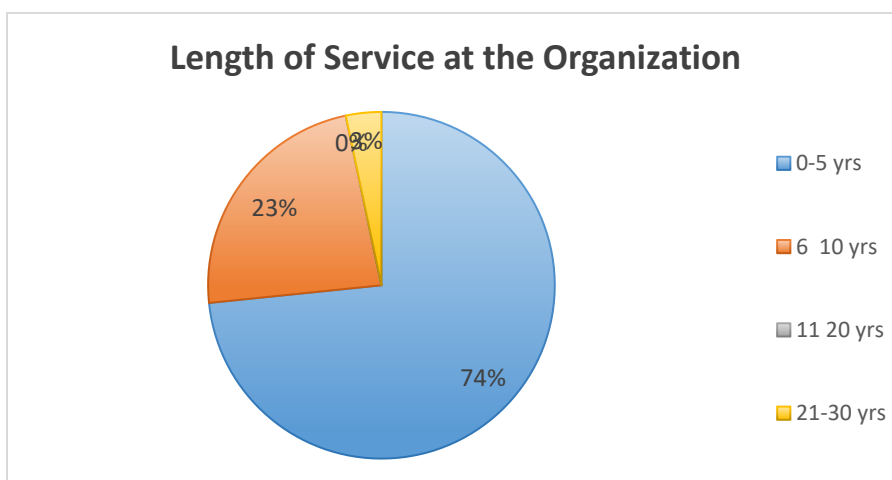
Figure 3: Showing the level of education of the respondents



According to the bar graph above as figure 3, the respondents' level of education was considered when conducting the research because it gives details about the different qualification levels among the individuals involved in the service delivery activities of Jumia, mainly tasks and roles are assigned to individuals according to their levels of education and certifications such as managerial and leadership roles, However the findings on the education levels of respondents in Jumia gives a diverse background in education levels of various respondents. For example, the largest group holding a bachelor's degree with a total of 28 respondents with a percentage rate of 90.3%, 2 with a diploma at a of 6.5% and lastly 1 with a master's at a rate of 3.2%. This therefore suggests that the workforce of Jumia predominately comprises of individuals holding degrees and diplomas mainly suited to the different tasks and responsibilities in Jumia.

4.1.4. Length of Service at the Organization

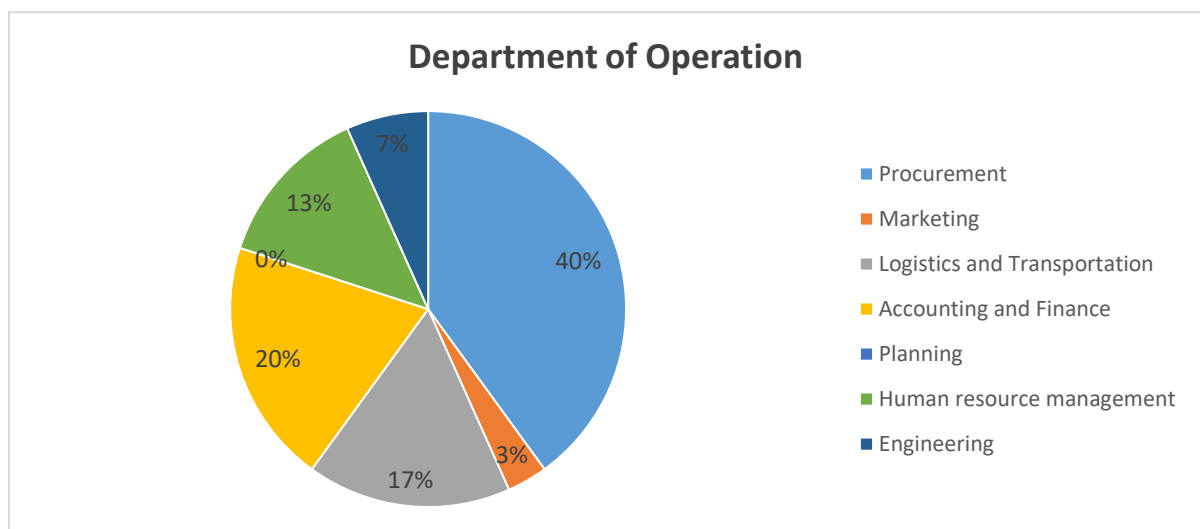
Figure 4: Showing the length of service of Jumia's respondents



The information reflected on a statistical diagram above as figure 4 gives details on how long various individuals have operated in their current fields of work. The findings on different respondents at Jumia were as follows; 0-5 years being the majority totaling up to 22 respondents at a percentage rate of 73.3%, 6-10 years with 7 respondents at a rate of 23.3% and lastly 21-30 years with 1 respondent at a rate of 3.3%. whereas 11-20 years had no respondent. This reflects that a majority of Jumia’s workforce operate or have operated not more than five years meaning that Jumia keeps on recruiting a young and new labor force which either occupies vacant placements or replaces the old labor force.

4.1.5. Department of Operation

Figure 5: showing the Departments of Operation of the respondents



The rates reflected on a chart above as figure 5, covers around the different departments involved in the various operation of Jumia such as the procurement, marketing, logistics and transportation, accounting and finance, etc. that involve various activities and tasks allocated in each. In regards to the findings on the departments of operation, the Procurement department had the highest respondents totaling up to 12 respondents with a percentage rate of 40%, Accounting and Finance having a total of 6 respondents with a rate of 20%, Logistics and Transportation with a total of 5 respondents at a rate of 16.7%, Human Resource Management with a total of 4 respondents at a rate of 13.3%, Engineering with a total of 2 respondents at a rate of 6.7%, lastly the Marketing department with 1 respondent at a rate of 3.3%. whereas the Planning department had no respondent.

4.2. THE IMPORTANCE OF ROUTE OPTIMIZATION ON SERVICE DELIVERY IN JUMIA

The first objective of the study was to assess the importance of route optimization and several statements about the importance of route optimization were presented to the respondents and each were asked to specify their levels of agreement and disagreement. Their responses are displayed in the statistics table below as table 1

Table 1: Showing the importance of Route Optimization on service delivery in Jumia

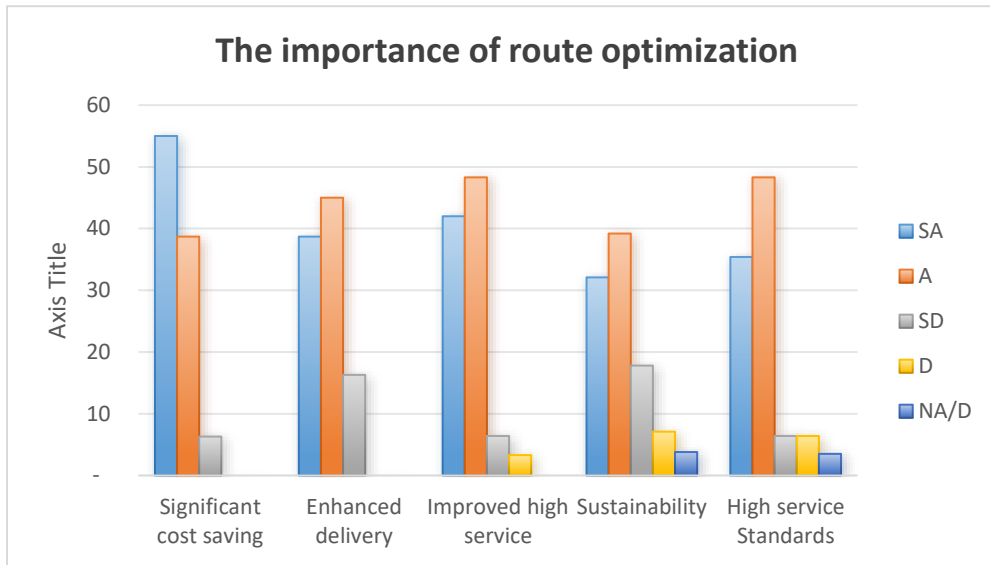
SA- Strongly Agree, A-Agree, SD- Strongly Disagree, D- Disagree, NA/D- Neither Agree nor Disagree

S/N	IMPORTANCES OF ROUTE OPTIMIZATION	SA		A		SD		D		NA/D	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
1	Route optimization can lead to significant cost saving by minimizing the distance covered and fuel consumed	17	55	12	38.7	2	6.3	0	0	0	0
2	Enhanced delivery reliability and customer satisfaction	12	38.7	14	45	5	16.3	0	0	0	0
3	Improved high service and goods delivery which directly impacts on customer satisfaction	13	42	15	48.3	2	6.4	1	3.3	0	0
4	Sustainability which reduces on carbon prints and emission levels through short distances covered	9	32.1	11	39.2	5	17.8	2	7.1	1	3.8
5	It allows room for agile and maintains high service	11	35.4	15	48.3	2	6.4	2	6.4	1	3.5

standards even in unpredictable conditions such as last mile deliveries												
---	--	--	--	--	--	--	--	--	--	--	--	--

Source: Primary data

A Bar graph showing a representation of the above statistical data



According to the findings, majority of the respondents both 55% and 38.7% strongly agreed and agreed that Route optimization can lead to significant cost saving by minimizing the distance covered and fuel consumed, where they believe that optimizing delivery routes can lead to significant cost savings by minimizing the distance covered and fuel consumed. Routing and scheduling in the comprehensive textbook “Designing and Managing the Supply Chain”, has various aspects such as cost efficiency and this is crucial for reducing transportation costs by finding the most efficient routes, companies can minimize fuel consumption, labor costs and vehicle wear and tear, Service levels that ensures timely deliveries which is essential for maintaining high service levels. The other respondents disagreed whereby 6.3% strongly disagreed with no reason backing their disagreement. This means that those that disagreed either lack knowledge and understanding or awareness about the importance of route optimization on service delivery.

Also, in response to enhanced delivery reliability and customer satisfaction as an importance of route optimization, both 38.7% and 45% strongly agreed and agreed, the

minority 16.3% strongly disagreed which means they were in disagreement with enhanced delivery reliability and customer satisfaction as an importance of route optimization. Their disagreements were further backed by optimized routes for faster delivery could result or encourage unsafe driving practices and also increase carbon emissions due to frequent deliveries.

When also asked about improved high service and goods delivery which directly impacts on customer satisfaction, both 42% and 48.3% strongly agreed and agreed that improved routing and scheduling enables more reliable and time deliveries which enhance customer satisfaction and they still feel cared for. Most customers expect prompt deliveries and if a company meets these expectations, that can lead to higher customer loyalty. Effective routing and scheduling lead to enhanced customer satisfaction by ensuring timely and reliable deliveries. Whereas both 6.4% and 3.3% strongly disagreed and disagreed suggesting that there could be complexity of implementation especially in dynamic environments which are influenced with fluctuating demands, delivery windows and traffic conditions.

In response to the statement that sustainability which reduces on carbon prints and emission levels through short distances covered plays a crucial role in sustainability by reducing the distances traveled and time spent on the road, which in turn lowers carbon emissions. Both 32% and 39.2 % strongly agreed and agreed to the statement and also both 17.8% and 7.1% strongly disagreed and disagreed but their disagreements were neither backed up with any reasons whereas 3.8% neither agreed nor disagreed which means that the respondent has no understanding about sustainability which reduces on carbon prints.

It allows room for agile and maintains high service standards even in un predictable conditions such as last mile deliveries. This statement was responded to by the various respondents having both 35.4% and 48.3% strongly agreed and agreed to the point that in dynamic supply chain environments, route optimization enables companies to be more flexible and responsive to fluctuating demands and unforeseen events. However, both 6.4% and 6.4% strongly disagreed and disagreed.

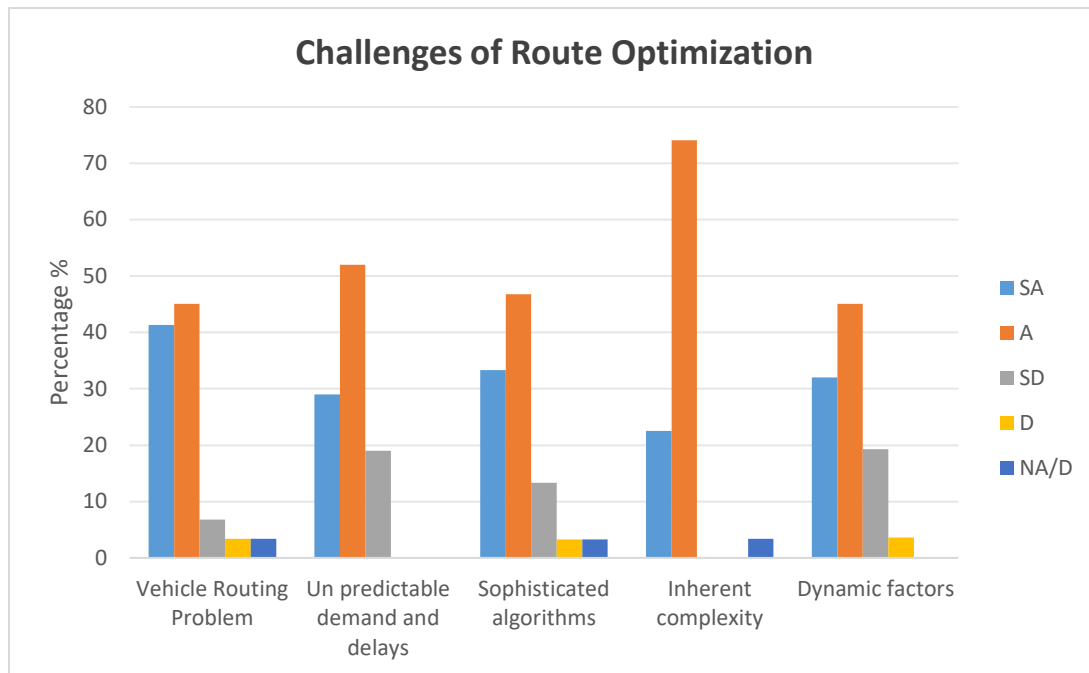
4.3. CHALLENGES OF ROUTE OPTIMIZATION

Table 2: Showing the Challenges of Route Optimization

S/N	CHALLENGES OF ROUTE OPTIMIZATION	SA		A		SD		D		NA/D	
		f	%	f	%	f	%	f	%	f	%
1	Vehicle Routing Problem	12	41.3	13	45.1	2	6.8	1	3.4	1	3.4
2	Un predictable customer demand, transport delays and supplier reliability	8	25.8	17	54.8	6	19.4	0	0	0	0
3	Route optimization require use of sophisticated algorithms and real-time data integration which require use of advanced technologies	10	33.3	13	43.3	4	13.3	2	6.8	1	3.3
4	Inherent complexity of the route optimization problem where by the number of destinations increases, number of possible routes grows exponentially making it impossible to solve the challenge.	7	22.5	23	74.1	0	0	0	0	1	3.4
5	Dynamic factors such as traffic congestion, weather changes, and last-minute customer requests.	11	35.5	14	45.2	5	16.1	1	3.2	0	0

Source: *Primary data*

A bar graph showing the statistical data above



The table above reveals that both 41.3% and 45.1% strongly agreed and agreed about the vehicle routing problem and that is to say that the (VRP) Vehicle Routing Problem, and its variants are computationally intensive, complex and difficult to solve optimally within a reasonable period of time, especially for large scale circumstances. In addition to that, both 6.8% and 3.4% strongly disagreed and disagreed to vehicle routing problem without a reason as to why they don't agree to such a challenge.

A challenge of un predictable customer demand, transport delays and supplier reliability was also reacted to by the respondents where both 25.8% and 54.8% strongly agreed and agreed meaning that those respondents were in support of un predictable customer demand, transport delays and supplier reliability as a challenge where they go ahead to believe and consider more other challenges such as constraints like vehicle capacity limitations, driver working hours regulations, specific customer requirements such as delivery time and windows, etc. However, 19.4% strongly disagreed insinuating that either the respondents lack knowledge about such a challenge giving them room to disagree with the researchers.

Route optimization requires use of sophisticated algorithms and real-time data integration which require use of advanced technologies. This challenge also attracted various responses from the respondents where the majority of them both 33.3% and 43.3% strongly agreed and agreed, on top of that others both 13.3% and 6.8% strongly disagreed and disagreed. Others that neither agreed nor disagreed were unsure about

route optimization requiring the use of sophisticated algorithms and advanced technology as a challenge in service delivery at Jumia.

Furthermore, Inherent complexity of the route optimization problem where by the number of destinations increases, number of possible routes grows exponentially making it impossible to solve the challenge. This was also considered a challenge in Jumia's service delivery activities as indicated in the table above with statistics figures having both 22.5% and 74.1% strongly agreed and agreed that the inherent complexity of the route optimization problem, often classified as NP-hard which means the number of destinations increases, the number of possible routes grows exponentially making it computationally infeasible to solve the problem / challenge within a reasonable time for large instances. There were none strongly disagreeing and disagreeing.

Lastly, both 35.5% and 45.2% strongly agreed and agreed to the challenge that dynamic factors such as traffic congestion, weather changes, and last-minute customer requests are a challenge in Jumia's service delivery operations which provide a detailed explanation of dynamic factors that seem to be a challenge in routing and scheduling for example traffic congestion, weather changes and last-minute customer requests which require real-time data analysis and adjustment to routing plans. They explain traffic congestion as a challenge that affects transportation efficiency which results to delays in delivery due to congested roads thus leading to last deliveries. Both 16.1% and 3.2% strongly disagreed and disagreed that last mile delivery is not a challenge because it should be put in consideration because customer preferences and changes in demand should be considered when conducting service delivery activities.

4.4. THE RELATIONSHIP BETWEEN ROUTE SCHEDULING AND SERVICE DELIVERY.

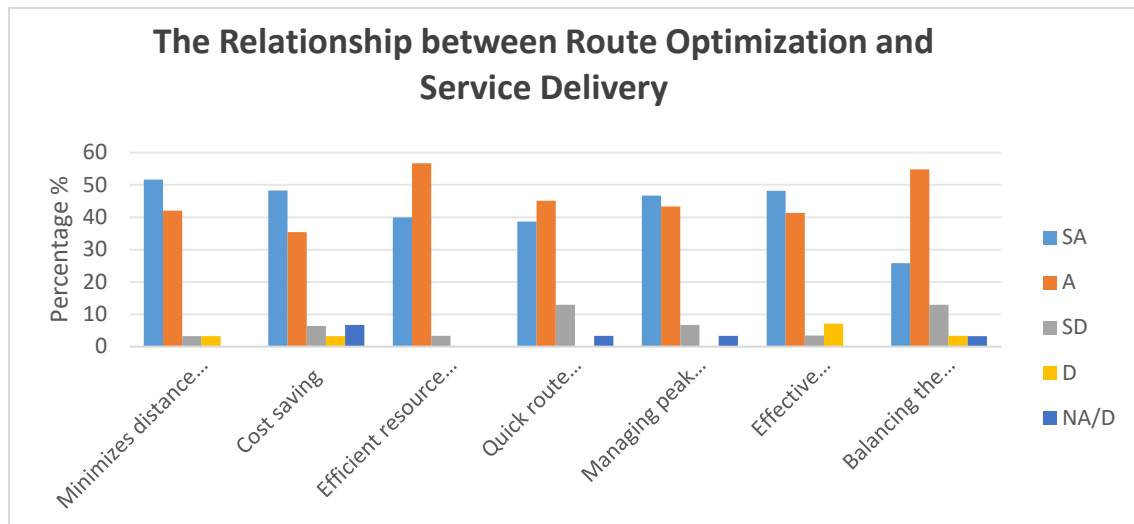
Table 2: Showing the relationship between route scheduling and service delivery

S/N	RELATIONSHIP BETWEEN ROUTE OPTIMIZATION AND SERVICE DELIVERY	SA		A		SD		D		NA/D	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
1	Route scheduling minimizes the distance traveled and reduces the number of vehicles on the road which leads to faster and efficient delivery times and customer satisfaction.	17	54.8	12	38.8	1	3.2	1	3.2	0	0
2	Route scheduling is cost saving due to low fuel consumption, vehicle wear and tear which allows drivers to complete more deliveries in a given period of time.	14	45.2	12	38.8	2	6.4	1	3.2	2	6.4
3	There is efficient resource allocation in route optimization thus ensuring timely and reliable service delivery	11	36.7	18	60	1	3.3	0	0	0	0
4	Dynamic route optimization capabilities allow service providers to quickly reschedule routes to accommodate for customers last-minute	11	35.4	15	48.4	4	12.9	0	0	1	3.3

	urgent needs. Which improves on customer loyalty and satisfaction										
5	Responsive route scheduling helps to manage peak demand periods and unexpected events ensuring timely service delivery even when demand is high	14	46.7	13	43.3	2	6.7	0	0	1	3.3
6	Effective communication between dispatchers, drivers and customers ensures smooth route scheduling and service delivery	14	48.2	12	41.3	1	3.4	2	7.1	0	0
7	Balancing the number of vehicles, personnel and equipment to match service demand which optimizes resource usage and maximizes service delivery	9	29.0	16	51.6	4	13	1	3.2	1	3.2

Source: *Primary data*

A bar graph showing the statistical data in the table above



From the responses generated from the different respondents, the relationship between route optimization and service delivery in Jumia had the following statistical data. Both 54.8% and 38.8% strongly agreed and agreed a majority of the respondents strongly believe that route scheduling minimizes the distance traveled and reduces the number of vehicles on the road, leading to faster and more efficient delivery times and customer satisfaction. A significant portion agreed with the statement meaning that over half of the respondents consider the importance of route optimization and scheduling in improving delivery times and customer satisfaction. However, a smaller group reaching 3.2% and 3.2% strongly disagreed and disagreed believing that other factors such as traffic or service capacity may influence delivery times which possibly indicates a level of skepticism about the effectiveness of route scheduling in their specific context. There were none agreeing nor disagreeing.

Furthermore, the point that route scheduling is cost saving due to low fuel consumption, vehicle wear and tear which allows drivers to complete more deliveries in a given period of time, also received a variety of responses where both 45.2% and 38.8% strongly agreed and agreed meaning that nearly half of the respondent percentage strongly believes in the cost saving benefits of route optimization. Those that agreed means that a notable percentage of respondents agreed that route scheduling reduces costs by optimizing fuel consumption and minimizing wear and tear thus increasing delivery capacity. However, 6.4% and 3.2% of the respondents strongly disagreed and disagreed which likely kept them questioning the reliability of route scheduling in their specific scenario, a small group disagreed possibly due to skepticism about the extent of cost savings achieved through route optimization and scheduling also leaving a

certain group of respondents neither agreeing nor disagreeing which left me suggesting that they might perceive the cost savings as a marginal dependent.

There is efficient resource allocation in route optimization thus ensuring timely and reliable service delivery. As a relationship between route optimization and service delivery, this factors also had a bunch of responses where 36.7% and 60% strongly agreed and agreed to the point highlighting the value they place on route optimization for efficient resource utilization and service reliability, those that agreed was an indication that many individuals in Jumia believe that route optimization is critical for timely deliveries by utilizing resources effectively. Whereas, a minority of 3.3% strongly disagreed with the point possibly due to bad experiences and challenges that come hand in hand with route optimization, there was no disagreement and some respondents neither agreed nor disagreed due to lack of knowledge and clear evidence of the benefits of route optimization.

Dynamic route optimization capabilities allow service providers to quickly reschedule routes to accommodate for customers last-minute urgent needs. Which improves on customer loyalty and satisfaction. 35.4% and 48.4% strongly agreed and agreed reflecting a lot of confidence in dynamic route optimization as a tool capable of enhancing customer satisfaction by addressing their urgent needs. Also showing a strong consensus that dynamic route optimization capabilities can enhance service flexibility and customer loyalty in Jumia Uganda. 12.9% respondents strongly disagreed which displays the fact that a notable minority strongly reject dynamic route optimization capabilities due to negative experiences or doubts about the practical benefits of dynamic route optimization. Though others agreed and disagreed, a certain group (3.3%) of the respondents neither agreed nor disagreed due to lack of personal experience with dynamic route optimization.

Responsive route scheduling helps to manage peak demand periods and unexpected events ensuring timely service delivery even when demand is high. This relationship also encountered a couple of responses where 46.7% respondents strongly agreed to the relationship evidencing that they value the role responsive route scheduling plays in handling peak periods and unpredictable challenges, 43.3% nearly half of the group agreed that responsive route scheduling can be crucial for maintaining timely service delivery during high demand peaks. However, 6.7% also strongly disagreed possibly due to certain circumstances that concern about the effectiveness of responsive scheduling that may raise from certain conditions. 3.3% neither agreed nor disagreed.

A significant percentage of 48.2% and 41.3% also strongly agreed and agreed recognizing the importance of clear communication for effective route scheduling and service delivery, emphasizing the critical role of communication in coordinating route schedules and delivering service efficiently. In addition to the responses, a few individuals touching both 3.4% and 7.1% strongly disagreed and disagreed because of a possibility of poor communication affecting service delivery, and also due to a problem of communication breakdowns in the process. There were none that neither agreed nor disagreed.

Balancing the number of vehicles, personnel and equipment to match service demand which optimizes resource usage and maximizes service delivery. Both 29% and 51.6% strongly agreed and agreed to this emphasizing the importance of balancing resources for service delivery optimization, and the majority agreed to this because source balancing is key to optimizing service delivery and meeting customer demand in Jumia. 13% and 3.2% also strongly disagreed and disagreed with a possibility they have experienced various issues with resource management in regards to service delivery, and also due to a possibility of questioning the effectiveness of resource balancing in practice.

CHAPTER FIVE

DISCUSSIONS, SUMMARY, CONCLUSION AND RECOMMENDATIONS OF THE FINDINGS.

5.0. INTRODUCTION

This chapter presents a summary of the data findings presented in chapter four which also relates the data generated from various scholars. This chapter also gives a detailed conclusion and recommendations based on the data findings throughout the report and also suggests areas of further research.

5.1. DISCUSSION OF THE FINDINGS

5.1.1. THE IMPORTANCE OF ROUTE OPTIMIZATION IN JUMIA UGANDA

The findings from the importance of route optimization in Jumia indicate that 93.7% of the respondents both strongly agreed and agreed that route optimization ensures that there is reduction of transportation costs such as fuel costs, vehicle maintenance costs, and decrease labor expenses. Sunil Chopra and Peter (2012) emphasize this aspect by explaining that determining the most efficient routes, companies dealing in service delivery can lower fuel consumption, reduce vehicle maintenance costs.

Also 83.7% respondents strongly agreed and agreed that routing and scheduling is critical for enhancing delivery reliability and customer satisfaction and this can be scored by ensuring that goods are delivered to customers on time and through the most efficient routes. And the minority 16.3% strongly disagreed which means they were in disagreement with Sunil Chopra and Peter Meindl's (2012) findings about the importance of route optimization. Improved customer service and care, improved routing and scheduling enables more reliable and time deliveries which enhance customer satisfaction and they still feel cared for. Most customers expect prompt deliveries and if a company meets these expectations, that can lead to higher customer loyalty. Effective routing and scheduling lead to enhanced customer satisfaction by ensuring timely and reliable deliveries. Customers expect prompt service, and meeting these expectations can significantly boost customer loyalty. Which is also in line with the study on technician routing and scheduling, improving these aspects leads to higher field service quality, which directly impacts customer satisfaction positively (Haugen & Hill, 1999).

The other findings also show that 71.3% respondents and 83.7% either strongly agreed or agreed that route optimization leads to sustainability by minimizing the distances travelled or covered and the time spent by the vehicles on the roads which reduces carbon prints and emission levels and also allows room for agile and maintains high service standards even in un predictable conditions such as last mile deliveries which are also in line with the studies on green vehicle routing models highlight the importance of optimization in achieving lower emissions and a smaller carbon footprint by Li, Lim, & Tseng, (2019); Fathollahi-Fard et al., (2018).

5.1.2. CHALLENGES OF ROUTE OPTIMIZATION

The (VRP) Vehicle Routing Problem, and its variants is one of the challenges of route optimization and a total rate of 86.4% respondents strongly agreeing and agreeing in Jumia because the Vehicle Routing Problem is computationally intensive, complex and difficult to solve optimally within a reasonable period of time, especially for large scale circumstances and such uncertainties make or hinder the planning process of routes in advance for example a route that is optimal can end up being sub-optimal due to a challenge brought up by traffic congestion which usually happens unexpectedly (Simchi-Levi et al., 2008). Martin Christopher (2016) in Logistics and Supply Chain Management, also highlights unpredictable customer demand, transport delays and supplier reliability as a challenge of route optimization where 80.6% respondents either strongly agreed and agreed.

Additionally, route optimization requires use of sophisticated algorithms and real-time data integration which require use of advanced technologies like GPS trackers, drones, etc. for security purposes and delivery. This was either strongly agreed and agreed upon by 76.6% of respondents in Jumia that were in support of Martin Christopher's findings in Logistics and Supply Chain Management (2016) about the various challenging factors when carrying out route optimization. 20.1% either strongly disagreed or disagreed. Inherent complexity of the route optimization problem where by the number of destinations increases, number of possible routes grows exponentially making it impossible to solve the challenge. Basing on Herbert Kopfer et al., 2012, one of the primary challenges discussed is the inherent complexity of the route optimization problem, often classified as NP-hard which means the number of destinations increases, the number of possible routes grows exponentially making it computationally infeasible to solve the problem / challenge within a reasonable time for large instances. 96.6% of

the respondents were either in strong agreement or agreed to the finding by Kopfer and Bierwirth.

Lastly, a challenge of dynamic factors such as traffic congestion, weather changes, and last-minute customer requests in the book “Supply Chain Management: Strategy Planning and Operation, (2012)” by Sunil Chopra and Peter Meindl provide a detailed explanation of dynamic factors that seem to be a challenge in routing and scheduling for example traffic congestion, weather changes and last-minute customer requests which require real-time data analysis and adjustment to routing plans. 80.7% respondents believe that traffic congestion as a challenge affects transportation efficiency which results to delays in delivery due to congested roads thus leading to last deliveries, this impacts customer and the overall performance of the supply chain performance.

5.1.3. THE RELATIONSHIP BETWEEN ROUTE SCHEDULING AND SERVICE DELIVERY.

The study highlights that 93.6% a total of that traffic the respondents that either strongly agreed or agreed believe that route scheduling minimizes the distance traveled and reduces the number of vehicles on the road, leading to faster and more efficient delivery times and customer satisfaction which is in correspondence with Taha (2017) who suggests that route scheduling is a critical component of many service delivery systems, including transportation networks, logistics, and supply chain management. Optimal route scheduling can significantly impact the efficiency and effectiveness of service delivery, as it affects the time and cost of completing tasks. Routing scheduling is also cost saving due to low fuel consumption, vehicle wear and tear which allows drivers to complete more deliveries in a given period of time. This is in support by 84% respondents strongly agreeing and agreeing with Bodin and Golden (1981) where they emphasized that the efficient scheduling of routes is a crucial component of effective service delivery, as it allows organizations to optimize the allocation of resources, minimize travel time and distance and ensures timely and reliable service delivery to the respective customers.

96.7% respondents also strongly agreed or agreed that if there is efficient resource allocation in route optimization, there is timely and reliable service delivery also being in agreement with (Collins et al., 2023). Dynamic route optimization capabilities allow service providers to quickly reschedule routes to accommodate for customers last-

minute urgent needs. Which improves on customer loyalty and satisfaction. This was supported by 83.8% respondents in Jumia also being in agreement with Pillac et al., 2013, whereby they state that incorporating dynamic routing capabilities, service providers can reschedule routes for the vehicles and personnel to accommodate for unexpected customer requirements thus improving customer loyalty and satisfaction. Responsive route scheduling can also help service providers to effectively manage peak demand periods and unexpected events thus ensuring timely service delivery.

Coordination and communication as a route scheduling and service delivery aspect ensures that there is effective communication between dispatchers, drivers and customers which is an essential for a successful route scheduling and service delivery (Ghiani et al., 2003). 89.5% of the respondents either strongly agreed and agreed making them believe that effective communication between dispatchers, drivers and customers ensures smooth route scheduling and service delivery. Though such a percentage was in agreement, 10.5% a minimal group of respondents either strongly disagreed or disagreed because of a possibility of poor communication affecting service delivery and also due to a problem of communication breakdowns in the process.

5.2. SUMMARY OF THE FINDINGS

The findings show that route optimization and scheduling consist of various importances, challenges and relationships that impact on service delivery in Jumia's operations. This is evidenced in the findings where a majority (93.7%) of the respondents recognized that route optimization can lead to significant cost saving by minimizing the distance covered and fuel consumed, enhanced delivery reliability and customer satisfaction reaching 83.7% respondents putting it in agreement with the scholars. Improved high service and goods delivery which impacts on customer's satisfaction and loyalty, route optimization also focuses on sustainability which ensures there are low carbon emissions and this is ensured through short distance travels. Addition to that, majority of the respondents at Jumia also believe that it also allows room for agile and maintains high service standards even in un predictable conditions. Whereas, though there are various importances Jumia Uganda benefits from route optimization and scheduling, there are also various challenges involved such as the Vehicle Routing Problem (VRP) with a percentage rate of 86.4% either strongly agreeing or agreeing and also 10.2% also either disagreeing and strongly disagreeing

due to various reasons and circumstances whereby some lack knowledge and are unsure about routing and scheduling and how it impacts on service delivery in Jumia.

Inherent complexity of the route optimization problem where by the number of destinations increases, number of possible routes grows exponentially making it impossible to solve the challenge attracted a major percentage of 96.6% of responses all either strongly agreeing or agreeing to inherent complexity as a problem in routing and scheduling on service delivery at Jumia.

Lastly, route optimization has various relationships with service delivery. For example, there are minimized distances covered and reduced numbers of vehicles on the road that leads to faster and efficient deliveries ensuring efficient delivery times and customer satisfaction 93.6% of the respondents were in agreement with it. Route optimization is also cost saving because of low fuel consumption, vehicle wear and tear is also limited thus allowing drivers to complete most of their deliveries in a given period of time allocated to them thus contributing to Jumia's customer satisfaction and loyalty. Though 16% of the respondents either disagreed or strongly disagreed, that is due to lack of knowledge and most of them are not sure about the relationship between route optimization and service delivery and that's the main reason as to why they really don't avail responses backing up their disagreements.

5.3. CONCLUSION

Therefore, the study mainly highlights how route optimization and scheduling have impacted on service delivery in Jumia, and this particularly flows in the realms of procurement and logistics. Route optimization not only enhances delivery and efficiency but also helps in cost reduction, customer satisfaction through timely deliveries and reliable services provided to the customers. Through minimizing distances traveled, there is a low carbon footprint left behind in the delivery processes. It also helps in enabling dynamic adjustments to meet last minute customer demands, these strategies are so integral in maintaining an edge in e-procurement. Route optimization is also essential for scheduling resources which maximizes resource usage with an aim of achieving optimal service deliveries at Jumia.

5.4. RECOMMENDATIONS

- Implementation of Environmental sustainability practices through exploring new ways of carrying out eco-friendly routing options for example through the introduction and use of (EVs) Electric Vehicles for deliveries and reducing unnecessary mileages

- Adopting to flexible logistics solutions that are more adoptable to the increasing order peaks and diverse customer demands in order to maintain an efficient and effective service delivery enhancing customer satisfaction and building customer loyalty.
- Monitoring and further analysis of the Key Performance Metrics (KPIs) that are related to routing and scheduling like delivery times, customer satisfaction, fuel consumption, resource allocations, etc. which helps in identifying various areas of improvement to ensure that the routing strategies are in alignment with the company's service delivery objectives and goals.
- Jumia should invest and implement the use of advanced route optimization software that focus on the use of real-time data to dynamically adjust different routes based on traffic maps/conditions, delivery windows, customer tastes and preferences in order to enhance and promote efficiency in delivery and reduce on operational costs involved during delivery.

REFERENCES

Bowersox, D. J., Closs, D. J., & Cooper, M. B. (2002). *Supply Chain logistics management*. McGraw-Hill/Irwin.

Christopher, M. (2016). *Logistics and supply chain management* (5th ed.). Pearson

Ellram, L. M., & Carr, A. (1994). Strategic purchasing: A history and review of the literature. *International Journal of Purchasing and Materials Management*, 30(2), 10-18.

Kaminsky, P., Simchi-Levi, D., & Simchi-Levi, E. (2007). *Designing and managing the supply chain: Concepts, strategies, and case studies* (3rd ed.). McGraw-Hill/Irwin

Mentzer, J. T., Flint, D. J., & Hult, G. T. M. (2001). Logistics service quality as a segment-customized process. *Journal of Marketing*, 65(4), 82-104.

<https://doi.org/10.1509/jmkg.65.4.82.18390>

Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2007). *Designing and managing the supply chain: Concepts, strategies, and case studies* (3rd ed.). McGraw-Hill/Irwin

Taniguchi, E., Thompson, R. G., & Yamada, T. (2001). *City logistics: Network modelling and intelligent transport systems*. Pergamon.

Bodin, L., & Golden, B. (1981). Classification in vehicle routing and scheduling. *Networks*, 11(2), 97-108.

<https://doi.org/10.1002/net.3230110205>

Chopra, S., & Meindl, P. (2012). *Supply chain management: Strategy, planning, and operation* (5th ed.). Pearson.

Collins, P., Thompson, J., & Wright, A. (2023). Optimizing logistics systems for service delivery. *Journal of Operations Management*, 51(3), 45-58.

<https://doi.org/10.1016/j.jom.2023.06.004>

Ghiani, G., Laporte, G., & Musmanno, R. (2003). *Introduction to logistics systems planning and control*. Wiley.

Haugen, S., & Hill, D. (1999). Field service scheduling and its impact on customer satisfaction. *Journal of Business Logistics*, 20(1), 85-99.

Pillac, V., Gendreau, M., Guéret, C., & Medaglia, A. L. (2013). A review of dynamic vehicle routing problems. *European Journal of Operational Research*, 225(1), 1-11.

<https://doi.org/10.1016/j.ejor.2012.08.015>

Taha, H. A. (2017). *Operations research: An introduction* (10th ed.). McGraw-Hill Education

Toth, P., & Vigo, D. (2014). *Vehicle routing: Problems, methods, and applications* (2nd ed.). SIAM

APPENDIX

QUESTIONNAIRE

My name is Olinga Daniel, a student of Uganda Christian University registration number is S21B12/010 third year pursuing a Bachelor's Degree in Procurement and Logistics Management. I am conducting research about the impact of routing and scheduling on service delivery in your organization. I promise to operate effectively with your organization and will have a high level of confidentiality that will not permit me to share information with other third bodies or organizations.

INSTRUCTIONS

Tick and fill in your information where necessary.

SECTION A

Bio-data

0. Gender.

Male

Female

0. Age

18-23

24-29

30-35

36-41

42-47

48-53

0. Level of Education

Diploma

Degree

Masters

0. Length of Service at the Organization

0-5 years

6-10 years

11-20 years

21-30 years

0. Department of Operation

- Procurement
- Marketing
- Logistics and transportation
- Accounting and Finance
- Planning
- Human resource management
- Engineering
- Any other specify

INSTRUCTIONS

In this part and parts that follow, you are required to rate your level of agreement with the statements: statements **SA- Strongly Agree, A-Agree, SD- Strongly Disagree, D- Disagree, NA/D- Neither Agree nor Disagree**

SECTION B: IMPORTANCE OF ROUTE OPTIMIZATION

S/N	IMPORTANCES OF ROUTE OPTIMIZATION	SA	A	SD	D	NA/D
1	Route optimization can lead to significant cost saving by minimizing the distance covered and fuel consumed					
2	Enhanced delivery reliability and customer satisfaction					
3	Improved high service and goods delivery which directly impacts on customer satisfaction					
4	Sustainability which reduces on carbon prints and emission levels through short distances covered					
5	It allows room for agile and maintains high service standards even in un predictable conditions such as last mile deliveries					

In case there are more importance of route optimization and are not mentioned above which are applicable to the organization, please specify

SECTION C: CHALLENGES OF ROUTE OPTIMIZATION

S/N	CHALLENGES OF ROUTE OPTIMIZATION	SA	A	SD	D	NA/D
1	Vehicle Routing Problem					
2	Un predictable customer demand, transport delays and supplier reliability					
3	Route optimization require use of sophisticated algorithms and real-time data integration which require use of advanced technologies					
4	Inherent complexity of the route optimization problem where by the number of destinations increases, number of possible routes grows exponentially making it impossible to solve the challenge.					
5	Dynamic factors such as traffic congestion, weather changes, and last-minute customer requests.					

In case there are other challenges the organization is facing during route optimization other than those mentioned in the table above, please specify.

SECTION D: RELATIONSHIP BETWEEN ROUTE OPTIMIZATION AND SERVICE DELIVERY

S/N	RELATIONSHIP BETWEEN ROUTE OPTIMIZATION AND SERVICE DELIVERY					
1	Route scheduling minimizes the distance traveled and reduces the number of vehicles on the road which leads to faster and efficient delivery times and customer satisfaction.					
2	Route scheduling is cost saving due to low fuel consumption, vehicle wear and tear which allows drivers to complete more deliveries in a given period of time.					
3	There is efficient resource allocation in route optimization thus ensuring timely and reliable service delivery					
4	Dynamic route optimization capabilities allow service providers to quickly reschedule routes to accommodate for customers last-minute urgent needs. Which improves on customer loyalty and satisfaction					
5	Responsive route scheduling helps to manage peak demand periods and unexpected events ensuring timely service delivery even when demand is high					
6	Effective communication between dispatchers, drivers and customers ensures smooth route scheduling and service delivery					
7	Balancing the number of vehicles, personnel and equipment to match service demand which optimizes resource usage and maximizes service delivery					

Thank You for Your Compliance

LETTER OF ACCEPTANCE



**UGANDA CHRISTIAN
UNIVERSITY**

A Centre of Excellence in the Heart of Africa

SCHOOL OF BUSINESS

19th Aug, 2024

TO WHOM IT MAY CONCERN

Name: DANIEL OLINGA

Reg. No S21B12/010

A bachelor's student who is seeking permission from your office to collect data for her dissertation titled

THE IMPACT OF ROUTING AND SCHEDULING ON SERVICE DELIVERY IN JUMIA.

We shall be grateful if you could render assistance to him in collecting the necessary data for his dissertation

The Uganda Christian University School of Business thanks you in advance

A handwritten signature in blue ink, appearing to read 'Mukisa Simon Peter'.

Mukisa Simon Peter
Research coordinator

