# *THE EFFECT OF TRANSPORTATION MANAGEMENT ON RESPONSIVENESS OF PHARMACEUTICALS SUPPLY CHAIN, A CASE OF ETHIOPIAN PHARMACEUTICALS SUPPLY AGENCY (EPSA), SOUTH WESTERN CLUSTER, ETHIOPIA*

*A RESEARCH PAPERSUBMITTED TO JIMMA UNIVERSITY, COLLEGE OF BUSINESS AND ECONOMICS DEPARTMENT OF MANAGEMENT (M.A) IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTERS DEGREE IN LOGISTICS AND TRANSPORTATION MANAGEMENT.*


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# *THE EFFECT OF TRANSPORTATION MANAGEMENT ON RESPONSIVENESS OF PHARMACEUTICALS SUPPLY CHAIN, A CASE OF ETHIOPIAN PHARMACEUTICALS SUPPLY AGENCY (EPSA), SOUTH WESTERN CLUSTER, ETHIOPIA*

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## Declaration

I hereby declare that, this thesis entitled ñThe Effect of Transportation Management on the responsiveness Pharmaceuticals Supply Chain: A case of Ethiopian Pharmaceutical Supply Agency of South Western Cluster (Jimma, Nekemte, and Gambella Hubs), has been carried out by me under the guidance and supervision of Dr. MekonnenBogale and Mrs. GadiseAmensis.

The thesis is original and has not been submitted for the award of any degree or diploma to any university or institutions.

| Researcherôs Name | Date | Signature |
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## Certificate

This is to certify that the thesis entitled ñThe Effect of Transportation Management on the responsiveness of Pharmaceuticals Supply Chain: A case of Ethiopian Pharmaceutical Supply Agency of South Western Cluster (Jimma, Nekemte, and Gambella Hubs)ò submitted to Jimma University, College of Business and Economics for the award of Degree of Master of Logistics and Transport Management (LTM) is a record of genuine research work carried out by Baharu Muze, under our guidance and supervision. Therefore, we hereby declare that no part of this thesis has been submitted to any other university or institution for the award of any degree or diploma.

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***Abstract***

*The main objective of this study was to examine the effect of transport management onthe responsiveness of pharmaceuticals supply chain of EPSA, South western cluster. The study mainly was focused on examining the effect of transport management particularly on vehicles scheduling, route planning, vehicles maintenance, and vehicles tracking on the responsiveness of pharmaceuticals supply chain in the case of Ethiopian Pharmaceuticals supply agency of south western cluster (Jimma, Nekemte and Gambella branches).The design of the study was explanatory research methods.The target population from EPSA south western cluster includes three branches namely; Jimma hub with 64 staff's, Nekemte hub with 57 staff's, and Gambela hub with 34 staff's as. These 3 hubs total staff's i.e. 155 were used as the target population of thisstudy.Therefore* ***112 respondents*** *the sample size was fixed according to theYemane formula. In order to increase the response rate, the researcher had increased the sample size to* ***123****(by adding ten percent of the sample size) persons. Out of the indicated number of respondents 113(91.9%) of them were provide response for this study. Both primary and secondary data collection approaches was used to conduct this study. Inferential statistics techniques, specifically correlation and multiple regression analyses was applied to tests whether the combined effect, of all the variables in the model, is different from zero. This study was also identified fleet and distribution management expertise of the agency significantly and positively interacts with transportation management of the agency in order to improve the responsiveness of pharmaceuticals supply chain EPSA South western cluster. However, the agency vehicle repair and maintenance should have to get a concern to be improved for sake of the significance. From the study it could be concluded that the EPSA South western cluster strive to enhance their responsiveness pharmaceuticals supply chain by ensuring maintaining/reduced the lead time, volume of product shipped for delivery, product mix, and order fulfillment. In order to reduce vehicle break down/idle time EPSA should have to establish repair and maintenance center at the cluster level. Currently all branches sent the vehicles for repair and maintenance/servicing at the center level. Thus, if the servicing sector found at the cluster level the vehicles had been a chance of to be repaired and maintained in a short time.*

***Key terms: Transport management, Responsiveness of supply chain, Supply chain performance***

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## Acronyms

**EDI:**Electronic Data Interchange

**EPSA:**Ethiopian Pharmaceuticals Supply Agency

**GPS:** Geographical Presentation Satellite

**ICT:** Information Communication Technology

**PSCM:**Pharmaceuticals Supply Chain Management

**RFDI:** Radio Frequency Data Identification

**SCM:**Supply Chain Management

**TMS:**Transportation Management System

**VRT:** Vehicle Route Tracking

# *CHAPTER ONE*

# *1. INTRODUCTION*

## *1.1. Background of the Study*

Transportation is at the center of logistics as it represents the physical movement of materials between points in a supply chain (Johnson, 2008); (Waters, 2009). The pressure to deliver faster and cheaper has made vehicle utilization an important aspect of fleet management (Johnson, 2008); (Waters, 2009). According to the statements of (Pisarki A. , 1981); (Small, 2006); (Ghasmi, 2014)Transportation is a critical link in the overall supply chain, which has become an importantconcept for organizations in the 21st century.

Svantesson(2009) has expressed that prescription drugs, being high pricemerchandise,demand a securemethodin any respect hubs within the chain, and security measurementsshould be harmonious and strictly checked across the operational lanes with its sub-warehouses and on/off loading places.According to Svantesson(2009), the market demands global solutions andcustomers are requesting the ability to order correct quantities and lower inventory levels. This situation heobserved brings a change to the order profile; with orders becoming smaller and production changing accordingly. Safety stocks, excess capacity and safety lead times all provide a time buffer to be able to react to demand variability (Spearman, 2004).

Transportation has been cited as a burning platform for firms working towards cutting supply chain costs. Fleet management function is not faring well globally with a substantial number of vehicles operating along the distribution networks with multiple mechanical issues which puts the supply chain at risk.

Transport planning requires software support with the use of transportation management systems. Determining the routes could enhance the efficiency of vehicle capacity utilization with increased amount of the volume of products which delivered to the customers at the same time as the delivery times are minimized. Improvements in transportation indicated in advanced planning which gives an emphasis on a factor like infrastructure conditions (Road and traffic condition) for the provision of realistic route. Additionally technological aspects which identified electronic

data process GPS based vehicle tracking had a potential to improve the business environment (Waters, 2009).

Through a supply chain performance achieving the right degree responsiveness needs a great effort on making various decisions within a transportation management. The decisions which involves in this regards includes attaining realistic route planning, practicing logical vehicle scheduling, aligning regular scheduled vehicle repair and maintenance and reliable vehicle tracking system for fast delivery of pharmaceutical products with a lead time. Identifying the effect of transportation to achieve responsiveness and efficiency simultaneously on the supply chain is the goal of the research presented in this paper.

Ethiopian Pharmaceuticals supply agency (EPSA) is the Federal ministry of health Ethiopia agency mandated with the task of providing logistic service particularly Medical Equipment and supplies to more than 3000 health facilities through its branch offices nationally the agency uses more than165 heavy and middle duty and refrigerator vehicles. For effective utilization of these resources the agency should have to hire personnel with a high fleet management expertise and experienced with the skill of transportation management.Therefore, this study will be attempted to identify the effect of transportation management on the pharmaceuticals supply chain performance of EPSA south west cluster, particularly the paper focused on the cycle time/lead time, delivery and volume of pharmaceuticals supply chain.

## *1.2. Statement of the problem*

According to Cecere(2015), we are living in times when supply chain growth is stalled and many companies are stuck in driving supply chain performance. Many local and global supply chains are not performing well and the inefficiency is emanating from the fleet management function whereby the delivery trucks are unreliable, low ICT application by the Third party logistics providers, ineffective vehicle routing and poor customer service. A technical survey by Airmic (2013) on supply chain failures have rated poor transport network as a supply chain risk.63% of the surveyed shippers cite cutting transport costs as their primary challenge and transportation is a burning platform for firms working towards cutting supply chain costs. Low ICT application in fleet management has limited the potential of supply chain to perform to the expected levels.

Coyle (2015) noted that Transportation risks are potentially disruptive events that produce supply chain disorder. Uncontrolled risk can produce negative outcomes ranging from minor delivery delays to major product losses that affect financial performance. Organizations can reduce threats to the continuing efficiency and effectiveness of their transportation operations through a process of risk management. Despite best efforts to reduce risks, most cannot be totally eliminated and disruptions may occur. Business continuity planning focuses on dealing with and recovering quickly from these disruption episodes.

The pressure to deliver faster and cheaper has made vehicle utilization an important aspect of fleet management (Johnson, 2008); (Waters, 2009). Efficient vehicle utilization lowers operating cost through aligning better planning. Transport planning requires software support with the use of transportation management systems. The aim is to indicate routes that will provide the highest overall utilization of vehicle capacity, with as many customers served and the largest amount of goods delivered, at the same time as the delivery times are minimized. Advanced designingconjointly takes into consideration specific factors like road and traffic conditions, so asto supplyadditional realistic route. Technological communication enhancementswithin the business atmosphere have allowed for higherdesigning through the utilization of electronic knowledge interchange (EDI), frequency identification (RFID), satellite navigation, then on (Waters, 2009).There have conjointly been technical enhancementsat intervals vehicle style, so asto fulfill environmental needs.According to Gitahi (2014) there is little literature on the current

Field transport Management (Field FTM) in supply chain operations. Data on vehicles is gathered and stored using unstructured databases like excel spreadsheets and text files (Wassenhove, 2010).

Transportation is at the center of logistics as it represents the physical movement of materialsbetween points in a supply chain. High customer expectations and little tolerance for inadequateperformance create a competitive environment for operating a fleet, which forces fleet managersto achieve high levels of reliability and cost-efficiency.

The medicine supply chain is a complex system with public and private organizations such as private distributors, governmental warehouses and NGOs with several tierssuch as National Level Medical Stores and District Level Medical Stores. Procurementand distributions, which often work as separate functions with a poor, irregular communicationand share of information, hinders a coordinated, coherent and efficient nationalprocurement and distribution plan. Furthermore, due to a lack of efficiency,shortage of vehicles and poor condition of vehicles, many programs built their ownsupply chain systems within the private sector. The system becomes even more complexdue to special supply chain requirements for each drug such as cold chains and short shelf lives, which makes the whole distribution network even more complex(USAID, 2008).

Different studies conducted in Ethiopia at different time regarding fleet/transportation management to measure their practice, efficiency and other performance status.Fekadu (2013) identifies the constraints associated with logistics system in Ethiopia Characterized by Inadequate fleets of vehicles (means of transport) for goods transport, the market possibility of the country is hampered by poor logistics system, Very high traffic accident (the highest in the world) in which contribution of goods transport is significant Congestion in cities and at inlets/outlets. Damage of goods and quality deterioration while in storage, packaging transporting, and post-harvest loss in food items (up to 70%) and Lack of Organization and management tools that are required to promote intermodal system.

Kibatu (2016) identifies how vehicle repair and maintenance, fuel management, vehicle tracking and driver management influence fleet management on PFSA Ethiopia. Amha (2018)Conducted a study on the practice and challenges of implementing GPS and RFID systems are products to the fleet management The study also showed that the tracking technology has eliminated unsanctioned trips and illegal night driving.Meskerm (2018), conducted on the effect of fleet management on operational efficiency and the finding showed that operational efficiency of WHO is weak. Therefore this study seeks to fill the existing time, methodological and variable research gap by determining the effects of route planning, scheduling, vehicle tracking and vehicle repair and maintenance on the responsiveness of pharmaceuticals supply chain of EPSA, South western Cluster. Additionally, this study focuses on identifying the interaction of fleet and distribution management expertise with transport management on supply chain perspectives as a supply chain performance metrics and also addressing vehicle route planning as a factor transportation which not touched in the former studies.

## *1.3. Research Objective*

### 1.3.1 General Objective

The main objective of this study is to examine the effect of transport management on the responsiveness of pharmaceuticals supply chain of EPSA, South western cluster.

### 1.3.2 Specific objectives

1. To evaluate the influence of vehicle scheduling onthe responsiveness of pharmaceuticals supply chain of EPSA, South western cluster.
2. To examine the influence of route planning on the responsiveness of pharmaceuticals supply chain of EPSA, South western cluster.
3. To identify the influence of vehicle maintenance on the responsiveness of pharmaceuticals supply chain of EPSA, South western cluster.
4. To determine the influence of vehicle tracking on the responsiveness of pharmaceuticals supply chain of EPSA, South western cluster.
5. To determine the moderating effect of fleet and distribution management expertise of the agency.

## *1.4. Research Hypotheses*

For a researcher hypothesis is a formal question that he intends to resolve. Thus a hypothesis may be defined as a proposition or a set of proposition set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation or accepted as highly probable in the light of established facts. Quite often a research hypothesis is a predictive statement, capable of being tested by scientific methods, that relates an independent variable to some dependent variable (Kothari, 2004). Based on the above statement of the problems and objectives of the research, the following hypotheses are formulated to test the effect of transport management factors on the responsiveness of pharmaceuticals supply chain of EPSA south western cluster. While inherently known that the alternative hypothesis of ***H1A, H2A, H3A*** and ***H4A*** of the variables are that they have significant effect on the responsiveness of pharmaceuticals supply of EPSA south western cluster, and ***H5A*** stands for ǿthe agency fleet and distribution management significantly interact with transportation management to alter the responsiveness of pharmaceuticals supply chain, null hypotheses are described as follows:

**Ho1:** The vehicle scheduling has no a positive significant effect on the responsiveness of pharmaceuticals supply chain of EPSA south western cluster.

**Ho2:**Theroute planning has no a positive significant effectonthe responsiveness of pharmaceuticals supply chain of EPSA south western cluster.

**Ho3:** The vehicle maintenance has no a positive significant effect on the responsiveness of pharmaceuticals supply chain of EPSA south western cluster.

**Ho4:** The vehicle tracking has no a positive significant effect on the responsiveness of pharmaceuticals supply chain of EPSA south western cluster.

**Ho5**: The agency fleet& distribution management expertise does not have a significant moderating effect.

## *1.5. Significance of the Study*

As a research, the primary merits of the study goes to the university academics. Since there are few studies in the area, it wouldgives a comprehensive starting point for further research on effect of transport management on the responsiveness of pharmaceuticals supply chain. Hence, it would be serving as a base line data for scholars. It would a source of inspiration for further research and narrows the gap ofthe increasing demand for the literature in the topic under consideration.

Secondly Organizations gets ideas on Transport/Fleet management and route planning, vehicle scheduling and maintenance for their respective company.

Public organizations, such as, Ethiopian Pharmaceuticals supply agency and all branches gets important concepts on the overall transport management and fleet maintenance and able to measure efficiency and cost effectiveness of Supply chain management and may take the recommendations to improve their fleet management system as a means of enhancing the responsiveness of supply chain of pharmaceuticals of the agency.

## *1.6. Scope of the Study*

The study mainly was focused on Assessment of the effect of transport management particularly on vehicles scheduling, route planning, vehicles maintenance, and vehicles tracking on the responsiveness of pharmaceuticals supply chain in the case of Ethiopian Pharmaceuticals supply agency of south western cluster (Jimma, Nekemte and Gambella branches). A cross-sectional survey was conducted from April 3, to May 5/2020. The respondents of this study were employees working at distribution, warehousing, inventory management, forecasting, fund administration, and general service departments.

## *1.7. Organization of the Study*

The study was organized in to five chapters. Chapter-one presented the introductory part of the study that comprises, among others, the background of the study, statement of the problem along with the objectives and hypothesis of the proposed study. Chapter-two would deal with the review of the existent literature related to the topic of inquiry; whereas chapter-three would gave detail account of the design and methodological aspects that will be employed. The analysis of

the study data, presentation of the results and corresponding discussions will be comprised under chapter-four. Chapter-five will be culminates the thesis by providing brief conclusions and relevant suggestions on the basis of the findings of the study.

## *1.8. Operational Definition*

- **Transportation management:** is represents managing the overall operations/practices of transportation, which includes; route planning, vehicle scheduling of vehicle, vehicle tracking and vehicle repair and maintenance within a supply chain.
- **Vehicles operators (VOs):** are the key people responsible for the effective, safe, and economic operation of a vehicle.
- **Fleet management:** is the management of a companyôs vehicle fleet, and can include a range of functions, such as: Vehicle financing, Vehicle maintenance, Vehicle telemetric (tracking and diagnosis), Driver management, Fuel management Health & safety management
- **Sustainable fleet management:** strategy that aims to reduce environmental impacts through a combination of cleaner vehicles and fuels, fuel-efficient operation and driving
- **Scheduled Maintenance:** is a planned servicing of equipment & vehicles to maximize efficiency
- **Unscheduled Maintenance:** is work resulting from breakdowns such as component failure & surprise failures, which may necessitate road calls
- **Lifecycle management:** refers to the stages of vehicle management from procurement to disposal.
- **Vehicle disposal and replacement:** deal with the end of vehicle life cycle.
- **Vehicle tracking system:** combines the use of automatic vehicle location in individual vehicles with software that collects these fleet data for a comprehensive picture of vehicle locations.
- **GPS tracking server:** The tracking server has three responsibilities: receiving data from the GPStracking unit, securely storing it, and serving this information on demand to the user.
- **Metrics:** Metrics are parameters or measures of quantitative assessment used for measurement, comparison or to track performance or production. Analysts use metrics to

compare the performance of different companies, despite the many variations between firms. From (https://www.investopedia.com/terms/m/metrics.asp).

- **Operational performance:** is defined as Firm's performance measured against standard or prescribed indicators of effectiveness, efficiency, (business dictionary).
- **Pharmaceuticals:** are all medicines, laboratory reagents, medical supplies and medicalEquipmentôs.
- **Distribution:** Distribution is the process by which products are physically transferred from theirPoint of production or upstream warehouse to the point at which they are availableto the final customer
- **Health Facilities**: are hospitals and health centers who receive pharmaceuticals from EPSAbranches.

# *CHAPTER TWO*

# *2. LITERATURE REVIEW*

This chapter explains past relevant literature from other researchers who have conducted research in the same field. It contains opinions, attributes, research outcomes and conclusions thereon from previous research work done by other people and organizations. Section 2.1 discusses the theoretical literature/ general overview of the subject matter. Section 2.2 presents the empirical literature. Section 2.3 presents Summary of empirical literature. Section 2.4 presents the framework of the study.

## *2.1. Theoretical Framework*

According to Coyle J. (2011), Transportation interlinked the supply and demand gap inherent in specialization by region or area and the related mass production. The linkage between transportation and large-scale productions points out the dependency of our global economy upon effective and efficient transportation. He described that Transportation is a critical link in the overall supply chain, which has become an important concept for organizations in the 21st century. Transportation can be viewed as the glue that helps to hold the supply chain together.

Transportation is often viewed because the glue that helps to carrythe availability chain along. In supply, transport could be areasonably activity directly to blame for the movement of products (materials and loads) between stationary components of supply networks and systems, like production facilities,Warehouses or points of retail sale. Logistics is therefore directly focused on the transport of goods, which is a link in a logistics chain which connects its other components, which include; .suppliers of raw materials and other materials, manufacturers of semi-finished and finished products, wholesalers and agents, points of retails sale (shops, market chains), and End consumers (Kisperska-Moron, 2009).

It ought to be stressed that transport not solely handles the processes of movement, howeveris additionallythe fundamentalpart of the structure of specific supplier-consumer relations.Without spareinformation on the characteristics of transport, in up to date economic conditions it'simpossibleto form a good and efficient transport system for a possibleclient.The transport system is additionally a link connecting enterprise's customers and suppliers of raw materials

with economic entities, i.e. it has a longtime place in an exceedinglysupplying channel. Transport makes it attainableto maneuver product between these 2 spots, therefore filling a niche and building a bridge between the customerand also thevendor. Knowledge of the transport system is of basic significance for activity effective supplying activities within the domain of transporting product. Transport is a physical thread which sews geographically scattered places together (Goldsby, 2000). It also grants additional value to enterprise products, creating the usefulness of time and place as a result of physical movement of goods (as added value) to specific places and in agreed time. Without effective transport, enterprises operating in contemporary global markets are virtually unable to function (Tracey, 2004).

Lyson(2006) Argue that transportation is sometimes to blame for the companyôs inability to properly serve its customers. Transportation facilitates customer service through provision of place and time utility. Capability measures is one of the key measures of customer service, the customer service capability measures include: order cycle time, distribution system flexibility and malfunction handling capability. The order cycle time relates to the timelines of the deliveries to the customers and logistics firms must always strive to make sure they deliver to their customers at the expected time frame failure to which customers may feel dissatisfied since the lateness of the deliveries may make the client business to incur losses.

### *2.1.1. Transportation Management*

Transportation is indispensable to economic growth and development of human settlement (Pisarki A. , 1981); (Small, 2006); (Ghasmi, 2014). A key component in addressing poverty and social equity goals while ensuring adequate access to public service is nothing but transportation. Majoring, education, health care, markets, jobs, and recreation ï that are essential to the lives of all persons (Rittner, 1995); (Sanchez, 1999); (Mbara, 2002); (Bullard, 2003). The vital and important aspects of developing in a nation, contributive, are transportation.On the other hand, integration in combined transport is a set of different undertakings aiming at connecting individual links of complex combined transport into one functionally and institutionally coherent transport system (Groothedde, 2005). It is also the basic tool for meeting the complex requirements of combined transport users, as it leads to the achievement of a number of partial goals, which are set in order to streamline the process of movement (Semenov, 2008).The main

ones among them include: limiting the degradation of natural environment, improving safety in transport and Meeting customers' expectations (Szwankowski, 1998).

Business-wide, not compromising communication, transportation is not just the primary element but delicate entity to be deliberated on in the supply chain. Consequently, it can make and unmake the growth of business. The dominant flow in an efficient supply chain of a company is nothing but transportation. Illustrated below, for example, is a simple chain.Themanagementoftransportationoperationsiscomprisedof all types and modes, including trackingandmanagingeveryaspectofvehiclemaintenance, fuelcosting,routingandmapping,warehousing,communications,EDIimplementations,cargohandling,carriersôelectionandmanagement,andevenaccounting(JAIF, 2014).

### *2.1.2. Fleet Management System*

Fleet Management is a function which allows companies which rely on transportation in business to remove or minimize the risks associated with vehicle investment, improving efficiency, productivity and reducing their overall transportation and staff costs, providing 100% compliance with government legislation (duty of care) and many more. These functions can be dealt with by either an in-house fleet-management department or an outsourced fleet-management provider. (Bekiaris, 2004).

Vehicle fleet management is the proactive management of an Organizationôs vehicle assets, which may include light vehicles, heavy vehicles, specialist vehicles and motorcycles. Fleet management covers a range of functions, including vehicle procurement and financing, vehicle maintenance, vehicles telemetric (tracking and diagnostics), driver and personnel management, speed management, fuel management, and health and safety management (Akker, 2011). In below we are going to see only three of the functions these are: driver management, Fuel management and Vehicle maintenance management.

This service is provided by the Human Resource and General Service Directorate. Transportation routings and maintenance are the main issues. Since most of the trucks are oldthey frequently get remarks. PFSA tries to solve these remarks by out sourcing the maintenanceservice. Here the most series problems are lack of spare parts and delay by the maintenanceservice provider.

Sometimes the follow up is also weak. In addition, PFSA does not have a long-term agreement with selected maintenance service provider since this will help to give priorities for the agency. PFSA also outsource transportation service, if the capacity of items transported is beyond the capacity of the agency (Eyob, 2013).

Most of the problem related to fleet management is related to limitation on transportation.Gullele branch a has number of vehicles, but due to lack of vehicles, these delivery vans alsoforced to give the service to special zones of Addis Ababa in Oromia like, Sululeta, Alemgena,Akaki, Sebeta etc. The other problem in fleet management is, there is a weak collaborationbetween procurement & storage and distribution. Without informing to the distribution &storage directorate huge amounts of items will be procured, and this greatly affects theefficiency of the distribution service. Because of lack of space in the warehouse, items will beoutside the warehouse without refrigeration and this leads to wastage of drags before use andfinally availability of drugs will not be ensured. In relation to these, in order to secure space foritems outside a huge amount of item are forced to be transported to the branch and thisgreatly influence the transportation service and delay become the main problems. PFSAcurrentlydistributes pharmaceutical items to all branches even though it is not in the required amount (Eyob, 2013).

The intention here is to provide a conceptual basis for monitoring systems and fleet management, which are functionally different. Fleet management focuses on providing the company with a means to manage its assets through control of the different variables involved in the process. Monitoring has as its objective, the exact product location, tying in with other variables related to the performance of the assets and the professional staff involved (Mauro, 2012).

### *2.1.3. Pharmaceutical Products Transportation Management*

Transportation refers to the movement of products from one location to another such as moving pharmaceuticals products from the beginning of a supply chain to the customerôs hands. It plays a key role in every supply chain as products are rarely produced and consumed in the same location. The ability to transport goods quickly, economically and reliably is vital to a nationôs prosperity and capacity to compete in global market (Fekadu, 2013).

The pharmaceutical manufacturerôs original outer packing should withstand normal handling and transportation. At the intermediate store, this outer packing often must be removed to allow the assembly of small consignments; these must be repacked for transport in strong cartons. Empty space in partially filled cartons should be filled with newspaper, straw, wood shavings, or other loose material to stop the content from rattling about and prevent cartons from being crushed. Pallets and cartons should be carefully and systematically loaded into vehicles on a first-in /last-out basis. They must then be held secure by straps, nets, or other means .The vibration caused by travel over rough road can damage tablets and other breakable products; long journeys over rough roads should be avoided whenever possible (MSH, 2012).

Transportation and storage of pharmaceutical products containing hazardous substances, such as toxic, radioactive material, and other dangerous pharmaceutical products presenting special risks of abuse, fire or explosion (e.g. combustible or flammable liquids, solids and pressurized gases) should be stored in safe, dedicated and secure areas, and transported in safe, suitably designed, secured containers and vehicles. In addition, the requirements of applicable international agreements and national legislation should be met. Products containing narcotics and other dependence-producing substances should be transported in safe and secure containers and vehicles and be stored in safe and secure areas (WHO, 2010).

The interiors of vehicles and containers should remain clean and dry while pharmaceutical products are in transit. Packaging materials and shipment containers should be of suitable design to prevent damage of pharmaceutical products during transport. Seal control programmersô should be in place and managed properly. Drivers of vehicles should identify themselves and present appropriate documentation to demonstrate that they are authorized to transport the load. Damage to containers and any other event or problem that occurs during transit must be recorded and reported to the relevant department, entity or authority, and investigated. Pharmaceutical products in transit must be accompanied by the appropriate documentation (WHO, 2010).

### *2.1.4. Supply Chain Management*

A provided chain consists of all parties concerned, directly or indirectly, in fulfilling a client request. The supplychain includes not solely the manufacturer and suppliers, however additionally transporters, warehouses, retailers, and even customersthemselves. Among every organization, like a manufacturer, the provision of supply chain includes all functionsinvolved in receiving and filling a clientrequest. These functions embrace, however are not restricted to, new productdevelopment, marketing, operations, distribution, finance, and clientservice (Chopra, 2005).

The supply chain management in general aims at improving value delivery to customers; relying on just-in-time system; eliminating waste; getting the involvement of all stakeholders in the value creation process as well as working closely with suppliers. According to (Ireland, 2007), SCM continues to be adopted by organizations as the medium for creating and sustaining a competitive advantage and points out that such a displacement is understandable considering the potential benefits of successful supply chain management. These benefits attributed to supply chain management include inventory reduction, improved delivery service, and shorter product development cycles. SCM is one of the most effective ways for firms to improve their performance (Ou, 2010). With the purpose of managing the supply chain actions for realizing improvement in enterprise performance, it is necessary to improve the planning and management of activities such as materials planning, inventory management, capacity planning, and logistics (Chandra, 2000)with suppliers and clients.

Effective supply chains must be flexible and responsive to the changing dynamics in the marketplace, in manufacturing and technology, and in consumer expectations. This is also true for public health supply chains, which must respond and adapt to dynamic environments. But, change must be planned and based on todayôs demands and tomorrowôs opportunities and risks. Supply chain optimization is a powerful, practical tool that can improve performance now and position supply chains for the future (USAID DELIVER, 2014).

#### **2.1.4.1**: **Pharmaceuticals Supply Chain Management**

The pharmaceutical industry supply chain according to Whewell(2009), covers drug research, development, manufacture; distribution and application through a range of healthcare services, together with all the ancillarybusinesses that help these different stages function effectively. Fundamentally, the pharmaceutical industry is abusiness that is about health and therefore about people. The pharmaceutical and healthcare industry, in the opinion of (Whewell, 2009), is hugely complex because it involves so many markets, products, processes andintermediaries. It is also globally heavily regulated and used by everyone in life. Changes in one area impactupon the others and environmental factors such as pricing, regulatory change or actions by competitors, impact the whole supply chain in ways that are not easily understood or properly managed.

In the opinion of Ricci (2006), the pharmaceutical industry currently delegates distribution to third-partylogistics providers and wholesalers and is less advanced in terms of channel management compared with othersectors. This weak spot in the pharmaceutical industry, he indicated, limits the amount of information aboutpatient demand and product flow that is passed to the manufacturer. This encourages parallel importing fromcheaper to more expensive regimes and prevents a company from being able to guarantee the integrity ofproducts after they leave the warehouse. Ricci (2006), indicated that parallel trading costs the pharmaceuticalindustry billions of dollars each year, but much of that money goes to the importers and pharmacy chains rather than healthcare payers and patients. Most of the imports are repackaged or relabeled, which increases the risk oferrors (such as tracing the original source of the product) and makes it more difficult for pharmacistsôtodistinguish imitation from legitimate drugs. Given these problems, he identified the importance ofpharmaceutical companies taking control of their own distribution to maximize the potential of the differentchannels and to protect patients from such errors as mentioned above.

SCM can be viewed as a set of activities to implement a management philosophy (Mentzer, 2001). They identified seven activities in this regard such as integrated behavior, mutually shared information, mutually shared risks and rewards, cooperation, the same goal and same focus on serving customers, integration of process, partners to build and maintainlong-term relationship. (Kumar, 2007)Mentioned that effective supply chainmanagement can impact and improve upon virtually all business processes, such as dataaccuracy, operational complexity reduction, supplier

selection, purchasing, warehousing anddistribution. The benefits of SCM are included as quicker customer response and fulfillmentrates, shorter lead time, greater productivity and lower costs, reduced inventory supplythroughout the chain, improved forecasting precision, fewer suppliers and shorter planningcycles. The pharmaceutical industry is a more than $500 billion global business that requiresa tight, safe, and efficient supply chain. Modern pharmaceutical products rely on ingredientsand materials from across the globe (Kaye, 2010).In Ethiopia, IPLS is the primary mechanism by which all public health facilities obtain essential and vital health products. The system explains not only physical flow of products but also the flow of information for decision making (PFSA, 2016).

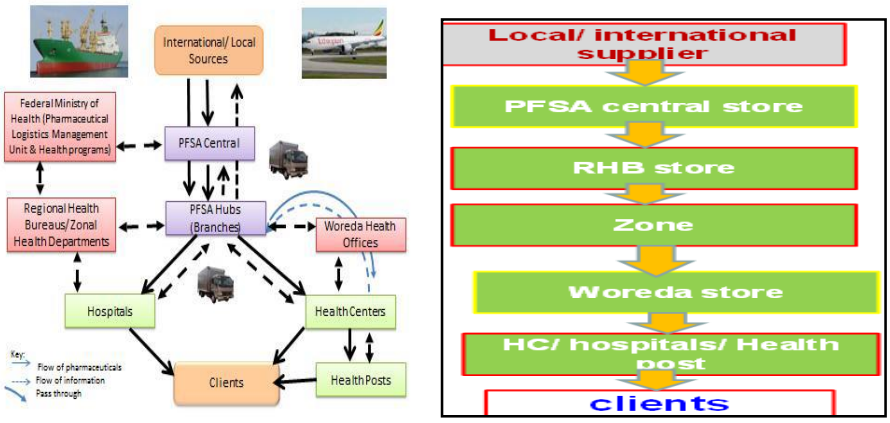


***Figure 1: Flow of Pharmaceuticals and Information in the Integrated Pharmaceutical Logistics System (IPLS)***

With the expansion of health facilities, since the initiation of IPLS, the distribution capacity of PFSA has significantly increased. About**145** vehicles of different capacity were procured and deployed to all hubs

PFSA is managing Revolving drug Fund (RDF) and health program pharmaceuticals inparallel. Program pharmaceuticals are ordered every two months by hospitals and healthcenters and delivered by PFSA to these facilities directly or indirectly. Direct delivery sitesare facilities that receive program pharmaceuticals directly from PFSA hubs whereas nondirectdelivery sites are health centers that receive products from PFSA hubs throughWoreda Health Offices (PFSA, 2015).

**2.1.4.2. Distribution Systems in Delivery Process**

Itôs a time a distribution system make a transition from general direct deliver towards distribution via terminals. As Compared to direct deliveries the terminal system has more frequent but also more rigid deliveries. (Lumsden, 2007) Those two systems are presented below in the figure 5. Since it has been system based, direct deliveries is fast, but requires also very high transport resources. Other problems connected to direct deliveries could be low delivery frequency and low resource utilization. (Lumsden, 2007) This means that from logistics perspective direct deliveries are not the most efficient solution.

In direct delivery system the goods can be stored both at suppliersô side, and transported to customers when needed, or at customers site, from where they can be requested quickly. The inventory status could affect the reaction speed for customers demand. Responsiveness to fluctuated demand is higher the near the inventory is placed to the customer.

As mentioned in the ñDelivery processò paragraph, it depends on the incoterm agreed upon, which party is responsible for the transportation and owns the goods. This agreement indicates the address where goods are physically handed over from the supplier to the customer ï this location could be called a pick up point. In case customer has agreed to arrange the transportation from suppliersô site then the pickup point for goods is located at the suppliersô factory. On the opposite, when supplier organizes the delivery, then pick up point for customer is at their premises. This concept is illustrated in figure 2 point 1 and 2 respectively.

In a distribution system with a terminal, goods always pass a depot on their way from supplier to the customer (Lumsden, 2007). That way the inventory will be stored for some time in an intermediary location. This system could lead to higher efficiency for the supply chain as consolidation of goods can be performed. Additionally, higher delivery frequency and resource utilization can be achieved. (Lumsden, 2007) According to the incoterms it is possible to agree that supplier will perform the transport until the terminal and customer will take care of the rest of the delivery. In that situation the terminal represents the pickup point of goods for the customer.

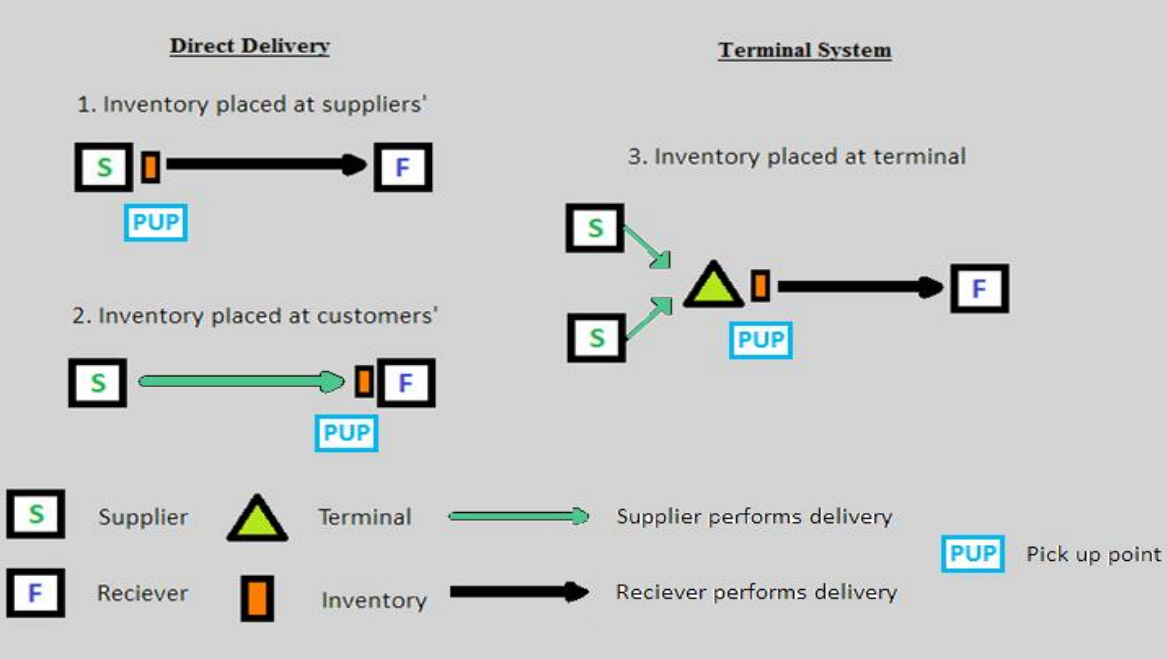


Figure 2: Distribution systems in delivery process, adapted from (Lumsden, 2007).

**2.1.4.3. Lead Time**

As mentioned previously, historically the purchase decision has been dependent mainly on the price (Bowersox, 2010); (Christopher, 2008)(Johnson, 2008). Nowadays the choice of supplier, not only price, also depends on ñthe cost of timeò while the customer is waiting for the delivery. (Christopher, 2008) This means that the sourcing process has become more complex for the purchaser as there should be considered not only cost efficiency, but also responsiveness of inbound material flow. One basic issue in most organizations is to meet the customerôs order cycle (the time the customer is willing to wait for the delivery) with logistics lead time (the time for the supplier to complete the process from receiving the order to delivering goods) not managing that will cause the lead time gap. This gap is specially a problem in longer flows because in general the final customer is not willing to wait longer just because the sourcing is done globally. The idea of lead time gap is presented in figure 3.(Christopher, 2008) Possible ways to reduce or close this time gap is shortening the logistics lead time by the aid of such tools as supply chain mapping and bottleneck management. Simultaneously the customersô order cycle could be moved closer by increasing the demand visibility (Christopher, 2008).

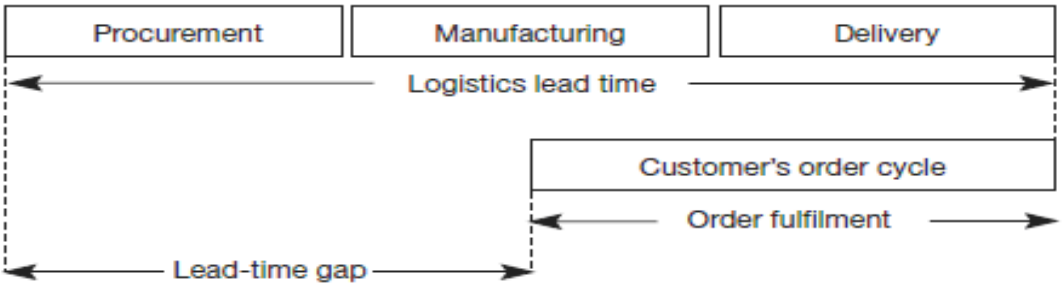


***Figure 3: Lead time gap, cited in*** (Christopher, 2008)***p. 160***

### 2.1.5. Supply Chain Performance Management

SCM is being recognized as the integration of key business processes across the supply chain. Theimplementation of SCM involves identifying the supply chain members with whom it is critical to link, theprocesses to be linked with each of these key members, and the type/level of integration that applies to each processlink (Lambert D. , 2006). Stavrulaki (2010) Assert that SCM processes which cross organizational boundaries can be easily defined, analyzed and improved to provide companies with a sustainable competitiveadvantage by the identification of key performance measures. Performance measurement is the process ofquantifying the efficiency and effectiveness of an action by means of a set of metrics (Gunasekaran, 2007). Hence, supply chain performance measurement is multi-dimensional and no one measure will suffice tomeasure performance (Asadi, 2012).

Measuring supply chain performance can facilitate a greater understanding of the supply chain, positivelyinfluence actorsô behaviors, and improve its overall performance. There are many indicators of performance thatcan be deployed in an organization. However, as alluded to by (Folan, 2005), there are a relatively smallnumber of critical dimensions that contribute more than proportionally to success or failure in the market, whichthey named key performance indicators. Key performance indicators, therefore, should relate to both effectivenessand efficiency of the supply chain and its actors. According to (vorst.J.G.A.J., 2000), a distinction should be madebetween performance indicators using three main levels: the supply chain level (e.g. product availability, quality,responsiveness, delivery reliability and total supply chain costs); the organization level (e.g. inventory level,throughput time, responsiveness, delivery reliability and total organizational costs); and the process level (e.g. responsiveness, throughput time, process

yield and process costs). (Petterson, 2009), asserted that in order to improves supply chain efficiency and effectiveness, four main indicators should be used: profit, lead-time performance, delivery promptness and waste elimination.

### 2.1.6. Responsiveness of Supply Chain

Responsiveness istherefore constituted by the systemôs response dimension of its external flexibility types. For thepurpose of this and further studies, the following definition will be adopted:

*The responsiveness of a manufacturing or supply chain system is defined by the speed with which the system can adjust its output within the available range of the four external flexibility types: product, mix, volume and delivery, in response to an external stimulus, e.g. a customer order.*

The types of *internal* flexibility required on the other hand will be contingent upon the types of responsiveness demanded as well as upon the specific operational setting. Most importantly it needs to be acknowledged that such relationships exist, i.e. mix responsiveness might for example require flexibility in machinery. A customer would however not be interested in how his supplier is able to meet changes in product mix demands, as long as the supplier can adjust the product mix to suit the customersô needs without negatively affecting other requirements, such as product quality. Similarly, a customer would not be interested in whether his supplier is sufficiently responsive to meet a large unforeseen order because the supplier itself is responsive (e.g. through buffer stocks of purchased components) or because the supplierôs suppliers can deliver the required components quickly. From a customerôs point of view his supplierôs manufacturing systemôs responsiveness is thus the same as the supply chainôs responsiveness. Hence a shift in the focus from manufacturing systems to supply chains is driven by other factors. Traditionally, supplier flexibility was seen as an operational factor impacting upon a manufacturing systemôs performance (Vokurka, 2000), yet with the increasing complexity in todayôs supply chains it is argued that the flexibility of manufacturing systems in a supply chain should be regarded as a factor contributing to a supply chainôs responsiveness and not vice versa, at least for firms, which want to compete on the basis of pharmaceuticals supply chains.

Looking at the time classification of flexibility, responsiveness can be split into at least short-term and medium-term responsiveness, too. A supply chainôs short-term or operational

responsiveness is its ability to adjust its output to short-term demand changes. These changes can be due to changes in the product mix (mix responsiveness), the volumes required (volume responsiveness), or the delivery sequence or timing (delivery responsiveness). New products are rarely introduced on short notice, and product responsiveness probably only exists on the medium- and long-term horizon. What exactly *short-term* means however depends on the industry and supply chain node under consideration; in fast clock speed settings such as electronics (where products can have a life cycle of as low as 2 months) it will be very different from slow clock speed settings, like automotive, where products stay in production for an average of six years (Holweg, 2004).

Supply chain responsiveness means how rapidly an organization treats with customer inputs. Agile and quick supply chain is important (Li et al, 2007). If the goal and vision of supply chain members are different then the profit of supply chain cannot be achieved (Arshinder et al, 2007). Agility in the supply chain is important factor. Agility means quickness; in which time you fulfill the order. Conflicts increase individual profits instead of profit of whole supply chain. There are three basic outcomes of long-term orientation one is relational behavior maximization second is minimization in conflicts and third is full satisfaction. When there is supply chain responsiveness in supply chain then delivery will be on time, cost will be reduce and forecasting of data will be accurate (Mehrjerdi, 2009).

## *2.2. Empirical Review*

### *2.2.1. Supply Chain and Transportation Strategies*

Some of the transportation and distribution challenges include limited funds for vehicle purchase, maintenance, repairs, fuel and driver salaries (USAID, 2011A). In Ghana 13% of the stock value of the essential health commodities constitute for logistics costs. There are competing interests between low distribution costs and high service quality. If distribution frequency is high, transportation costs are high, but in a more reliable demand planning horizon with less stock-out situations (Yadav, 2011). Research shows that decentralized transportation systemsin Guatemala results in a high performance (Bossert, 2007).

Last mile distribution is usually on a collection basis, meaning HCs pick up orders at warehouses via bicycles, public transport or vehicles, of which some are often used for several different purposes and bring the commodities back to the facilities. Collections often occur in an ad hoc manner and HCs need funds for transportation. Furthermore, collection of medicine by HCs could mean that HWs need to travel long distances and close the HC due to a lack of human resources (HR). Delivery by warehouse like the DTTU in Zimbabwe arranges direct deliveries from NLMS to HCs and collect information and consumption data from the HC when the top-up team is on-site for delivery of drugs. This model has high initial costs and is resource intensive. The frequency of distribution depends on the distance from the NLMS and the storage capacity of the HC. This approach decreases administrative tiers and stock levels on the entire supply chain, but often increases transportation costs. But the DTTUôs running costs are similar to models used before in Zimbabwe, whereas stock-outs decreased and logistics performance benefited. Outsourced delivery can be very effective but needs to be strictly managed and controlled (USAID, 2008A).

Research in Nigeria outlines savings from 12-19% for outsourcing.However, structural or political barriers can exist such as the capability of 3PLs, client communication or conflicts (TRANSAID, 2010). For example in Gambia the government outsourced theirdistribution to a NGO, this maintains a vehicle fleet and charges the government on a cost perkilo meter basis. Private organizations often distribute with mini-vans, public transport or via collection (Yadav, 2011). It is important to schedule deliveries to avoid exceeding deliverydeadlines due to a shortage and poor condition of vehicles or high costs of transport (FederalMinistry of Health, 2010a). In general distribution systems need to balance high initial investments,capacity of HWs, reliability and stock-outs to optimize distribution performance (USAID, 2011A).

There may be opportunities to reduce the number of supply chains by combining different commoditieswith similar distribution characteristics which may reduce overall costs for T&D. But,supply chain entities are fragmented and competing and thus, collaboration is difficult (WHO, 2006). Vertical supply chains have advantages for ad hoc and irregular drug deliveries and for a lack of capacity within the public supply chains. On the other side vertical approaches duplicatethe need for specific services, this could increase total costs (USAID, 2008A). Another

approachis to bundle consumer goods and medicine for last miledeliverybut there are differences between consumer goods and medicine due to strong regulations in asmall market and high necessity of traceability and security for health commodities (Yadav, 2011).

The last mile challenge is to deliver small quantities to several HCs and includes physical distribution of medicine and the collection of data. The last mile could be the link between HWs andHCs, especially as HCs are often located in rural areas, which are difficult to access and havepoor communication technology. Transportation means delivery or collection; High-quality logistics data needs to be captured atHCs such as stock levels, consumption and adjustments; Order fulfillment could follow a pull or push strategy. This process could be facilitated by the use of a LMIS with standardized process forms and electronic communication technology. Challenges for last mile distribution are a lack of human resource (HR) capacity, low salaries, a lack of capital to cover transportation costs and limited electricity and communication infrastructure (USAID, 2011A).

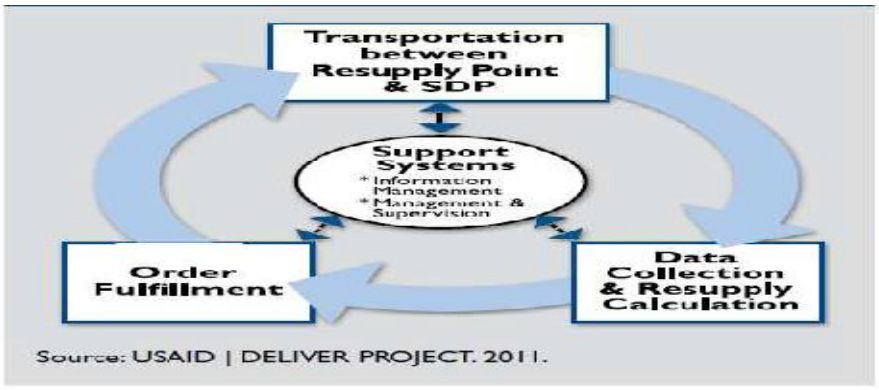


***Figure 4: The logistics cycle at the last mile,*** (USAID, Last mile distribution to increase access to health commodities, 2011A)

Research in Kano State in Nigeria suggests different transport strategies related to differentcommodities and distances for the last mile distribution. Facilities within 30 km are suitable foran ad hoc collection, whereas facilities which are farther away should be serviced by scheduleddeliveries from warehouses for low volume commodities and manufacturer delivery for high volume commodities (USAID, 2010B).

Transportation management deals with transportation mode, fleet size, route selection, and vehicle scheduling and freight consolidation. All four areas are economically interrelated and

should be planned in an integrated manner to achieve maximum benefit. Methodologies and systems that deal with integrated planning typically are at an aggregate level and do not include detailed problem definition. Systems and procedures that are more de-tailed do not address all four areas simultaneously. The primary reason is size and complexity. Logistics network modeling tools attempt to include as much detail as possible bit still address the logistics sys-tem design problem in an integrated manner. Some of the questions answer by an integrated logistics network is as follows:

a)The number of warehouses, their location, owner-ship (private or public) and their size, the allocation of customer demand to supply points (warehouses or plants); allocation to single or multiple supply points, The amount of inventory to be maintained at various locations,

b) The type of transportation services to use;

c) The level of customer service to be provided;

d) Determination of the optimal logistics network con-figuration is a fairly complex task because of the large number of vendors and customers, the hundreds of candidate locations for warehouses and plants and the extremely large number of transportation options. Before you start building up such a network, you should calculate the different determinations of the logistics network configurations (Santosh, 2014).

According to Zegordi (2010) which pointed out that Capacity of each vehicle could be different from the others. The capacity is defined as the volume or weight of orders that is carried in a batch of a vehicle. If the total volume of orders assigned to a vehicle is more than its capacity, it should be divided in multiple batches where each is not more than the vehicle capacity. This is to mean that the quantity of order could be altered by the size of the quantity which made an impact on the reliability of the supply chain.

Heng(2006) Argues that it has become an important issue to track vehicles especially with haulage firms to effectively monitor their movements. GPS fleet tracking puts the fleet manager in control by providing him/her with the ability to monitor and enforce driver speeding right from the office. GPS makes it easy to set speed thresholds via web. When a driver exceeds the pre-set speed threshold, the GPS fleet tracking system lets the fleet manager know through a text message or email alert so that immediate action can be taken. The speed control promotes safe

driving which leads to fewer accidents thus the company is not subjected to unnecessary loses. Use of a Mileage Tracking and Fleet Management application in a business that has a large fleet of vehicles helps to show you the location of every vehicle in your fleet, down to a specific parking spot. You can see real-time driving routes and locations for each driver in your fleet. Drivers can also share trips on Facebook, Twitter and Google Maps/Earth.

Lyson (2006) Argue that transportation is sometimes to blame for the companyôs inability to properly serve its customers. Transportation facilitates customer service through provision of place and time utility. Capability measures is one of the key measures of customer service, the customer service capability measures include: order cycle time, distribution system flexibility and malfunction handling capability. The order cycle time relates to the timelines of the deliveries to the customers and logistics firms must always strive to make sure they deliver to their customers at the expected time frame failure to which customers may feel dissatisfied since the lateness of the deliveries may make the client business to incur losses. The logistics firm should have a flexible distribution system to match any variance the customer may wish to make failure to which the customer may switch to another logistics provider whose fleet is flexible to his/her needs. In regard to malfunction handling capability the customer expects his/her consignment to be delivered without any damages and should it happen the logistics firm should address the issue with the urgency it requires to prevent any discomfort from the customer that may make him/her to think of switching to another logistics provider since losing a customer is the path to a business failure. The fleet management function should deeply engage in customer tracking and evaluation activity which involves reviewing customer performance and requirements. This helps to identify where a logistics firm is not providing adequate customer service or where improved customer service could increase supply chain performance.

## *2.3. Summary of Empirical Literature*

### 2.3.1. Route planning

Route planning systems specify the sequences inwhich the selected transport vehicles should supplythe demand points by requested quantities ofgoods. To find the most cost-effective trips travelingsalesman models can be used. However, when thereis a large number of locations and many constraintsthe resulting number of combinations doesnôt allowthe model to be solved

exactly. Route planning is an NP-hard problem that is difficult solve optimally.Instead, route planning modules can use heuristicsor expert rules (Knolmayer, 2002);(Laporte, 2000). The most well-known classicalheuristics are the Savings and Sweep algorithms andthe most successful Met heuristic approach is thetab search heuristics (Gayialis, 2004).

Besides the travelling routes, the route planningpackage can graphically display the travel routes, provide various lists (routes, customers, orders, vehicles), or check the economics by calculating some statistics (Knolmayer, 2002).

Route planning systems bring many advantages tocustomers (improved service, increased reliability,reducing delivery times, quick response to specialrequests), management (increased transparency, independence on plannerôs intuition, simpler training of new employees, reliable data fordecisions) or schedulers (reduction of routine tasks, less errors) (Knolmayer, 2002). Thus, the above fact support the first alternative hypothesis of the study which state;

***HA1; Route planning significantly affect the responsiveness of pharmaceutical supply chain.***

**2.3.2. Vehicle Scheduling**

Planning and scheduling models may also interactwith other types of models, such as long term strategicmodels, facility location models, demand managementmodels, and forecasting models; these modelsare not discussed in this paper. The interactions withthese other types of models tend to be less intensiveand less interactive. In what follows, we assume that thephysical settings in the supply chain have already beenestablished; the configuration of the chain is given, andthe number of facilities at each stage is known (Stephen, 2004).

To survive in the current competitiveenvironment of global markets, manufacturershave been forced to choose an appropriatesupply chain network for cost reduction intheir inventory systems (Ghasmi, 2014). This paper investigates the schedulingproblem in a transportation system composedof cross-docking and Vehicle Routing Problem (VRP) approaches in supply chain tominimize total delays in ordersô delivery. Thesupply chain consists of some suppliers whoare spread in different geographical zones andan integrated transportation system consistingof multiple vehicles. This hybrid transportationfleet transports orders from the suppliers to amanufacturer. It is assumed that suppliers useshared vehicles to reduce transportation

costs.Therefore, the above statement draws the second alternative hypothesis of the study, which stated;

***HA2: Vehicle scheduling significantly affect the responsiveness of pharmaceuticals supply chain.***

### 2.3.3. *Vehicle Tracking*

Although the majority of the dynamic fleet management models assume that the travel timesare Deterministic, there are a variety of applications where traffic jams, equipment failures andundesirable weather conditions create substantial variability in the travel times. (Huseyin, 2006)Furthermore, even if these events are rare, the travel times may appear to be random to the modeler, since they depend on factors outside the scope of the model (Huseyin, 2006).

Huseyin (2006) Investigated in the car allocation business, the railroad company receives carrequests from its clients on a daily basis. These requests are for a particular number of cars of a particular type, at a particular operating station and on a particular date. The company decides which cars should be used to satisfy the requests and tries to get these cars to the clients. Afterusing the cars for a certain amount of time, the clients return the cars to the company. To servethe clients in a prompt manner and to set the imbalances between where the requestsoriginate and where the cars are returned, the company continuously repositions the empty cars (Huseyin, 2006).

Sharon (2012) Discussed Choose good fleet management software and uses it in decisionmaking. In order to properly track costs, fleet management software is a must. Software tied tomake, model, class and department should track preventive and scheduled maintenance, fuelusage, repair time, etc., for each vehicle. Software should interface with fuel systems. Manygood fleet management software systems are on the market.(Sharon, 2012) Noted that main goals of any fleet management system are to provideinformation to improve efficiency, decrease downtime and in-service breakdowns, reduceinventory, lower ownership cost and avoid waste. The selected software should providedetailed vehicle information such as: downtime, percentage of downtime, total miles traveledand cost/mile. It should be able to provide information on mechanicsô efficiency andproductivity. It should track parts inventory and have the capability to

track/analyze all directand indirect labor costs. This information should be used in purchasing decisions (Sharon, 2012).

For decades, the physical operating layer in logistics lived in disconnected isolation from the information layer of supply chain management. The movement of products within a manufacturing or distribution facility was nearly invisible. Of course, the information systems could show that they were somewhere in the facility, and possibly the designated storage location, but little beyond that ï particularly if the items were in-transit. The same was true outside facilities. Goods that were shipped to a warehouse were ñon the road, boat, or air,ò but little more was known other than possibly when they were received at their destinations. Today, all that is changing. The race to connect the physical logistics layer and the information layer is accelerating. Many technologies are emerging to close the gap including wireless devices (e.g., RFID tags, 802.11 and Bluetooth-enabled devices, pagers, cellular), global positioning systems (GPS), and legacy tracking, including EDI links and bar coding, all linked to the massive information backhaul capabilities of the internet. When the connection is complete, the ubiquitous communication capability will make physical items visible throughout the supply chain (Johnson, 2008).

***HA3: Vehicle tracking significantly affects the responsiveness of pharmaceuticals supply chain***

**2.3.4. Maintenance Management**

Maintenance, repair and operations (MRO) involves maintaining, repairing, and replacing if necessary devices, equipment, machinery, building infrastructure, and supporting utilities in industrial, business, governmental, and residential installations,(DLA, 2016). Over time, this has come to often include both scheduled and preventive maintenance as cost-effective practices. Scheduled inspections have also come to fall under MRO purview.

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Although vehicle maintenance policies are predominantly governed by safety, it is important to remember that vehicle performance and fuel consumption are also affected by maintenance standards. Turbochargers, fuel injection systems, tire, axle alignment and oil and lubricants are just a few of the factors that have an impact on fuel consumption and should always be maintained to high standards. It is essential to remind drivers of their responsibility to undertake

daily walk-around checks of vehicles. This not only helps to ensure that vehicles remain in legal roadworthy condition, but also helps identify common problems such as oil and water leaks and incorrect tire pressure. There is also scope to make improvements in the way maintenance facilities themselves are operated (Richardson, 2011).

State of Wisconsin (2004) Noted that it is the driverôs or work shared vehicle coordinatorôs responsibility to ensure that all preventative maintenance is performed on schedule and has the vehicle serviced in a timely manner when notified of a recall or preventive maintenance. Failure to perform the maintenance and repairs in accordance with agency policy may result in loss of the vehicle or, in the event of damage to the vehicle, payment for vehicle repair (Wisconsin, 2004).

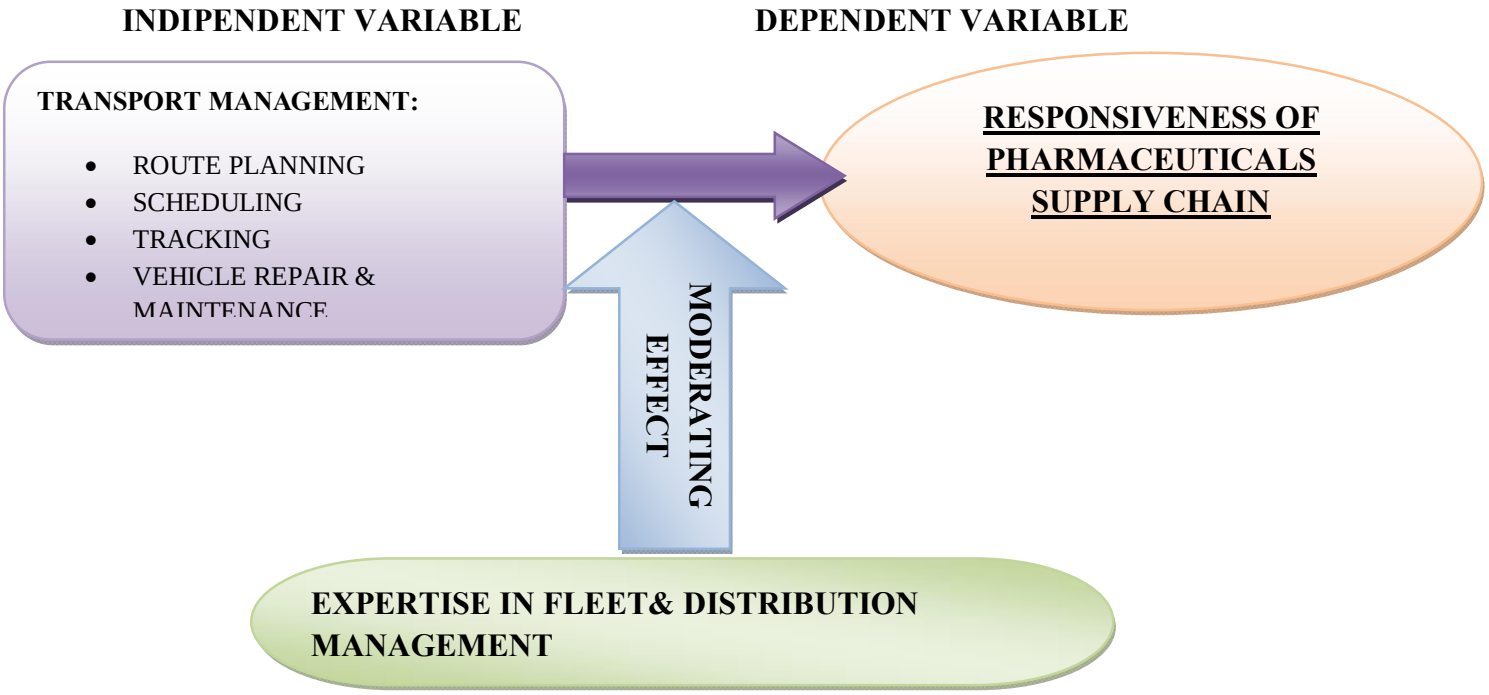
***HA4: Maintenance and repair management significantly affect the responsiveness of pharmaceuticals supply chain.***

## *2.4. Conceptualization*

Conceptual framework as a concise description of the phenomenon under study accompaniedby a graphical or visual depiction of the major variables of the study (Gitahi, 2014).According to Gitahi (2014), conceptual framework is a diagrammatical representationthat shows the relationship between dependent variable and independent variables. In thestudy, the conceptual Framework is look at assessment of the effect of transport management practices on the supply chain performance of Ethiopianpharmaceuticals fund supply agency (EPSA) at Jimma cluster.

According toSCC (2010) the SCOR model has the following supply chain performance attributes among others: supply chain reliability, responsiveness, agility, costs and asset management. The researcher used the SCOR model to explain the various attributes of supply chain performance.

## Conceptual Framework




**Independent variables**

Transportation management a bridge between logistic and supply chain function; this affects the supply chain performance to remarkable levels. Transport route planning is critical for supply chain performance as it helps efficient delivery of pharmaceutical products in supply chain network. Additionally vehicle scheduling, vehicle tracking and maintenance repair could fasten the delivery and reduce cycle time/ order fulfillment/ lead time and hence capable potential to enhance the supply chain performance.

**Dependent variable**

Supply chain performance is determined by how well the different elements of transport/ fleet management are managed. A well performing supply chain is marked by reduced cycle times and faster deliveries which can only be attained by an effective and efficient transport/ fleet management since transportation is a glue that holds the different parties in the supply chain together.

**Moderate Variables:** Fleet and distribution management expertise which indicates efficient management of fleet and distribution management could interact with transportation management to significantly enhance the supply chain performance.

# CHAPTER: THREE

# 3. RESEARCH DESIGN AND METHODOLOGY

In this chapter, research design, sampling design, method of data collection, procedures and analysis was described.

## 3.1. Description of the Study Area.

The study was conducted on the western EPSA cluster that consists of Jimma, Gambella and Nekemte branches. The pharmaceuticals supply chain of this cluster addresses parts of Oromia, SNNPs, Gambela, and BenishangulGumuuz regions. Its catchment area covers 447 health centers, 43 hospitals, 168 woredas and 15 zonal health offices. It also provides supervisory, material support and Capacity building to health facilities for strengthening and enforces the implementation of IPLS and pharmacy service.

## 3.2 Research Design and Approach

The study was employed explanatory research methods and descriptive as well. This research design facilitates a better understanding of the effect of transportation management towards pharmaceuticals supply chain performance with a moderating effect of fleet and distribution management.Accordingly, the collected data were presented in to two parts; in the first part the study examined the effect of independent variables on the dependent variable, and the interference of moderate variable on independent variables using frequency and percentage. In the second part the study sought to triangulate the interdependence between the dependent and independent variables plus moderating variable using explanatory research design.

For this study, mixed research approach (both qualitative and quantitative approaches) was applied in data collection and analysis. In qualitative approach the study was traced word impression and texts, whereas in quantitative approach numerical data were considered.

## 3.3. Sampling Design

### *3.3.1. Target Population*

The target population for this study was employees from distribution, warehouse & inventory management, forecasting department, fund administration and general service departments which found under south western cluster (including Jimma, Nekemte&Gambella hubs). Therefore, the sampling frame for this study comprises Jimma hub with 64 employees, Nekemte hub with 57 employees, and Gambela hub with 34employees**.** Totally, 155 employees were the sampling frame of the study. From this population, the researcher obtained the sample from the subgroup as presented in table 3.1. Whereas to evaluate the responsiveness of the pharmaceuticals supply chain this study was targeted customers those were availed at the branches for pharmaceuticals procurement and emergency orders during the study period. According to the past trend about 165 customers were expected on the three branches during the two weeks working hours.

### *3.3.2. Sample Size*

The sample size obtained was used the following formula proposed by Yamane (1967): $n=\frac{N}{1+N(e^2)}$ Where n is the sample size, N is the target population and e is the level of precision. This study assumes a confidence level of 95% and hence precision of .05.

Applying the above formula therefore we get the following results:

$$n=\frac{155}{1+155(.05^2)}=\frac{155}{1.3875}=\mathbf{111.7}$$

The above calculation resulted in 111.7 respondents. Therefore **112respondents**were determined as the sample size according to the formula. In order to increase the response rate, the researcher has increased the sample size to **123**(by adding ten percent of the sample size) persons. Therefore**123respondents** were selected using stratified sampling after rounding up as shown in the table below:

From each hub the researcher selected respondents from the permanent employees. The researcher was calculated the percentage each facility staffôs representative among the total

number of branches staff and was used the same percentage to calculate the number of respondents for that facility using regression analysis.

**Table 3.1: sample size**

| **Description** | **Target hub Staff** | **Percentage (% )** | **Number selected** | **Round up number Respondents** |
|---|---|---|---|---|
| **JIMMA HUB** | 64 | 79.3 | 50.75 | 51 |
| **NEKEMTE HUB** | 57 | 79.3 | 45.20 | 45 |
| **GAMBELLA HUB** | 34 | 79.3 | 26.96 | 27 |
| ***TOTAL*** | ***155*** | **79.9** | ***122.915*** | ***123*** |

**Source: HR profile data of the branches, 2020**

According to the above formula given above, 123employeeswerebecame a representative samples for the study. This study considers permanent employees of the company which were selected using simple random sampling. The sample for the customers almost nearly similar to the employees. Thus, the same sample for customers was fixed.

### 3.3.3. Sampling Technique

Stratified multi sampling was employed based on the strata of the departments and in the agency. Simple random sampling using random table was done accordingly. The reason for using stratified simplerandom sampling is that first, we can have more precise information inside the sub-populationabout the variables we are studying. And second, we can raise precision of the estimate of thevariables of the whole population. Therefore, the study was fixed 123 respondents from the cluster as sample size of the study.

## 3.4. Sources of Data

Both primary and secondary data was used to conduct this study. The source for primary data was the employeeôs from selected samples and questionnaires were distributed for selected sample of each branch staffs. The sources for secondary data were books, journals and desk research to clarify most of the issues.

## 3.5 Method of Data Collection and Data collection Instruments

### 3.5.1. Method of data collection

The methods of collecting primary andsecondary data differ since primary data are to be originally collected, while in case of secondarydata the nature of data collection work is merely that of compilation (Kothari, 2004).

**Primary Data Collection:**

Questionnaires were developed and distributed to the entire employees of Ethiopian Pharmaceuticals Supply Agency of South western cluster who worked at different positions and departments. The questions used in the questionnaire were close and open ended, and a five-point Likertôs scale type. The reason for using questionnaire was it is quick for gathering responses in a standardized way, and to make the study more objective and certain. A personal delivery and pickup methods was used to improve the return of the questionnaires from study participants. Moreover covering letter was attached to each questionnaire to introduce the research objectivity and confidentiality to the study participants. The questionnaire based data collections had an advantage of low cost, free from the bias of the interviewer and respondents have got enough time to respond well to the questions.

Whereas the qualitative data was collected through interview guide questions which was prepared and asked the management bodies on the study areas.The interview method of collecting data involves presentation of oral-verbal stimuli and reply interns of oral-verbal responses. This method can be used through personal interviews.

**Secondary Data Collection:**

The secondary data which the study was focused on published secondary data. These data were collected through the review analysis of the published secondary data sources which were journals, articles, books and electronics media. The data were collected with regard to the subject matter which this study was focused on.

### 3.5.2. Data Collection Instrument

Zikmund (2003) defines data collection tools as the instruments used to collect information in research or the methods employed to collect research data. The choice of the method to use is influenced by the nature of the problem and by the availability of time and money (Cooper &Schindler, 2006). In this study closed ended questionnaires, semi-structured interview and observation was employed to gather information from respondents.

### 3.5.2.1. Questionnaire

In an attempt to collect data, questionnaires were prepared by the researcher and used as the main source of data gathering instrument. The items were prepared in accordance with the designed objectives and hypothesis to be tested in the study. i.e. concerning the effects of transportation management that affect the pharmaceuticals supply chain management performance in the moderating effect of fleet and distribution management in EPSA south western cluster.

The questionnaire was preferred to other methods of data collection hoping that it may provide opportunities for obtaining reliable and valid information from more number of respondents. The first part of the questionnaire was about the demographic data and profile of respondents. It consisted of sex, age, education level, work experience, department and responsibilities in the organization. Part two reflects the major elements that are assumed to test the relationship effects of independent, moderating and dependent variables. They are presented tables with five possible options to be rated by the respondents ranging from strongly disagree to strongly agree scales.

The Likert scale questionnairemethod was used to form the range of responses: strongly disagree, disagree, Neutral, Agree, and strongly agree, with a numeric value of 1-5, respectively. The usage of this particular scaling method ensured that the research study illustrated the ability to assess the responses and measure the responses quantifiably. So that a pattern or trend may be produced in order to answer the research questions. As Neuman (2003) explained, it is a process of asking many people the same questions and examining their answers research questions.

### 3.5.2.2. Interview Guide

According to Drew, Hardman and Hart (1996), the advantage of the interview technique is that it enables the participants to enlighten the researcher about unfamiliar aspects of the setting and situation. It is also important to obtain information with regard to issues that require clarification and vital information that is not expected to access using questionnaires, and it was used concurrently with the design of the questionnaire. On doing so, in addition to the questionnaire, interview guide has been used and conducted with 4 key officials of EPSAôs south western cluster and with the head of the head of the cluster and EPSA Jimma branch. Hence, the researcher has made the interview in accordance with the objectives of the study and the basic questions rose in the statement of the problem so as to identify particular effect of transportation management on the responsiveness of pharmaceuticals supply chain in EPSA, and particularly in the cluster of south western Ethiopia.

## 3.6. Pilot study

Before using questionnaire method of data collection, it is always advisable to conduct ópilot studyô (Pilot Survey) for testingthe questionnaires. In a big enquiry the significance of pilot survey is felt very much. Pilot survey isin fact the replica and rehearsal of the main survey. Such a survey, being conducted by experts, bringsto the light the weaknesses (if any) of the questionnaires and also of the survey techniques. From theexperience gained in this way, improvement can be effected. Thus, pilot study was conducted with 12 individuals of the sample size in the branches not included on this study. Based on the findings of the pilot survey modification and improvement was made on the questionnaire to fill the identified gaps during the pilot test.

## 3.7. Methods of Data Analysis and Data analysis tool

The data was obtained through questionnaire was first edited for their completeness, categorized, registered. Based on this the data was analyzed using descriptive and inferential statistical analysis techniques. With regards to the descriptive analysis the study was analyzed using mean and standard deviation. On the other hand, inferential statistics techniques, specifically hierarchal multiple regression analyses were applied to tests whether the combined effect, of all the variables in the model, is different from zero. If, for example, < 0.05 then the model have some relevant explanatory power, which does not mean it is well specified or at all correct.

Hierarchical regression analysis was used to test the hypothesis so as to control for the effects of moderate variables (Expertise of fleet & distribution management. The study was used SPSS version 20.0 software package in the entire analysis parts.

## *3.8. Reliability and Validity of Data*

### *3.8.1. Reliability test*

The result of reliability test as measured by Cronbachôs alpha for all the 45 items of the main questionnaire part was 0.846. Route planning scored Cronbachôs alpha of 0.889, for vehicle scheduling 0.795, vehicle tracking 0.878, for vehicle repair and maintenance, 0.906, for fleet and distribution management expertise 0.775, for responsiveness of pharmaceuticals supply chain was 0.841 See table on reliability in the table 3.2 below.

**Table 3.2.Descriptive statistics Cronbach's  for Reliability test**

| **Construct** | **Item No** | **Cronbach's ** |
|---|---|---|
| **Route planning** | 8 | 0.889 |
| **Vehicle Scheduling** | 7 | 0.795 |
| **Vehicle Tracking** | 8 | 0.878 |
| **Vehicle Repair and maintenance** | 8 | 0.906 |
| **Fleet & Distribution expertise** | 7 | 0.775 |
| **Responsiveness of pharmaceuticals supply chain** | 7 | 0.841 |
| **Total** | 45 | 0.846 |

**Source, Survey data, 2020**

The reliability of the survey variables were initially tested before the hypothesis theory mentioned in previous work was verified. Firstly, in accordance with the work of (Thompson et al, 2017), The Cronbachôs  used in this study for the dimensions of each construct is higher than the critical value of 0.7, as proposed by (Nunnally, 1978), indicating that the internal consistency of the scale used in this research is excellent.

### 3.8.2. Validity test

**A. Content validity**

The idea of validity to questionnaire refers to the steps was take by the researcher to ensure clarity, wording and ordering of the questions. Thus to ensure the validity of the questionnaire, it was necessary to ask sample of the employee and leaders of the organization questions which was written precisely and clearly.

**B. Construct validity**

One measure of validity as described by Me Burney and White (2007). They were state that ñface validity is researcher was attempt to support the interpretation of the measurement and its connection to the construct was seek professional judgment that there were a plausible connection between the surface features of the measureôs content and the constructs as theoretically defined.ò One measure of validity as describe by Me Burney and White (2007).

## 3.9. Model Specification

**A. Regression model for hypotheses testing**

The algebraic expression of the hierarchal linear regression model takes the following form

$$\boldsymbol{Y = i_1 + c_1 X + c_2 Z + c_3 XZ + e_1} \text{ ……..... (1)}$$

Where $Y$ is the dependent variable (Supply chain performance/ Responsiveness of pharmaceuticals Supply Chain) , $X$ is the independent variable (transportation management) , $Z$ is the moderator variable (Fleet and distribution management expertise), and $XZ$ is the interaction of the moderator and the independent variable; $e_1$ is a residual, and $c_1$, $c_2$, and $c_3$ represent the relation between the dependent variable and the independent variable, moderator variable, and moderator by independent variable interaction, respectively. The moderating variable $XZ$ is the product of $X$ and $Z$ where $X$ and $Z$ are often centered (centered means that the average is subtracted from each observed value of the variable).

Moderator variables may be specified before a study as a test of theory or they may be investigated after the study in an exploratory search for different relations across subgroups. Although single moderators are described here referring to the situation where the relation

between two variables differs across the levels of a third variable, higher-way interactions involving more than one moderator are also possible.

According to this research context the variables;

Where;
Y = the dependent variable

$i_1$ = a constant

$c_1$ = the relationship b/n dependent variable and independent variable (YX)

$c_2$= the relationship between dependent variable and moderating variable (YZ)

$c_3$= the relationship between independent variable and moderating variable (XZ)

X1, X2, X3, X4 = the independent variable

$\varepsilon t$ = residual

Y=SP= Supply chain performance

X1=RP=Route planning

X2=VS=Vehicle scheduling

X3=VT=Vehicle tracking

X4=VRM=Vehicle Repair and Maintenance

Z=FDM=Fleet and Distribution Management

The statistical significance of the relationships between the dependent and the independent variables& Moderating variable and independent and moderate variable was measured at a confidence interval of 95%. Analysis of variance between the independent variables and dependent variables were measured at a significant level of 0.05. If the P value of the model is less than the level of significance (0.05) then the independent variables were taken as having an effect of the dependent variable with the interaction of the moderate variable. If the efficiency of the transportation management increases with the effect of increase fleet and distribution

management, then supply chain performance was increase. The study was concluded that transportation management has a significant effect on supply chain performance with the moderating effect of fleet and distribution management. If the p value is greater than 0.05 then the model is insignificant and therefore the study cannot conclude that the independent variables have get a significant effect on the dependent variables.

## *3.10. Ethical Consideration*

For this study permission letter was forwarded from JU, BECO to EPSA south west cluster, Jimma, Nekemte and Gambella branches. Then principal investigator was communicate the objective of the study with the supply chain, department head and pharmaceuticals distribution and fleet management and warehouse and inventory management teams. After getting consent from the management data collection will be started. And was informed to each respondent that the information that was collected was kept confidential.

# CHAPTER FOUR

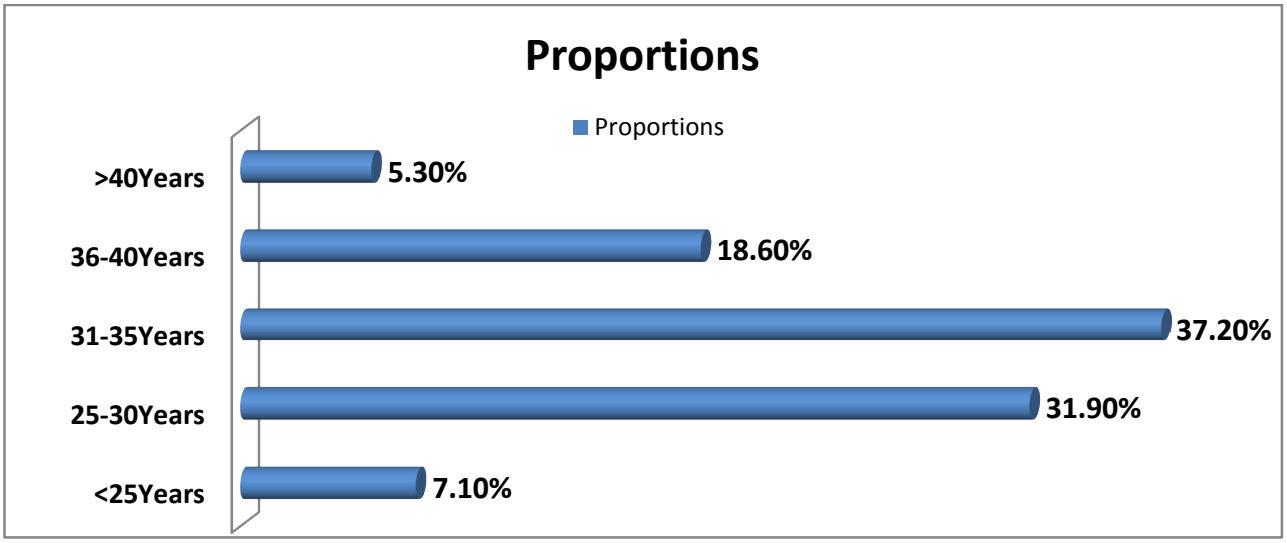
# DATA PRESENTETION, ANALYSIS AND INTERPRETATION

This chapter contains the presentation, analysis and interpretations of data. The statistical techniques that were outlined in chapter three were applied to the data, and the results obtained are presented in this chapter. The first part describes the demographic characteristics of respondents in terms of age group, education level, job position, working department, branch employer and service years. In the second part the analysis and interpretation of data gathered through questionnaire were analyzed and interpreted with descriptions of the variables with different assumption tests, result of goodness of fit test and result of independent variables effect tests.

## *4.1. Findings of Demographic Analysis*

The study sought to collect data from 123 staffôs of EPSAôs south western cluster but the researcher managed to collect 113 questionnaires. This represents a response rate of 91.87 percent which is very good for analysis. According to Babbie (2004) **a response rate of 60 percent is good and that of 91.87 percent is feasible and logical** which was near to the confidence level to the study 95%.

***Fig: 4.1.1. Age Category of Respondents***




***Source, Survey data, 2020***

This section presents background information of the respondents. Concerning the respondents percentage distribution of age category; the study found that larger proportion (37.2 %) of the respondents in the study area were aged between 31 and 35 years followed by 31.9 percent of the respondentôs aged between 25and30, 18.6 percent were in between 36-40 years. The least proportion of 5.3 percent of the respondents indicated that they were found at above 40 years of old. Therefore, most of the respondentswere found under the age group of 25-35 years and above (Figure 4.1.1). This indicates that therespondents were found at their productive and maturity age. Thus, they have potentially evaluated the agencyôs logistic functions and its supply chain performance very well.

**Table 4.1.1: Work experience of Respondents**

| Age category | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| <3years | 17 | 15.0 | 15.0 | 15.0 |
| 3-5years | 24 | 21.2 | 21.2 | 36.3 |
| 6-10years | 61 | 54.0 | 54.0 | 90.3 |
| >10years | 11 | 9.7 | 9.7 | 100.0 |
| **Total** | **113** | **100.0** | **100.0** | |

***Source, Survey data, 2020***

As indicated in the above table, respondents work experience which the finding of this study showed that, larger proportion (54%) of the participants were served for 6-10 years followed by 21.2% were serve for 3-5 years and 15 % were include respondents those serve <3 years. The least group 9.7% were served more than 10 years. This could show that as the participants experienced enough to provide information for this study and also they were found out what problems are there regarding the transportation management throughout the pharmaceuticals supply chain operations of the agency.

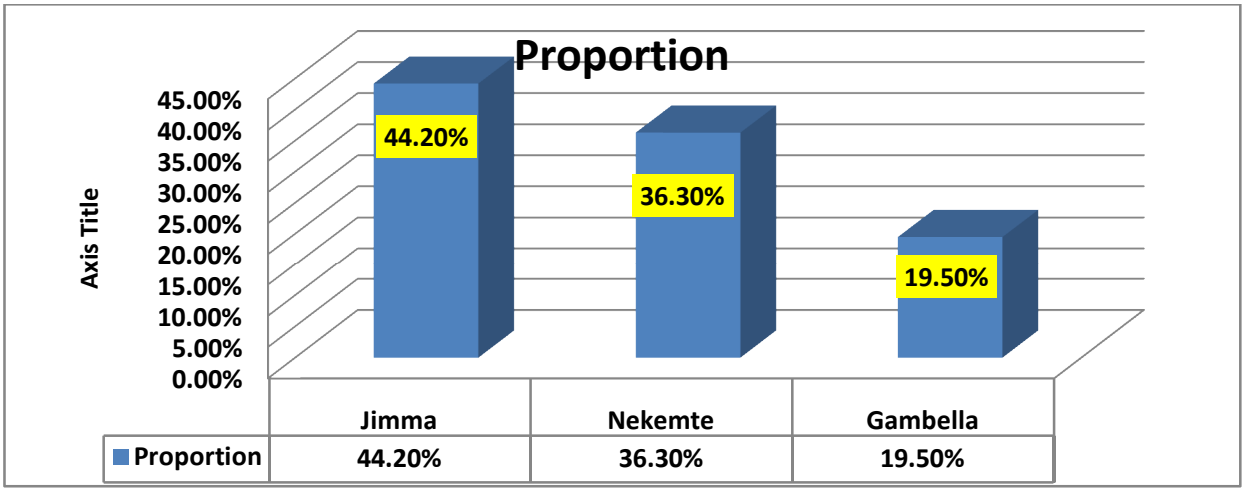
**Table 4.1.2: Educational Level of Respondents**

| Educational Level | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Diploma | 35 | 31.0 | 31.0 | 31.0 |
| 1st Degree | 63 | 55.8 | 55.8 | 86.7 |
| 2nd degree | 11 | 9.7 | 9.7 | 96.5 |
| Others | 4 | 3.5 | 3.5 | 100.0 |
| **Total** | **113** | **100.0** | **100.0** | |

***Source, Survey data, 2020***

According to the information observed on table 4.1.2, above regarding respondents educational level the finding showed that more than 55.8% of the respondents were first degree holders, followed by diploma holder(31%), 9.7% of them were hold their second degree and the remaining least group 3.5% were sorted on other groups, those were hold certificate and technique levels. The above finding implies that the agency enrolled degree levels of employees for its supply chain operations. Thus, the study participants were found at a professional level to concern the subject matter of this study.This indicated that most of the respondents are able to understand and clearly identifiespractices of transportation management factors on Supply chain performance.

**Figure 4.1.2: Respondents Proportion with their branch**




***Source, Survey data, 2020***

EPSA south western cluster was encompassing Jimma, Nekemte and Gmbella branches. The scope of this study covers all these three branches. Regarding the proportion of respondents from each branch the information observed on figure 4.1.2 above showed that larger proportion 44.2% of respondents were from EPSA Jimma branch, 36.3% were from Nekemte branch and the remaining 19.5% were from Gambella branch. As indicated on the above findings the difference of the proportions of the study participants from each branch could be happened the difference of the target population from the branches. Therefore, respondents were proportionally selected from the branches to made representative group of the cluster. The number participants from Jimma hub and Nekemte hub higher than the participants from Gambella hub. The reason for this could the branchesservice level difference.

**Table 4.1.3: Respondents Department of work in the agency**

| Departments | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Distribution | 38 | 33.6 | 33.6 | 33.6 |
| Warehouse and inventory management | 42 | 37.2 | 37.2 | 70.8 |
| General Service | 12 | 10.6 | 10.6 | 81.4 |
| Fund Administration | 8 | 7.1 | 7.1 | 88.5 |
| Forecasting & Market shaping | 13 | 11.5 | 11.5 | 100.0 |
| **Total** | **113** | **100.0** | **100.0** | |

***Source, Survey data, 2020***

Regarding the working departments of respondentsô as the information observed on table 4.1.3, above the result showed that larger proportion 37.2% of the respondents have been worked on Warehouse and inventory management team of the agency followed by the staff served on distribution team of the agency (33.6%) and least group 7.1% of the respondents have been found on fund administration team. From this we can conclude that the study participants were included mainly from WIM and distribution team of the agency. This could suggest transportation mainly integrated on the operations of this two major team of the agency. Thus, most of the participants could be efficiently measured the transportation management of the agency since their operation mainly joined the transportation functions.

**Table 4.1.4: Respondents Position in the agency**

| Positions | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Team leader | 14 | 12.4 | 12.4 | 12.4 |
| Officer | 34 | 30.1 | 30.1 | 42.5 |
| Warehouse manager | 19 | 16.8 | 16.8 | 59.3 |
| Delivery personnel | 16 | 14.2 | 14.2 | 73.5 |
| Driver | 16 | 14.2 | 14.2 | 87.6 |
| Manager | 3 | 2.7 | 2.7 | 90.3 |
| Vice manager | 1 | .9 | .9 | 91.2 |
| Dispatcher | 10 | 8.8 | 8.8 | 100.0 |
| **Total** | **113** | **100.0** | **100.0** | |

***Source, Survey data, 2020***

Regarding respondents position in the agency, the information indicated in table 4.1.4, showed that larger proportions 34(30.1%) of the participants were found at an officer level from different team; such as distribution officer, warehouse and inventory management officer, finance & forecasting officer and so on, followed by warehouse managers 19 (16.8%) and 16 (14.2%) were delivery personnel and drivers equally. The least group 1 (0.9%) were vice manager. This could support that vice manager has been found on only a cluster led branch, Jimma branch. According to the above findings the number of officers dominate others positions which met the proportions of degree holders since the title given to degree holders according to the structure of the agency. Thus, most the respondents were found middle level position of the agency and could provide valid and considerable information regarding this study.

## 4.2. Descriptive Analysis

The descriptive statistics utilized are based on frequency tables to provide information on the demographic variables. Through tables, summary statistics such as means, standard deviations, minimum and maximum are computed for each transportation management and supply chain performance in this study. The findings which identified on this study presented as follows;

Mesfin (2016) used a kind of rule of thumb to create equal intervals for a range of five points Likert scale (that ranges from strongly disagree to strongly agree in the survey questionnaire). A calculated mean value that ranges from 1 to 1.80 implies strong disagreement, a mean range from 1.81 to 2.6, from 2.61 to 3.4,from 3.41 to 4.2 and from 4.21 to 5.00 represented

respondentsô perceptions of somewhat disagree, neutral, somewhat agree and strongly agree respectively. The 0.8 served as a boundary for each elements of the measurement in the questionnaire. According to this study the average variability of the mean within the scale was 0.78, which is almost 0.8.

Accordingly, the 0.8 was a result found by dividing the difference between the maximum (5) and minimum (1) scores to the maximum score (5) of the questionnaire. In the process of examining of the data, standard deviation was used. Small standard deviations (relative to the value of the mean itself) indicate that data are close to the mean whereas a large standard deviation (relativeto the mean) indicates that the data points are distant from the mean. The mean is a poor fit of the data. Standard deviation is a measure of how well the mean represents the data (Field 2009). All of the variables were measured using a five point likert scale where 1 stands for Strongly Disagree and 5 stands of Strongly Agree. Therefore the interpretation made using the mean of each variable, as a matter of fact the mean falls between the two ranges, hence if the mean approaches to 1 the interpretation would be the respondents didnôt agree on the raised issue or variable and if it approaches to 5 the reverse would be true.

**Table 4.2.1: Descriptive Statistics of Supply chain performance & Transportation management**

| Variables | Mean | Std. Deviation | N |
|---|---|---|---|
| **Responsiveness of Pharmaceuticals Supply Chain** | 4.05 | 1.007 | 113 |
| **Route Planning** | 3.75 | 1.285 | 113 |
| **Vehicle Scheduling** | 3.85 | 1.136 | 113 |
| **Vehicle tracking** | 3.65 | 1.280 | 113 |
| **Vehicle Repair & Maintenance** | 3.54 | 1.310 | 113 |
| **Fleet & Distribution Management** | 3.99 | 1.048 | 113 |

***Source, Survey data, 2020***

Table 4.2.1; represents the calculated means and standard deviations for the dependent variable (supply chain performance) and independent variables (route planning, scheduling, vehicle

tracking and vehicle repair and maintenance,) and moderating variable Fleet & Distribution Management. The mean of route planning is 3.75 which showed that average employees on the study areas were nearly agree for the effect of route planning on the supply chain performance on the study area. This could imply route planning of EPSAôs at south western cluster could able to exert an effect on the performance of pharmaceuticals supply chain. Similarly the means of scheduling shows that (3.85) this figure was reveals almost an agreement on average employees on the study area for the effect of scheduling on the supply chain performance on the study area.

This could imply the effect of scheduling slightly higher than route planning on the agency supply chain performance. Whereas the mean value of vehicle tracking and vehicle repair and maintenance were 3.65, and 3.54 respectively the findings showed that almost agreement of employees to the effects of vehicle tracking and VRM respectively on the supply chain performance of the agency at study areas. This could assure as vehicle tracking and VRMhad been rated as lessefficiently operated than route planning and scheduling on the agency. The reason for this might be due to the existing system at the agency and also commitment of the employees which operated the tasks and the functionality which the practically installed GPS for vehicle tracking had been poor

However, the findings the GPS had not been applied for decision making except simply for reporting purpose. The main gap on VRM at the agency is the vehicle maintenance and repair has been conducted at center level for all branches. This might be a possible reason of time lag of the service activities of the vehicles and the supply chain performance could reflect a gap with regards to its responsiveness. The mean value of the moderating variable, fleet and distribution management is 3.99 which was indicate that average number of the respondents were agree the clusterôs fleet and distribution management agreeable effect of the pharmaceuticals supply chain performance of the agency. This implies that the fleet and distribution management of the cluster could assist the transportation management to enhance the supply chain performance of the agency. However, the mean value for supply chain performance (responsiveness) was 4.05, which has indicated agreement response of employees for its effectiveness at the cluster. According to the above findings the existing status of the supply chain performance mainly supported by route planning and scheduling through the moderating effect of fleet and distribution management.

### 4.2.1. Descriptive Findings of Route Planning

Route planning systems specify the sequences in which the selected transport vehicles should supply the demand points by requested quantities of goods. To find the most cost-effective trips traveling salesman models can be used. This study was identified the descriptive findings of route planning through the transportation management of EPSAôs south western cluster. Thus, the findings presented as shown below.

**Table 4.2.2: Route planning Practices at EPSA South western Cluster**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| The agency route planning maximize use of good roads | 3.85 | 1.115 | 113 |
| The agency planned short cut use of poor roads | 3.79 | 1.111 | 113 |
| Planning route of the agency take account for fuel availability | 3.86 | 1.039 | 113 |
| Route planning considers public health facilities found on their road access | 4.04 | .990 | 113 |
| Planning delivery route concerned as the vehicles securely parked during overnight stops. | 3.84 | .862 | 113 |
| There is arranged delivery routes and vehicle start each journey fully loaded | 3.72 | .930 | 113 |
| Experienced drivers consulted before deciding on the route. | 3.21 | .910 | 113 |
| Routes are planned as resources are used economically | 3.72 | .836 | 113 |

***Source, Survey data, 2020***

More particularly, employees tended to agree that the following route planning mechanisms were being used in the agency. The agency route planning maximize use of good roads(m=3.85, SD=1.115); the agency planned short cut use of poor roads (m=3.79, SD=1.111); planning route of the agency take account for fuel availability (m=3.86, SD=1.039); route planning considers public health facilities found on their road access (m=4.04, SD=.990); planning delivery route concerned as the vehicles securely parked during overnight stops(m=3.84, SD=.862); there is

arranged delivery routes and vehicle start each journey fully loaded (m=3.72, SD=.930);and routes are planned as resources are used economically (m=3.72, SD=.836). However employees tended to be neutral only for experienced drivers consulted before deciding on the route (m=3.21, SD=.910) which was the mean found in the range of 2.61-3.4 for average number of employees provide neutral response for the activity.

These results imply that the agency operating in the south western cluster recognize the important implementation of route planning for the effective practicing of transport management play towards increasing responsiveness of pharmaceuticals supply chains. In response to this, the agency could be achieved better responsiveness for its pharmaceuticals supply chain through using short cut road, taking account fuel availability in its route planning, considering the facilities road access to deliver products with appropriate vehicles, and also identify secure parking for vehicles during route planning and also arranging effective way of delivery route for pharmaceuticals distribution. However it was not sure that the agencies have been consulting experienced drivers before deciding route plan. This could essential point that the agency has been confirmed the aspects since it have been essential on deciding the mechanism for the route planning.

### 4.2.2. Descriptive Findings of Vehicle Scheduling

This paper investigates the effects of vehicle scheduling in a transportation system composed of cross-docking and Vehicle Routing Problem (VRP) approaches in supply chain to minimize total delays in ordersô delivery. The supply chain consists of some suppliers who are spread in different geographical zones and an integrated transportation system consisting of multiple vehicles. Therefore, the descriptive findings of vehicle scheduling presented as shown below.

**Table 4.2.3: Descriptive findings of Vehicle Scheduling**

| | Mean | Std. Dev | N |
|---|---|---|---|
| Vehicles are loaded pharmaceuticals according to the order of the facilities destination | 4.00 | 1.150 | 113 |
| Vehicle item selected according to the road status of the delivery route | 4.00 | 1.141 | 113 |
| Appropriate vehicle size arranged according to the order size to be loaded | 3.91 | 1.138 | 113 |
| Facilities are arranged for delivery according to their resupply period | 4.04 | 1.180 | 113 |
| Vehicles are arranged timely for order fulfillment during the resupply period | 3.71 | 1.184 | 113 |
| Items are integrated/product mix during the delivery of pharmaceuticals product | 3.62 | 1.117 | 113 |
| Right vehicles are assigned according to the products characteristics to keep product safety | 3.71 | 1.093 | 113 |

***Source, Survey data, 2020***

Based on the above mean results of the respondents regarding Vehicle scheduling practices of the agency as a transportation management factorspresented as shown below;

More particularly, employees tended to agree that the following vehicle schedulingpractices were being used in the agency. Vehicles are loaded pharmaceuticals according to the order of the facilities destination (m=4.0, SD=1.150); Vehicle item selected according to the road status of the delivery route (m=4.0, SD=1.141); Appropriate vehicle size arranged according to the order size to be loaded (m=3.91, SD=1.138); Facilities are arranged for delivery according to their resupply period (m=4.04, SD=1.180); Vehicles are arranged timely for order fulfillment during the resupply period. (m=3.71, SD=1.184); Items are integrated/product mix during the delivery of pharmaceuticals product (m=3.62, SD=1.117); and Right vehicles are assigned according to the products characteristics to keep product safety (m=3.71, SD=1.093).

These results imply that the agency recognize the importance of vehicle scheduling for its transportation management. The practices of vehicle scheduling in the study area which was acceptable according the evaluation made by the employees. In response to this, the agency could be achieved better responsiveness for its pharmaceuticals supply chain through loading the pharmaceuticals according to the sequence of the facilities arrangement to facilitate effective delivery pattern, selecting vehicles according to the road status of the distribution site, arranging facilities for delivery according to their resupply period , arranging vehicles for the order fulfillment during the resupply period and also items are integrated/product mix during the delivery of the products. The above findings could indicate the agency vehicle scheduling mechanism which was convincing on improving the performance the pharmaceuticals supply chain performance. It could be support the responsiveness of the pharmaceuticals supply chain through product mixing during delivery, keeping the fixed lead time for delivery and maintaining the delivery speed with arranged route plan.

### 4.2.3. Descriptive Findings of Vehicle Tracking

Sharon (2012) Noted that main goals of any fleet management system are to provide information to improve efficiency, decrease downtime and in-service breakdowns, reduce inventory, lower ownership cost and avoid waste. The selected software should provide detailed vehicle information such as: downtime, percentage of downtime, total miles traveled and cost/mile. It should be able to provide information on mechanicsô efficiency and productivity. This study could be identified the descriptive findings of vehicle tracking and hence the results were presented under on the table below.

**Table 4.2.4: Descriptive findings of Vehicle Tracking**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| The organization is using the vehicle tracking system for fleet management | 3.89 | 1.080 | 113 |
| The organization has modern technology of GPS for vehicle tracking system | 4.00 | 1.024 | 113 |
| The organization has installed vehicle tracking system on all EPSA vehicles | 3.82 | 1.095 | 113 |
| The organization assigned a person to monitor and manage the GPS tracking system | 3.76 | 1.044 | 113 |
| The organization supervises speed limit by GPS tracking system | 3.35 | 1.117 | 113 |
| The organization provide immediate solution for problems encounter in vehicle tracking | 3.38 | 1.094 | 113 |
| The organization used the Tracking system to manage fuel consumption and maintenance scheduling. | 3.31 | 1.040 | 113 |
| Allocation vehicle/ delivery Routing as required by the organization | 4.17 | .990 | 113 |

***Source, Survey data, 2020***

According to the mean analysis of the study variables concerning vehicle tracking based on the findings indicated above on table 4.2.3, this study showed that, õThe organization is using the vehicle tracking system for fleet managementô (m=3.89), which mean average number of respondents were agreed on the statement indicated above. This imply that the agency have been implemented vehicle tracking system on its fleet management system. Thus, if vehicle tracking system there the agency could improve its vehicle utilization in order to enhance the responsiveness pharmaceutical supply chain. Practically, the agency had been followed vehicle brake down time/Idle time, & speed with its existing vehicle tracking system.

Concerning implementing modern vehicle tracking system/GPS on the agency fleet management the study showed that; õThe organization has modern technology of GPS for vehicle tracking systemô (m=4.00), which mean average number of respondents were agreed on the statement indicated above.Technological communication improvements in the business

environment have allowed for better planning through the use of electronic data interchange (EDI), radio frequency identification (RFID), satellite navigation, and so on (Waters, 2009). Thus, the agency through implementing modern vehicle tracking system/GPS which achieved better management of fleet with improved navigation, communication and better planning for route and distribution.

On the other hand ǒThe organization has installed vehicle tracking system on all EPSA vehiclesô & ǒThe organization assigned a person to monitor and manage the GPS tracking systemô with (m=3.82 & 3.76-) respectively which average number of respondents were agree on both the above statements. These could suggest EPSA had been installed for all its trucks/Vans a vehicle tracking system. This could be ensured that efficiently utilization of the existing vehicles at the agency which could be supported to the improvements of the pharmaceuticals responsiveness of the agency. Additionally, the agency had been assigned a person to monitor and manage the GPS tracking system. This was practically suggested by the agency had been trained 2 persons/branch one from distribution team and the other from general service on monitoring and managing GPS tracking system for the vehicles which functioned at the agency. This could be indicated that the agency had been a responsible person for monitoring GPS tracking system at the branches. And hence, the agency had been track vehicles data for decision making on the vehicles utilizations of the agency.

About the organization supervises speed limit by GPS tracking system, the organization provide immediate solution for problems encounter in vehicle tracking and The organization used the Tracking system to manage fuel consumption and maintenance scheduling ( with m= 3.35,3.38 & 3.31) respectively which average respondents were had neutral attitudes/response for the above statements. This could signify that supervised speed limit by GPS tracking system, giving immediate solutions for problems encounter and the tracking system managing fuel consumption and maintenance scheduling had been conducted smoothly at the agency, as a result could not able to convince employees of the agency. According the report of the agency which stated that even though some improvements made on the transportation management system of the agency with implementing GPS tracking transport management there is a weakness in the system of issuing of fuel to the vehicles and the total amount of fuel consumed and the cost keeps going up each year, lack of maintenance garage at the branch level, and

former poor transportation tracking system (EPSA, 2019). So, the agency should have strengthened the tracking system to be fully implemented applicable for better improvements of vehicles utilization and monitoring.

### 4.2.4. Descriptive Findings of Vehicle Repair & Maintenance

Although vehicle maintenance policies are predominantly governed by safety, it is important to remember that vehicle performance and fuel consumption are also affected by maintenance standards.

**Table 4.2.5: Descriptive findings of Vehicle Repair & Maintenance**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| The organization has successful vehicles repair and maintenance control system. | 3.59 | 1.072 | 113 |
| The organization has regular Vehicle servicing time (Mileage) schedule. | 3.77 | 1.098 | 113 |
| The organization has well organized control mechanism for genuine spare part used for vehicle service and maintenance. | 3.54 | 1.142 | 113 |
| The organization has professional fleet manager and maintenance controller. | 3.63 | 1.149 | 113 |
| The repair and maintenance garage complete the service and maintenance on time. | 3.26 | 1.068 | 113 |
| The vehicles of the organization donôt have frequent technical failure after service and maintenance | 3.36 | 1.164 | 113 |
| Drivers of the organization gives proper feedback for fleet department about service and maintenance of the assigned vehicle | 3.65 | 1.187 | 113 |
| The fleet department of the organization handles complaint regarding service and maintenance appropriately. | 3.52 | 1.089 | 113 |

***Source, Survey data, 2020***

Based on the mean analysis of the study variables concerning vehicle repair and maintenance practices of the agency the findings indicated above on table 4.2.4, this study showed that, ôThe

organization has successful vehicles repair and maintenance control systemô (=3.59) which was indicated average number of respondents were almost agree on the indicated statement. This could imply that the vehicles at the agency were found under functioned repair and maintenance control system. Thus, as the vehicles had a well maintenance and repair they were functioned well and could assist the responsiveness of the pharmaceuticals supply chain. ôThe organization has regular Vehicle servicing time (Mileage) scheduleô (=3.77) which was indicated average number of respondents were almost agree on the indicated statement with at a higher rate that of the successfulness the vehicle repair &maintenance of the agency. Practically, each vehicle at the agency had been allocated for service when it reaches 10,000 km of travel. The defect identified before the Km reaches had been maintained at a local garages. Thus, the vehicles of the agency had a servicing time according to their functioning km on the agency operations.

ôThe organization has well organized control mechanism for genuine spare part used for vehicle service and maintenanceô (=3.54) which was indicated average number of respondents were almost agree on the indicated statement. This could imply that the vehicles could replace the spare parts which are an original from the companyôs. Thus, the maintenance and repair of the vehicles could keep the vehicles functions as a first time. This could suggest the vehicles keep the speed normal after repairmen and could fasten the delivery of the pharmaceuticals products and hence had a considerable effect on a responsiveness of the pharmaceuticals supply chain. ôThe organization has professional fleet manager and maintenance controllerô (=3.63) which was indicated average number of respondents were almost agree on the indicated statement. This implies that the agency could be assured a mechanics as a professional for its vehicles maintenance controller. Practically, the agency could assign the professionals for this purpose at the central office level. Thus, the agency could be approved the vehicles maintenance with its professional controller. This might be ensured the efficiency of the maintenance of the vehicles.

ôThe repair and maintenance garage complete the service and maintenance on timeô and ôthe vehicles of the organization donôt have frequent technical failure after service and maintenanceô (=3.26 & 3.36) respectively which were indicated average number of respondents were almost had a neutral responses on both the indicated statements since their mean less than 3.42. The above findings imply that the agency contracted garage repair and maintenance garage not

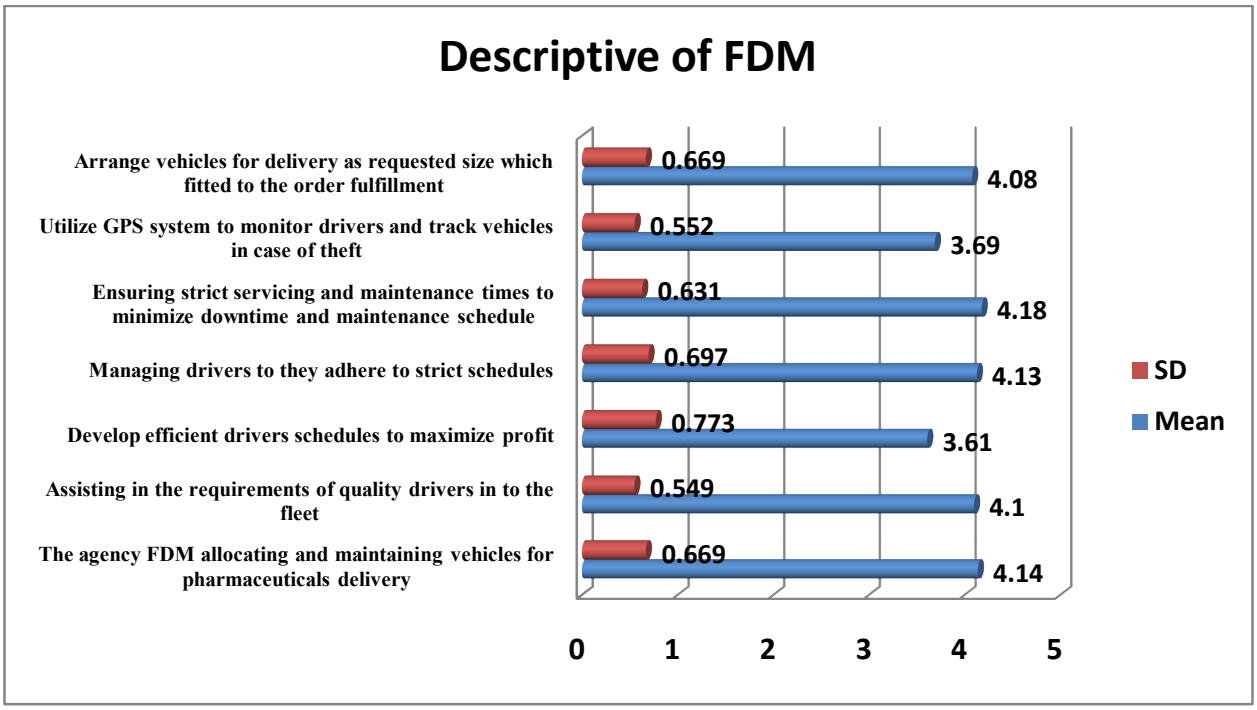
convincing for its completing the service and maintenance on time. Thus, the garage might be not released the vehicles at its first appointment. This might be a possible reason which led to pharmaceuticals distribution delay. As a result it creates a considerable gap on the responsiveness of pharmaceuticals supply chain. Similarly, respondents were not agreeing for the statement of lack of failure after servicing and maintenance. This implies that as there were a probability of frequent technical failure to be happened after servicing and maintenance. This could disturb the functionality of the vehicles and made a time gap on the pharmaceuticals distributions and could challenge for the responsiveness of pharmaceuticals supply chain.

Regarding ôDrivers of the organization gives proper feedback for fleet department about service and maintenance of the assigned vehicleô and ôThe fleet department of the organization handles complaint regarding service and maintenance appropriatelyô ( =3.65 & 3.52) respectively which was indicated average number of respondents were almost agree on the indicated statements. This could imply as drivers of the agencies had a potential to provide proper feedback to their department and also the fleet department could be able to handle compliant regarding service and maintenance appropriately. This could suggest the agency could be approving the service and maintenance after analyzing the feedbacks from the drivers and handling the possible complaints.

### 4.2.5. Descriptive Findings of Fleet & Distribution Management

The intention here is to provide a conceptual basis for monitoring systems and fleet management, which are functionally different. Fleet management focuses on providing the company with a means to manage its assets through control of the different variables involved in the process. Monitoring has as its objective, the exact product location, tying in with other variables related to the performance of the assets and the professional staff involved (Mauro, 2012).

**Figure 4.2.5: Descriptive findings of Fleet & Distribution Management**




***Source, Survey data, 2020***

Regarding the FDM expertise of the agency according the mean analysis information which indicated above on figure 4.2.5 above, the findings showed that, ôThe agency FDM allocating and maintaining vehicles for pharmaceuticals deliveryô (m=4.14) which indicated that average number of respondents were agree on the above indicated statement. This implies that EPSA south western cluster FDM could allocate and maintaining vehicles for pharmaceuticals delivery. This could suggest that the expertise which found in FDM could able to add a contribution to support the supply chain operations. As a result this might be improving the overall transportation management of the agency to enhance the pharmaceuticals supply chain responsiveness. According to Lyson (2006) argue that the fleet management function should deeply engage in customer tracking and evaluation activity which involves reviewing customer performance and requirements. This helps to identify where a logistics firm is not providing adequate customer service or where improved customer service could increase supply chain performance. Thus, allocating & maintaining for pharmaceuticals delivery an input for adequate customer service which had a value to increase the supply chain performance.

Concerning ôAssisting in the requirements of quality drivers in to the fleetô (m=4.10) which indicated that average number of respondents were on the above indicated statement. This implies that the FDM expertise at the study area could assist in ensuring quality drivers in the fleet operations. Drivers are a critical component in Field Vehicle Fleet Management, Mejza, et al. (2003), the authors noted that find the best performers of motor carriers in the US as to driver management practices. They find that careful hiring processes lead to better performance. Thus FDM expertiseôs in the study area were support the pharmaceuticals supply chain performance through identifying the requirements of quality drivers in to the fleet of the agency. ôDevelop efficient drivers schedules to maximize profitô (m=3.61) which indicated that average number of respondents were almost agree on the above indicated statement. This implies the drivers had been scheduled the vehicles for service and maintenance based the set of criteria. This could help the vehicles to keep their functions effectively. Therefore, this might be giving a considerable effect on the responsiveness of the pharmaceuticals supply chain.

Baas (2012) the author identified Steps taken to improve driver management included, Developing a comprehensive prestart check sheet, ensuring that drivers understand that they are responsible and accountable for their actions , improving driver recruitment procedures, including the use of pre-employment external assessments, requiring all new staff to complete a comprehensive in-house induction and training program (new staff remained under training until being assessed as fully competent by a qualified driver trainer) , educating and coaching drivers about vehicle standards and visual inspections. This study showed that ôManaging drivers to they adhere to strict schedulesô (m=4.13) which indicated that average number of respondents were agree on the above indicated statement. This implies that the agency FDM could had an effort to manage drivers for adhering themselves to strict schedules concerning the agency operational efficiency. Thus, this might be assist the agency transportation management in order to enhance the responsiveness of the pharmaceuticals supply chain through reduce/maintain the lead time of pharmaceuticals delivery and order fulfillment as per the customer demand.

It is essential to remind drivers of their responsibility to undertake daily walk-around checks of vehicles. This not only helps to ensure that vehicles remain in legal roadworthy condition, but also helps identify common problems such as oil and water leaks and incorrect tire pressure. There is also scope to make improvements in the way maintenance facilities themselves are

operated (Richardson, N. 2011). The finding of this study about óEnsuring strict servicing and maintenance times to minimize downtime and maintenance scheduleô (m=4.18) which indicated that average number of respondents were agree on the above indicated statement. This could suggest the FDM the agency had been pay a great role on following strict servicing and maintenance times to minimize down time and maintenance schedule. Therefore, the FDM had a considerable role on the transportation management of the agency through ensuring strict servicing and maintenance schedule. By doing this the agency tries to minimize the down time of the vehicles and enhance their functions on the pharmaceuticals SC operations. Thus, FDM could support on improving the responsiveness of the PSC.

The number of trips made by these trucks carrying containers is very high, and only a small percentage of the containers are inspected. Losses of containers loaded due to theft, accidents and damages, and fleet unavailability is unfortunately increasing time to time. It seems like no local studies have been conducted about the practice and challenge of the implementation of the new technology on the logistic system in Ethiopia, particularly in companies under the supervision and control of ERCA. (ERCA, 2016). In this study concerning óUtilize GPS system to monitor drivers and track vehicles in case of theftô the result showed that (m=3.69) which indicated that average number of respondents were almost agree on the above indicated statement. This implies that the agency could able to track vehicle information through GPS to some extent. As a result, the agency could able to follow informal driversô activities through evaluating their idle time beyond their destination. Thus, this might exert a pressure to fasten the delivery of pharmaceuticals through reduction of unnecessary down time of the vehicles. According to (Mauro, 2012)the current logistics systems require real-time monitoring andinteraction with fleet vehicles in order to achieve high utilization and rapid responses tocustomer needs. The technology needed to support real-time logistics requires mobilecommunication, GPS (Global Positioning System) and GIS (Geographical Information Systems), combined with information systems.

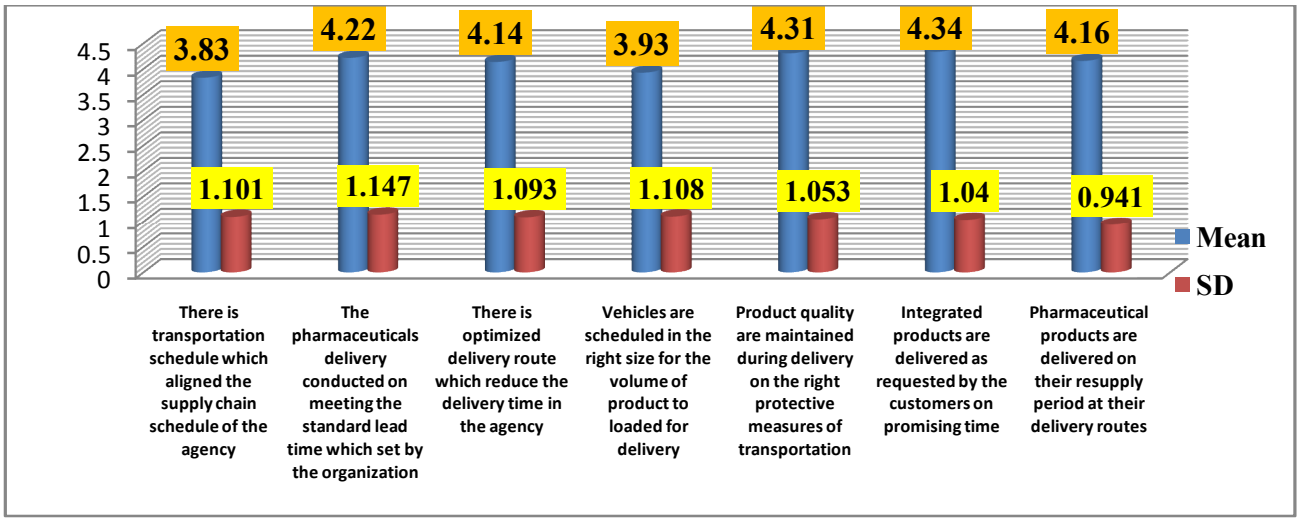
Regarding the issue of óArrange vehicles for delivery as requested size which fitted to the order fulfillmentô (m=4.08) which indicated that average number of respondents were agree on the above indicated statement. The above finding could suggest that the agency could be arranging the vehicles which fitted to the order fulfillment. In the real data allocate vehicles with different

van sizes for each branch. This might be ensures the above issues. Therefore EPSA loaded pharmaceuticals efficiently according to the vehicles arranged for delivery. This might be support to make better the order fulfillment of the customer.

### 4.2.6. Descriptive Findings of Responsiveness of PSC

Responsiveness is therefore constituted by the systemôs response dimension of its external flexibility types. For the purpose of this and further studies, the following definition will be adopted: *The responsiveness of a manufacturing or supply chain system is defined by the speed with which the system can adjust its output within the available range of the four external flexibility types: product, mix, volume and delivery, in response to an external stimulus, e.g. a customer order.* The descriptive findings about the responsiveness of pharmaceutical supply chain presented as shown below.

**Figure 4.2.6: Descriptive analysis of Responsiveness of Pharmaceuticals Supply Chain**




***Source, Survey data, 2020***

Based on the above mean results of the mean analysis ôThere is transportation schedule which aligned the supply chain schedule of the agency ó(m=3.83) which indicated that average number of respondents were agree on the above indicated statement. This implies that the agency could schedule the transportation access with the vehicles avail for its supply chain schedule as a means of operational response. By doing this the agency could able to fasten its delivery of pharmaceuticals. This might signify an improvement on a time and order fulfillment. The above

findings also justifies the coordination exists between transportation and supply chain for their integrated schedule. Coordination is also including every effort in developing delivering and producing a product or service to customer (Lao *et al.,* 2008).

õThe pharmaceuticals delivery conducted on meeting the standard lead time which set by the organizationô ó(m=4.22) which indicated that average number of respondents were strongly agree on the above indicated statement. Since pharmaceutical supply chain had a great concern on public health service inputs it had a great concern of keeping the lead time to the pharmaceuticals delivery to refill public health facilities. Practically the agency with a lead time of one month delivers pharmaceutical for the refill period of 2 months stock. Based on this fact the agency could able to deliver pharmaceuticals from the reporting period up to one month to the respected public health facilities. Thus, the agency might be ensured its time response for the pharmaceuticals delivery.

õThere is optimized delivery route which reduce the delivery time in the agency óó(m=4.14) which indicated that average number of respondents were strongly agree on the above indicated statement.[Alinezhad et al., 2018] discussed Vehicle Routing Problem (VRP) considering simultaneous delivery and pickup and time windows. However, optimized route had improved delivery and pick up windows. Thus, the agency had optimized route, as a result, exert a positive effect on responsiveness of the PSC with its improved delivery and pick up time window. õVehicles are scheduled in the right size for the volume of product to loaded for deliveryô (m=3.93) which indicated that average number of respondents wereagree on the above indicated statement. This implies that the agency pay a concern to arrange vehicle size according to the volume of products to be loaded for delivery. This could suggest the agency could be responds for the quantity of pharmaceuticals products which requested by public health facilities. Thus, the agency could be respond for the order fulfillment of the customers with loading the right quantity of products with the right transportation means. However, this issue might be affected rather than size of the vehicle, but due to products availability at the depot.

õProduct quality are maintained during delivery on the right protective measures of transportationô (m=4.31) which indicated that average number of respondents were strongly agree on the above indicated statement. Practically, the agency vehicles for transportation of

pharmaceuticals were maintained with thermo stat and refrigerator van for vaccine distribution. Thus, the pharmaceuticals required temperature maintained during the delivery with the protection of sun light and rain. Vaccine had been distributed with cold chain equipped vehicles. Thus, the agency could be ensured a protective measure for pharmaceuticals during their transportation. This implies that the requested amount of pharmaceuticals products might be reached to the customers with their required quality. This could be ensured the order fulfillments of the customers.

"Integrated products are delivered as requested by the customers on promising time" (m=4.34) which indicated that average number of respondents were strongly agree on the above indicated statement. This implies that EPSA had been delivered varied health program pharmaceuticals products integrate. According the real data of the agency various products used to be managed using vertical systems. Family health products were managed by Ministry of Health route using the quarterly logistics reports from the lower levels.Anti-TB and Leprosy drugs are also managed by the ministry of health route but there was no defined reporting and resupplying schedule. HIV/AIDs pharmaceuticals and supplies were distributed by the PFSA distribution networks though PFSA central, PFSA Hubs and then to health facilities using monthly LMIS reports. This could be ensured the order fulfillment and also keeping lead time for promising time and also identified product mix as a response for varied health program pharmaceuticals demand of the facilities.

"Pharmaceutical products are delivered on their resupply period at their delivery routes" (m=4.16) which indicated that average number of respondents were agree on the above indicated statement. This implies that the agency could be delivered pharmaceuticals for the facility every other month of the resupply period for both even and odd month routes. This could suggest as the agency performed well on regarding its responsiveness towards the pharmaceuticals supply chain and ensuring better health provisions at the public health facilities.

### 4.2.7. Summary of Qualitative Data from Interview Guide

According to the response from the higher Officials of EPSA south western cluster, which gathered during the interview conducted with some questions in interview guide for further elaboration the results were summarized as follows;

Regarding the transportation management practices of the cluster the higher officials stated as it was good, however, its on the way for improvement to be made it better then best. Based on the trends which practiced on the cluster for the purpose of product delivery to the facility, currently the route has been planned on traditional way according to the facilities geographically setting. The agency collected the necessary data at each branch with the supporting partner Chemonics to conduct route optimization. The tasks have been attempted to provide a significant change on the route alignment of the facilities at the distribution network. This could helps the Agency on the efficiently utilization of the vehicles for transportation.

In relation to vehicle scheduling the agency scheduled the vehicles for pharmaceuticals distribution as well as for servicing. The route plan prepared regularly for distribution also integrates vehicle scheduling for order fulfillment. Based the road status at each route the capacity of the vehicle considered for the road category and guides the vehicle scheduling. Additionally, the size of shipment is the other point to determine the vehicle size to load the order arranged.

Currently, the agency implemented GPS to improve the vehicle tracking practices. The officials also noted that the agency not yet begin to utilize each GPS data for decision making. However not all branches utilize GPS data efficiently. This might be indicating that as there was a gap of skill on data generating implementing for decision among the assigned persons at the branches. This provides an insight the agency should have to facilitate skill transfer strategies between branches. In the cluster under this study Jimma branch rated driversô performance based on GPS data which traces that driving on the limited speed and idle time of the vehicle. This could improve the efficiency of vehicle utilization on the safe and economical ways.

Concerning the vehicle repair and maintenance the higher officials stated that vehicles are scheduled for repair and maintenance. Each vehicle after serving 10000 km it should have to stop for servicing the vehicle. However, the repair and maintenance had been done at the center level. Once the vehicles sent for repair it has been stayed there on average date of 1 to 2 months. This creates a potential gap on the pharmaceuticals supply chain performance. But the severity of this created gap managed through transferring excess vehicle from branch to branch within a cluster. During reduced the number of vehicles due to repair and maintenance the branch could fail to distribute products to the facilities on the attempted lead time.

According to the information obtained from the higher officials at the cluster the task of fleet and distribution conducted in collaboration of general service and distribution team of the agency. The distribution plan the distribution route and the vehicle demand and share this plan for the general service team and the general service allocate vehicle as per the plan on the indicated operation day.

Based on the identified information which stated by the higher officials the agency have been faced some challenges due to poor accessibility the facilities poor infrastructure of the roads create damage of vehicles, delay of the distribution. The other challenges on the other side were long down time of vehicles during the servicing time. This could be creates shortage vehicles for the operation purpose and hence creates delay of products delivery.

Generally, the officials noted that the supplement vehicles necessary since the number facilities at the catchments increases time to time which could be increase the scope of the distribution network for each branch. Thus, additional vehicles for the hub should have to allocate to overcome the operational size increment and improves the responsiveness of pharmaceuticals supply chain.

## 4.3. Result of Inferential Statistics

### 4.3.1. Regression assumption testing (Residual analysis)

The responses data were added together using variable addition tools of the SPSSto form new set of combined variables. These combined (aggregated) results gavethe transformed data set from ordinal type to a scale type, which is suitable toapply multiple linear hierarchal regressions. However, before the application of the regressionmodel, the classical assumption of regression) was tested through residuals (dependent variable) analysis in terms of the following factors:

#### (a) Sample characteristics (Normality Testing)

**Normality testing—**The purpose of normality testing is to know that all data of independent and dependent variables have normal distribution. For data to be normal, they must have the form of a bell curve, or Gaussian, distribution, with values dropping off in a particular fashion as they increase or decrease from the mean. Specifically, a normal distribution contains 65.4% of the data within ±1 standard deviation from the mean *(Dan Flynn, Studentguide to SPSS).* In normality test, the Sig. (p) value is compared to a priori alpha (Ŭ) level (level of significance for

the statistic) ï and a determination is made as to reject (p <Ŭ) or retain (p >Ŭ) the assumption. In this research, normality testing was done based on Shapiro-Wilks test statistic, in which:

According to normal Q-Q plots and box plot showed that the data for route planning, vehicle scheduling, vehicle tracking, vehicle repair and maintenance, fleet & distribution management and supply chain performance were normally distributed with the value of asymptotic significance (p-value) 0.429 which is higher than alpha (Ŭ = 0.05). The value of asymptotic significance for route planning was 0.373, for vehicle scheduling was 0.422, for vehicle tracking 0.360, for VRM 0.400, for FDM 0.548 and for supply chain performance 0.473 (See on the on table 4.3.1) below.

**Table 4.3.1.: Sample characteristics (Normality Testing)**

| | Descriptive Statistics | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No of items | Skewness | | Z-value of skewness (Skew/Standard Error of skewness | Kurtosis | | Z-value of kurtosis (kurtosis/ Standard Error of kurtosis | Observed correlation coefficient r-value | Critical value From Pearson's r-table | Sig. (pvalue) (2tailed) |
| | | Statistic | Std. Error | | Statistic | Std. Error | | | | |
| **Route Planning** | 8 | -0.425 | 0.227 | -1.872 | -0.387 | 0.451 | -0.858 | 0.739 | 2.571 | 0.000 |
| **Vehicle Scheduling** | 7 | -0.362 | 0.227 | -1.595 | 0.808 | 0.451 | 1.791 | 0.779 | 2.571 | 0.000 |
| **Vehicle Tracking** | 8 | -0.395 | 0.227 | -1.740 | 0.829 | 0.451 | 1.838 | 0.764 | 2.571 | 0.000 |
| **Vehicle repair and maintenance** | 8 | -0.355 | 0.227 | 1.564 | 0.668 | 0.451 | 1.481 | 0.713 | 2.571 | 0.000 |
| **Fleet & Distribution Management** | 7 | -0.431 | 0.227 | -1.899 | 0.758 | 0.451 | 1.681 | 0.726 | 2.571 | 0.000 |
| **Responsiveness of pharmaceuticals Supply Chain** | 7 | -0.374 | 0.227 | -1.647 | 0.823 | 0.451 | 1.825 | 1.00 | 2.571 | 0.000 |

***Source, Survey data, 2020***

**Note:** 1. Standard error of Skewness for supply chain performance, Route planning, Vehicle scheduling, vehicle tracking, vehicle repair and maintenance and FDM expertise is 0.227 each and standard error of their kurtosis is 0.451. Z-value should be somewhere -1.96 and +1.96. Z-value can be determined bydividing the observed measure of skewness or kurtosis by their respective standarderror. Skewness and Kurtosis measures should be as close to zero as possible. In reality, however, data are skewed and kurtosis. A small departure from zero is therefore no problem as long as the measures are not too large compared to their standard errors. As a consequence we must divide the measures by their standard errors. This will give us the z-value.

**(b) Sample characteristics of Multico linearity**

**Multico linearity Testing—**Multi co linearity is a condition in which one or more independent variables are in a linear contribution with other independent variables (Suyono&Hariyanto, 2012). A useful approach is the examination of the variance inflation factors (VIFs) or the tolerances of the explanatory variables. The VIFs are inversely related to the tolerances with larger values indicatinginvolvement in more severe relationships (according to a rule of thumb, VIFsabove 10 or tolerances below 0.1 are seen as a cause of concern). (Sabine L. &Brian S.E., 2004). Hence, in this research multico linearity testing wasconducted from variance inflation factor (VIF) in which:

- If the value of VIF lies between 1 &10 is less than 10 or tolerance more than 0.1, there is no multico linearity;
- If the VIF <1 or >10 or tolerance less than 0.1, then there is multico linearity.

**Table 4.3.2: Co linearity statistics**

| Variables | Tolerance | VIF |
|---|---|---|
| Route planning | .468 | 2.136 |
| Vehicle Scheduling | .374 | 2.675 |
| Vehicle Tracking | .454 | 2.200 |
| Vehicle Repair and maintenance | .431 | 2.322 |
| Fleet & Distribution expertise | .557 | 1.796 |

***Dependent variable: Responsiveness of pharmaceuticals supply chain***

***Source, Survey data, 2020***

According to the information observed above on table 4.3.1 Output of variance inflation factor (VIF) column in the coefficients table of theregression output shows that VIF for route planning (2.136), vehicle scheduling (2.675), vehicle tracking (2.200), vehicle repair and maintenance (2.322) and FDM expertise (1.796), all are smaller than 10. It meansthat there is no problem of multico linearity between independent variables/moderate variable.This can be further ascertained from the Tolerance column of the same table inwhich the tolerance for the four independent variables& 1 moderate variable is 0.468, 0.374, 0.454, 0.431 and 0.557 respectively all > 0.1 indicating that there is no multi co linearity.

**(C). Sample characteristics of Heteroskedasticity**

Based on Output Coefficients of Park Glejser test, the obtained value of sig. (p-value)shows that significance of route planning was (0.43), Vehicle scheduling (0.074), Vehicle tracking (0.078), VRM (0.13), FDM expertise (2.41) and responsiveness of PSC(0.190), all are higher than alpha (Ŭ= 0.05). Itmeans that there is no heteroskedasticity in this model.

**(D) Sample characteristics of Sample size test**

N > 50 + 8m (where N = sample size and m = number of independent variables), Tabachnick and Fidell (2007) so the sample size assumption meet for this study since sample size greater than 82.

## 4.3.2. Result of Goodness of fit test

Predictor variables can also be added to the model at level 1, level 2, or both. Adding one predictor to each level results in the following model

□□□= □**0j** + □**1j**□**ij** + □**ij**

□□□= □**00** + □**01**□ **j** + □**0j**

□**1j** = □**10** + □**11**□ **j** + □**1j**

**SCP**= β**0j**+β**1jRP**+β**2jVS**+β**3jVT**+β**4jVRM**+**rij**

β**0j**=γ**00**+γ**01FDM**+**u0j……**

**Where: RP: Route Planning** **VRM: Vehicle Repair & Maintenance**

**VS: Vehicle Scheduling** **SCP: Supply Chain Performance**

**VT: Vehicle Tracking FDM: Fleet & Distribution Management**

Where ij represents a predictor variable for individual *I nested in level 2 unit j* and jrepresents a predictor variable for level 2 unit *j.*

The real question here is that ñdoes this model works? How can we know that?

Three ways to answer this question. Always we have to look at the model fit (ñANOVAò) first. We do not have to make the mistake of looking at the R-square before checking the goodness of fit.

**Table 4.3.3: ANOVA[a]**

| ***Model*** | | ***Sum of Squares*** | ***df*** | ***Mean Square*** | ***F*** | ***Sig.*** |
|---|---|---|---|---|---|---|
| 1 | Regression | 34.082 | 1 | 34.082 | 77.516 | .000[b] |
| | Residual | 48.803 | 111 | .440 | | |
| | Total | 82.885 | 112 | | | |
| 2 | Regression | 54.172 | 5 | 10.834 | 40.376 | .000[c] |
| | Residual | 28.713 | 107 | .268 | | |
| | Total | 82.885 | 112 | | | |
| a. Dependent Variable: Responsiveness of Pharmaceuticals Supply Chain | | | | | | |
| b. Predictors: (Constant), Fleet & Distribution Management | | | | | | |
| c. Predictors: (Constant), Fleet & Distribution Management, Vehicle Scheduling, Route Planning, Vehicle tracking, Vehicle Repair & Maintenance | | | | | | |

***Source, Survey data, 2020***

Test of the goodness of fit of the model in this research showed negative results. From the result of F-test, it is known that the F-statistic of model **1 77.516** is higher than the critical value **2.776** (from t-table)and the probability (p-value or the Sig. value) 0.000 is smaller thanalpha (0.05). F-statistic of mode2 **40.376** is higher than the critical value **2.571** (from t-table)and the probability (p-value or the Sig. value) 0.000 is smaller thanalpha (0.05). Therefore, the model is fit. The third confirmatory test islooking at the $R^2$ value of the model summary in model 1 & 2 which is .411 & 0.654 respectively which are > 0. As this value getsapproach to +1, the better the model will be.

**Table 4.3.4: Model Summary[c]**

| *Model* | *R* | *R Square* | *Adjusted R Square* | *Std. Error of the Estimate* | *Change Statistics* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *R Square Change* | *F Change* | *df1* | *df2* | *Sig. F Change* |
| 1 | .641[a] | .411 | .406 | .663 | .411 | 77.516 | 1 | 111 | .000 |
| 2 | .808[b] | .654 | .637 | .518 | .242 | 18.717 | 4 | 107 | .000 |

**a. Predictors: (Constant), Vehicle Scheduling, Route Planning, Vehicle tracking, Vehicle Repair & Maintenance**

**b. Predictors: (Constant), Fleet & Distribution Management, Vehicle Scheduling, Route Planning, Vehicle tracking, Vehicle Repair & Maintenance**

**c. Dependent Variable: Supply Chain Performance**

***Source, Survey data, 2020***

The model summary statistics displayed in table 4.3.4 show that when fleet and distribution management expertise was not entered in model 1, the R-square was 0.411 implying that variation without fleet and distribution management expertise contributed only 41.1 % of the variation in performance. However when the conceptualized determinants (fleet and distribution management was entered in model 2, the coefficient of determination (R square) increased up to 0.654. The associated R-square change was 0.243 which implies that variation in the fleet and distribution management expertise contributed 24.3 % of the variation in performance.

The model summary note that *R Square Change* is same as the difference in the*R Square* values between Model 2 and Model 1. The *p*-value for testingsignificance of corresponding *F* change is 0.000, significant at 5% levelof significance. This means that inclusion of *fleet and distribution management expertise*significantly improves ourmodel to predict firm performance.

**Table 4.3.5: Summary of theregression output is given in the following table.**

| Variables | F-test and T-test | | | | | | $R^2$ change | K | N | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|
| | F-statistic | Critical value | Regression coefficient | t | Critical value | p-value | | | | |
| **Goodness of fit testing** | 40.376 | 2.571 | | | | 0.000 | | | | Significant |
| **(Constant)** | | | 1.641 | 4.133 | 2.571 | 0.009 | | | | Significant |
| Route planning | | | .183 | 2.199 | 2.571 | .030 | 0.243 | 6 | 113 | Significant |
| Vehicle Scheduling | | | .326 | 3.504 | 2.571 | .001 | 0.243 | 6 | 113 | Significant |
| Vehicle Tracking | | | .186 | 2.547 | 2.571 | .010 | 0.243 | 6 | 113 | Significant |
| Vehicle Repair and maintenance | | | .134 | 1.548 | 2.571 | .125 | 0.243 | 6 | 113 | Insignificant |
| Fleet & Distribution expertise | | | .244 | 3.205 | 2.571 | .002 | 0.243 | 6 | 113 | Significant |

Based on the above tables, the regression model will be filled in as follows:

**Y = 1.641 + 0.183X1+ 0.326X2+ 0.186X3+0.134x4+0.244x5+ε**

The regression coefficients are shown in the above table. The intercept, 1.641, is representing the estimated average value of corporate responsiveness of pharmaceuticals supply chain when route planning, vehicle scheduling, vehicle tracking, vehicle repair & maintenance and fleet and distribution management expertise is zero. Thus anorganization with no route planning, vehicle scheduling, vehicle tracking, vehicle repair & maintenance and fleet and distribution management expertise will have severe impact on the responsiveness of pharmaceuticals supply chain of the agency. The slop of independent variables also exhibits useful predictive information about the implication. The slop of route planning, vehicle scheduling, vehicle tracking, vehicle repair & maintenance and fleet and distribution management expertise (moderating variable)which are 0.183, .326, .186, .134 and .244 means that responsiveness of pharmaceuticals supply chain changes (increases or decreases) by 0.183, .326, .186, .134 and

.244 when route planning, vehicle scheduling, vehicle tracking, vehicle repair & maintenance and fleet and distribution management expertise respectively increases or decreases by 1.

Based on the $R^2$ value of 0.654, these four variables could explain 65.4% variation in the responsiveness of pharmaceuticals supply chain performance. An examination of these four independent variables and the moderate variable indicated that the vehicle scheduling represented the strongest effect on pharmaceuticals supply chain performance as with the standard beta of 0.326 followed by the moderate variable (FDM expertise) on pharmaceuticals supply chain performance as it interacted with independent variables with beta of 0.244, vehicle tracking with standard beta 0.186 and route planning with ϐ of .183. Thus the statistical results prove that positive and significant linear relationships exist between dependent and independent variables.

**Table 4.3.6: Multiple Regression Coefficients Result According to the hierarchal regression analysis**

| Items | Standardized Beta Values | | Remarks |
|---|---|---|---|
| | **Without Moderator (Step 1)** | **With Moderator (Step 2)** | |
| Route Planning | .439 | .183* | Has Moderation Effect |
| Vehicle Scheduling | .531 | .326** | Has Moderation Effect |
| Vehicle Tracking | .394 | .186* | Has Moderation Effect |
| Vehicle Repair & Maintenance | .440 | .134 | No Moderation Effect |
| Fleet & Distribution Expertise | | .244** | Moderator is Significant |
| R | .641 | .808 | Coefficient of correlation |
| R2 | .411 | .654 | Coefficient of determination |

| | | | |
|---|---|---|---|
| Adjusted R2 | .406 | .637 | |
| F Value | 77.52 | 40.376 | F-Statics |

(Note: ** significant at the 0.01 level and * = significant at the 0.05 level (2-tailed)).

According to the data indicated above on table 4.3.6, Out of the tested independent variables route planning ($p<0.05$), Vehicle tracking ($p<0.05$), and Vehicle scheduling ($p<0.01$) has moderation effect. Whereas vehicle repair and maintenance ($p>0.05$) had no moderation effect and fleet and distribution expertise ($p<0.01$) was a significant moderator.

## 4.4. Tests of Hypothesis

Descriptive analysis of the EPSA south west cluster employeesô and heads responses revealed that pharmaceuticals supply chain determinants of performance appeared to directly impact on firm performance as conceptualized in the present study. It was therefore necessary to confirm existence of causal relationships between the individual determinants and firm performance by testing the hypothesis formulated in this study.

Hierarchical regression analysis was used to test the hypothesis so as to control for the effects of the fleet and distribution management expertise of the participating employees (Tabachnick&Fiddell, 2013). Under this approach, pharmaceuticals supply chain performance was first regressed on the determinants and then on the identified determinants withfleet and distribution management expertise. The change in the coefficient of determination ($R^2$ï change) was then examined to isolate the influence of supply chain drivers from those of fleet and distribution management expertise.

### 4.4.1. Result of first hypothesis testing

Hypothesis **H01** postulated that, the ***vehicle scheduling has no a positive significant effect on the responsiveness of pharmaceuticals supply chain of EPSA south western cluster.***The hierarchical multiple regressions results presented in Table 4.4 revealed that vehicle scheduling positively and significantly affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster ($\beta = 0.326$, $P<0.05$,N=113).The implication is that a unit standard β coefficient increase in vehicle scheduling has potential to improve the responsiveness of pharmaceuticals supply chain by 0.326 units. The hypothesis that vehicle scheduling had no a

positive significant effect on the responsiveness of pharmaceuticals supply chain in EPSA south western cluster was therefore not supported. Thus, we had accept the alternative hypothesis ‘‘vehicle scheduling had a positive significant effect on the responsiveness of pharmaceuticals supply chain in EPSA south western cluster’’.

The regression finding that shows that vehicle scheduling impacts positively on supply chain performance explains the descriptive and thematic findings which showed effective fleet and distribution management expertise involvement. Moreover, it justifies the need to have in place various strategies and practices for transportation management and why it is necessary to consider modern transportation management systems.According to Coyle J. (2011) describedthat Transportation is a critical link in the overall supply chain, which has become an important concept for organizations in the 21st century. Transportation can be viewed as the glue that helps to hold the supply chain together. Thus the agency could able to arrange vehicles regularly for pharmaceuticals delivery for the public health facilities which scheduled for the responsiveness of the pharmaceuticals supply chain.

### 4.4.2. Result of second hypothesis testing

Hypothesis **H02**postulated that, ‘‘the rout planning has no a positive significant effectonthe responsiveness of pharmaceuticals supply chain of EPSA south western cluster’’. The hierarchical multiple regressions results presented in Table 4.4 revealed that rout planning positively and significantly affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster ($\beta = 0.183$, $P<0.05$, $N=113$). The implication is that a unit standard β coefficient increase in rout planning has potential to improve the responsiveness of pharmaceuticals supply chain by 0.183 units. The hypothesis that rout planning had no a positive significant effect on the responsiveness of pharmaceuticals supply chain in EPSA south western cluster was therefore not supported. Thus, we had accept the alternative hypothesis ‘‘rout planning had a positive significant effect on the responsiveness of pharmaceuticals supply chain in EPSA south western cluster’’.Route planning systems bring many advantages to customers (improved service, increased reliability, reducing delivery times, quick response to special requests), management (increased transparency, independence on planner’s intuition, simpler training of new employees, reliable data fordecisions) or schedulers (reduction of routine tasks, less errors) (Knolmayer, 2002). This study could be revealed as the agency enhance the supply chain performance might

be through reducing delivery times with accurate rout planning, quick response with responding for special request and so on.

### 4.4.3. Result of third hypothesis testing

Hypothesis **H03**postulated that, ćhe vehicle repair &maintenance has no a positive significant effect on the responsiveness of pharmaceuticals supply chain of EPSA south western cluster.ô The hierarchical multiple regressions results presented in Table 4.4 revealed that vehicle repair &maintenance positively and insignificantly affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster (ɓ = 0.134, P>0.05,N=113). The implication is that a unit standard β coefficient increase in vehicle repair & maintenance has slightly potential to improve the responsiveness of pharmaceuticals supply chain by 0.134 units but this is not significant effect according to this study. The hypothesis that vehicle repair & maintenance had no a positive significant effect on the responsiveness of pharmaceuticals supply chain in EPSA south western cluster was therefore supported. Thus, this could suggest the agency vehicle repair and maintenance system failed to improve the responsiveness of pharmaceuticals supply chain. This might be due to the delay on repair and maintenance of the vehicle could exert an effect on the delivery of the pharmaceuticals. Failure to perform the maintenance and repairs in accordance with agency policy may result in loss of the vehicle or, in the event of damage to the vehicle, payment for vehicle repair (Wisconsin, 2004)

### 4.4.4. Result of fourth hypothesis testing

Hypothesis **H04**postulated that, ćhe vehicle tracking has no a positive significant effect on the responsiveness of pharmaceuticals supply chain of EPSA south western cluster.ôThe hierarchical multiple regressions results presented in Table 4.4 revealed that vehicle tracking positively and significantly affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster (ɓ = 0.186, P<0.05,N=113). The implication is that a unit standard β coefficient increase in vehicle tracking has potential to improve the responsiveness of pharmaceuticals supply chain by 0.186 units. The hypothesis that vehicle tracking had no a positive significant effect on the responsiveness of pharmaceuticals supply chain in EPSA south western cluster was therefore not supported. Thus, we had accept the alternative hypothesis ćôvehicle tracking had a positive significant effect on the responsiveness of pharmaceuticals supply chain in EPSA south western clusterôô

To servethe clients in a prompt manner and to set the imbalances between where the requestsoriginate and where the cars are returned, the company continuously repositions the empty cars (Huseyin, 2006). The agency on its effective fleet management could able to track the vehicles considering the customers pharmaceuticals request to enhance the responsiveness of the pharmaceuticals supply chain.

### 4.4.5. Result of fifth hypothesis testing

Hypothesis **H05**postulated that, ôThe agency fleet& distribution management does not interact with the transportation management to alter the responsiveness of pharmaceuticals supply chain.ô The hierarchical multiple regressions results presented in Table 4.4 revealed that fleet distribution management interact positively and significantly with transportation management to affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster (ß = 0.244, P<0.05, N=113). The implication is that a unit standard β coefficient increase in fleet& distribution management has potential to improve the responsiveness of pharmaceuticals supply chain interacting with transportation managementby 0.244 units. The hypothesis that the agency fleet& distribution management does not interact with the transportation management to alter the responsiveness of pharmaceuticals supply chain.ô was therefore not supported. Thus, we had accept the alternative hypothesis ôthe agency fleet& distribution management does interact with the transportation management to alter the responsiveness of pharmaceuticals supply chain.ôõ

Additionally, the summary regression output revealed that the associated R-square change was 0.243 which implies that variation in the determinants contributed 24.3 % of the variation in performance. The model summary note that *R Square Change* is same as the difference in the *R Square* values between Model 2 and Model 1. The *p*-value for testing significance of corresponding *F* change is 0.000, significant at 5% level of significance. This means that inclusion of *fleet and distribution management expertise*significantly improves our model to predict firm performance. Thus, according to the above findings the fleet and distribution management expertise interacting with the transportation management of the agency as a result could able to improve the responsiveness of the pharmaceuticals supply chain. According to Bekiaris, (2004) Fleet Management is a function which allows companies which rely on transportation in business to remove or minimize the risks associated with vehicle investment,

improving efficiency, productivity and reducing their overall transportation and staff costs, providing 100% compliance with government legislation (duty of care) and many more.

# CHAPTER FIVE

# SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

## *5.1. SUMMARY OF FINDINGS*

According to the collected data from the study population, after the study was processed and analyzed this raw data in order to present relevant result of the study with full of interpretation and discussion. The findings on the result part of the study were sorted with descriptive and inferential statistics presentation. Therefore, based on the identified result of the study, the researcher could able to summarize the major findings of the study and present as shown below.

The background information of the respondents first presented on this study. Concerning the respondents percentage distribution age category the study found that larger proportion (37.2 %) of the respondentôs in the study area were aged between 31 and 35 years followed by 31.9 percent of the respondentôs aged between 25and30, 18.6 percent were in between 36-40 years. Regarding respondents work experience which the finding of this study showed that, larger proportion 54% of the participants were served for 6-10 years followed by, 21.2% were serve for 3-5 years and 15 % were include respondents those serve <3 years.Respondents educational level the finding showed that more than 55.8% of the respondents were first degree holders, followed by 31% were found at diploma level, 9.7% of them were hold their second degree and the remaining least group 3.5% were sorted on other groups, those were hold certificate and technique levels.

The overall mean response score among employees with regard to the rout plan used in EPSA south western cluster was 3.75. The value lies on the interval between $3.41 \leq R < 4.2$which indicated that average employees on the study areas were nearly agree for the effect of route planning on the supply chain performance on the study area. This could imply route planning of EPSAôs at south western cluster could able to exert an effect on the performance of pharmaceuticals supply chain. In a Similar vein the means of scheduling shows that (3.85) this figure was revealed almost an agreement on average employees on the study area for the effect of scheduling on the supply chain performance on the study area. This could suggest the effect of

scheduling slightly higher than route planning on the agency supply chain performance. Whereas the mean value of vehicle tracking and vehicle repair and maintenance were 3.65, and 3.54 respectively the findings showed that almost agreement of employees to the effects of vehicle tracking and VRM respectively on the supply chain performance of the agency at study areas. This could assure as vehicle tracking and VRM had been rated as less efficiently operated than route planning and scheduling on the agency.

The mean value of the moderating variable, fleet and distribution management is 3.99 which was indicate that average number of the respondents were agree the clusterôs fleet and distribution management agreeable effect of the pharmaceuticals supply chain performance of the agency. This implies that the fleet and distribution management of the cluster could be affecting the transportation management to enhance the supply chain performance of the agency. However, the mean value for supply chain performance (responsiveness) was 4.05, which has indicated agreement response of employees for its effectiveness at the cluster.

The detail findings concerning route planning practices of EPSA south western cluster the study showed that; most of the respondents were tends to agree on the practices of ; the agency route planning maximize the use of good roadsô (ε = 3.85) and ôThe agency planned short cut use of poor roadsô (ε = 3.79) , ôPlanning route of the agency take account for fuel availabilityô (ε =3.86), ôExperienced drivers consulted before deciding on the route are determinedô had a mean value (ε =3.21) ,ôRoute planning considers public health facilities found on their road accessô (ε = 4.02),ôPlanning delivery route concerned as the vehicles securely parked during overnight stopsô (ε = 3.84),the agency having delivery routes with (m=3.72), ôthere is arranged delivery routes and vehicle start each journey fully loadedô and in similar vein, average number of respondents were agree with (m=3.72) for a statement of ôRoutes are planned as resources are used economicallyô.

Regarding Vehicle scheduling practices of the agency as a transportation management factors most of the respondents were tends to agree on ôVehicles are loaded pharmaceuticals according to the order of the facilities destinationô (m=4.00) , ôAppropriate vehicle size arranged according to the order size to be loadedô (m=3.91) ,ôVehicles are arranged timely for order fulfillment during the resupply periodô (m=3.71) , ôItems are integrated/product mix during the delivery of pharmaceuticals productô (m=3.62) and ôRight vehicles are assigned according to the products

characteristics to keep product safetyô (m=3.71) which was indicated average number of respondents were agree on the indicated statement.

According to the mean analysis of the study variables concerning vehicle tracking based on the findings, this study showed that, average number respondents were tends to agree on ôThe organization is using the vehicle tracking system for fleet managementô (m=3.89), , ôThe organization has modern technology of GPS for vehicle tracking systemô (m=4.00),The organization has installed vehicle tracking system on all EPSA vehiclesô & ôThe organization assigned a person to monitor and manage the GPS tracking systemô with (m=3.82 & 3.76-) respectively.However, most of the respondents were have not sure/neutral response for the organization supervises speed limit by GPS tracking system, the organization provide immediate solution for problems encounter in vehicle tracking and The organization used the Tracking system to manage fuel consumption and maintenance scheduling ( with m= 3.35,3.38 & 3.31) respectively.

Based on the mean analysis of the study variables concerning vehicle repair and maintenance practices of the agency the findings on this study showed that, ôThe organization has successful vehicles repair and maintenance control systemõ(=3.59) , ôThe organization has regular Vehicle servicing time (Mileage) scheduleô(=3.77) which was indicated average number of respondents were almost agree on the indicated statement with at a higher rate that of the successfulness the vehicle repair & maintenance of the agency. Additionally, most of the respondents were agree on ôThe organization has well organized control mechanism for genuine spare part used for vehicle service and maintenanceô (=3.54), ôThe organization has professional fleet manager and maintenance controllerô (=3.63), ôThe fleet department of the organization handles complaint regarding service and maintenance appropriatelyô (=3.65 & 3.52) respectively. However, average number of respondents were agree on ôThe repair and maintenance garage complete the service and maintenance on timeô and ôthe vehicles of the organization donôt have frequent technical failure after service and maintenanceô(=3.26 & 3.36) respectively.

Regarding the FDM expertise of the agency according the mean analysis information which indicated on this study, the findings showed that, average number of respondents were agreed on ôThe agency FDM allocating and maintaining vehicles for pharmaceuticals deliveryô (m=4.14),

ôAssisting in the requirements of quality drivers in to the fleetô (m=4.10), ôDevelop efficient drivers schedules to maximize profitô (m=3.61), ôManaging drivers to they adhere to strict schedulesô (m=4.13) , ôEnsuring strict servicing and maintenance times to minimize downtime and maintenance scheduleô (m=4.18) , ôUtilize GPS system to monitor drivers and track vehicles in case of theftô the result showed that (m=3.69) and óArrange vehicles for delivery as requested size which fitted to the order fulfillmentô (m=4.08) .

Based on the above mean results of the mean analysis õThere is transportation schedule which aligned the supply chain schedule of the agency ó(m=3.83) which indicated that average number of respondents were agree on the above indicated statement. This implies that the agency could schedule the transportation access with the vehicles avail for its supply chain schedule as a means of operational response. õThe pharmaceuticals delivery conducted on meeting the standard lead time which set by the organizationô ó(m=4.22) which indicated that average number of respondents were strongly agree on the above indicated statement.

On similar vein most of the respondents tends to agree on õThere is optimized delivery route which reduce the delivery time in the agency óó(m=4.14) ,õVehicles are scheduled in the right size for the volume of product to loaded for deliveryô (m=3.93), ôPharmaceutical products are delivered on their resupply period at their delivery routesô ó(m=4.16) and also ôProduct quality are maintained during delivery on the right protective measures of transportationô (m=4.31) which indicated that average number of respondents were strongly agree on the above indicated statement. Practically, the agency vehicles for transportation of pharmaceuticals were maintained with thermo stat and refrigerator van for vaccine distribution. On the other hand most of the respondents have neutral response on ôIntegrated products are delivered as requested by the customers on promising timeô ó(m=4.34).

Test of the goodness of fit of the model in this research showed negative results. From the result of F-test, it is known that the F-statistic of model 1 77.516 is higher than the critical value 2.776 (from t-table) and the probability (p-value or the Sig. value) 0.000 is smaller thanalpha (0.05). F-statistic of mode2 40.376 is higher than the critical value 2.571 (from t-table) and the probability (p-value or the Sig. value) 0.000 is smaller thanalpha (0.05). Therefore, the model is fit. The third confirmatory test islooking at the $R^2$ value of the model summary in model 1 & 2 which is

.411 & 0.654 respectively which are > 0. As this value getsapproach to +1, the better the model will be.The model summary statistics show that when fleet and distribution management expertise was entered in model 1, the R-square was 0.411 implying that variation in fleet and distribution management expertise contributed only 41.1 % of the variation in performance. However when the conceptualized determinants were entered in model 2, the coefficient of determination (R square) increased up to 0.654. The associated R-square change was 0.243 which implies that variation in the determinants contributed 24.3 % of the variation in performance.

The slop of independent variables also exhibits useful predictiveinformation about the implication. The slop of route planning, vehicle scheduling, vehicle tracking, vehicle repair & maintenance and fleet and distribution management expertise (moderating variable)which are 0.183, .326, .186, .134 and .244 means that responsiveness of pharmaceuticals supply chain changes (increases or decreases) by 0.183, .326, .186, .134 and .244 when route planning, vehicle scheduling, vehicle tracking, vehicle repair & maintenance and fleet and distribution management expertise respectively increases ordecreases by 1.

The hierarchical multiple regressions results presented on this study revealed that vehicle scheduling positively and significantly affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster ($\beta = 0.326$, $P<0.05$), rout planning positively and significantly affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster ($\beta = 0.183$, $P<0.05$), vehicle repair &maintenance positively and insignificantly affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster ($\beta = 0.134$, $P>0.05$), vehicle tracking positively and significantly affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster ($\beta = 0.186$, $P<0.05$) and fleet distribution management interact positively and significantly with transportation management to affects the responsiveness of pharmaceuticals supply chain in EPSA south western cluster ($\beta = 0.244$, $P<0.05$).

## 5.2. CONCLUSION

From the study it is concluded that transport management have a positive significant effect on pharmaceuticals supply chain performance of EPSA South western cluster. In view of this; management of EPSA South western cluster have taken steps to put in place adequate mechanisms to address transportation of supplies and products so as to enhance the responsiveness of pharmaceuticals supply chain and thus improved Supply chain performance. They have adopted vehicle scheduling, route planning, and vehicle tracking for purposes of improved pharmaceuticals supply chain performance. This study was also identified fleet and distribution management expertise of the agency significantly and positively interacts with transportation management of the agency in order to improve the responsiveness of pharmaceuticals supply chain EPSA South western cluster. However, the agency vehicle repair and maintenance should have to get a concern to be improved for sake of the significance.

Mechanisms for addressing transport are commendable and should be maintained and other systems that can improve transport management are further introduced. From the study it could be concluded that the EPSA South western cluster strive to enhance their responsiveness pharmaceuticals supply chain by ensuring maintaining/reduced the lead time, volume of product shipped for delivery, product mix, and order fulfillment. The current study was restricted to EPSA South western cluster. The findings may therefore have been influenced by the context in which this study was conducted. The researcher therefore recommends that similar studies should be replicated in pharmaceuticals supply agency in other regions/cluster so as to improve the external validity of the findings.

## 5.3. RECOMMENDATIONS

In order to accomplish its goals and to be effective EPSA should give due emphasis on transportationmanagement factors. Cost effective and efficient movement of pharmaceuticals and medicalequipment is relevant for the successfulness of agency. Based on the assessment made on practices of transportation management, the following remarks were drawn:

- Routine servicing, Allocation or Routing, scheduling for maintenance and repair, fuel sourcing, fleet administration & costing, Vehicle Inspection and Maintenance Training was considered to be one of the important determinant factors. EPSA and its branches should be considering the importance of routine servicing, Allocation or Routing, Fuel monitoring, fuel sourcing, fleet administration & costing, Vehicle Inspection and Maintenance Training in decision making process.
- In order to reduce vehicle break down/idle time EPSA should have to establish repair and maintenance center at the cluster level. Currently all branches sent the vehicles for repair and maintenance/servicing at the center level. Thus, if the servicing sector found at the cluster level the vehicles had been a chance of to be repaired and maintained in a short time.
- All EPSA drivers and maintenance officers should be aware of transport policies, manuals and operating procedures. All standard operating procedures should be kept in a file wherever vehicles are located and made accessible to all staff members.
- To improve Repair and maintenance EPSA should maintain adequate spare parts, planning all predictive and preventative repair and maintenance schedules to minimize repair and maintenance costs, and unplanned breakdowns, using genuine parts when replacing components, and implementing a tire management program with service providers using based on tire pressures, rotations and maximum tire life, monitoring electronic brake system intervention

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## *ANNEXE-I- Questionnaire*

**JIMMA UNIVERSITY**

**COLLEGE OF BUSINESS AND ECONOMICS**

**DEPARTMENT OF MANAGEMENT**

### *Dear respondents*

My name is **Baharu Muze** conducting a study on **the effect of Transportation management on the performance of pharmaceuticals supply chain in EPSA South western cluster** for the partial fulfillment of masterôs degree in logistics and transport management in Jimma University, college of business and economics department of management. I would like to extend my deep appreciation to your hub and you for the willingness and cooperation in undertaking this valuable research. Taking part in this study you will contribute towards alleviating the problem of pharmaceuticals delivery and order fulfillment on the supply chain of your hub. I request your cooperation to fill and respond truthfully for the asked Questions. If you have any question, you can contact me through **0917981069**. Finally, I would like to appreciate and thank you in advance for your dedication, time and genuine response to the questions.

**PART I: GENERAL INFORMATION AND DEMOGRAPHIC BACKGROUND OF RESPONDENTS**

**Please tick (✓) or provide your own answers where applicable.**

2. Age: _____

3. Work experience in the agency (in years)?

<3years ☐ 3-5years ☐ 6-10 years ☐ >10years ☐

4. Educational level

Diploma ☐ 1st degree ☐ 2nd degree ☐ Others,_____

5. In which EPSA branch do you work in? _____

6. Department you work in the agency? _____

7. Position in the agency? _____

**PART II: INFORMATION OF TRANSPORTATION MANAGEMENT (TM) EFFECT ON SUPPLY CHAIN PERFORMANCE (SP) IN CASE OF EPSA SOUTH WESTERN CLUSTER.**

This part of the questionnaire consists of forty five (45) questions. The main purpose of this instrument is to examine ñThe effect of Transportation management on the performance of pharmaceuticals supplychainò.Judge how frequently each statement fits the situation of your organization. Use the following rating scale, and put **"✓"** mark for each rating.

**Key: Strongly agree (5), Agree (4), Neutral (3), Disagree (2), and strongly disagree (1).**

| Statement | Rating | | | | |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |
| **Transportation Management (TM)** | | | | | |
| **Route planning (RP)** | | | | | |
| The agency route planning maximize use of good roads | | | | | |
| The agency short cut use of poor roads | | | | | |
| Planning route of the agency take account for fuel availability | | | | | |
| Route planning considers public health facilities found both at on and off the road the supply chain network | | | | | |
| Planning delivery route concerned as the vehicles securely parked during overnight stops. | | | | | |
| There is arranged delivery routes and vehicle start each journey fully loaded | | | | | |
| Experienced drivers consulted before deciding on the route. | | | | | |
| Routes are planned as resources are used economically | | | | | |
| **Vehicle scheduling(VS)** | | | | | |
| Vehicles are loaded pharmaceuticals according to the order of the facilities destination | | | | | |
| Vehicle item selected according to the road status of the delivery route | | | | | |
| Appropriate vehicle size arranged according to the order size to be loaded | | | | | |
| Facilities are arranged for delivery according to their resupply period | | | | | |
| Vehicles are arranged timely for order fulfillment during the resupply period | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Items are integrated/product mix during the delivery of pharmaceuticals product | | | | | |
| Right vehicles are assigned according to the products characteristics to keep product safety | | | | | |
| **Vehicle Tracking (VT)** | | | | | |
| The organization is using the vehicle tracking system for fleet management | | | | | |
| The organization has modern technology of GPS for vehicle tracking system | | | | | |
| The organization has installed vehicle tracking system on all EPSA vehicles | | | | | |
| The organization assigned a person to monitor and manage the GPS tracking system | | | | | |
| The organization supervises speed limit by GPS tracking system | | | | | |
| The organization provide immediate solution for problems encounter in vehicle tracking | | | | | |
| The organization used the Tracking system to manage fuel consumption and maintenance scheduling. | | | | | |
| Allocation vehicle/ delivery Routing as required by the organization | | | | | |
| **Vehicle Repair & Maintenance (VRM)** | | | | | |
| The organization has successful vehicles repair and maintenance control system. | | | | | |
| The organization has regular Vehicle servicing time (Mileage) schedule. | | | | | |
| The organization has well organized control mechanism for genuine spare part used for vehicle service and maintenance. | | | | | |
| The organization has professional fleet manager and maintenance controller. | | | | | |
| The repair and maintenance garage complete the service and maintenance on time. | | | | | |
| The vehicles of the organization donôt have frequent technical failure after service and maintenance | | | | | |
| Drivers of the organization gives proper feedback for fleet department about service and maintenance of the assigned vehicle | | | | | |
| The fleet department of the organization handles complaint regarding service and maintenance appropriately. | | | | | |
| **Fleet & Distribution Management (FDM)** | | | | | |
| The agency FDM allocating and maintaining vehicles for pharmaceuticals delivery | | | | | |
| Assisting in the requirements of quality drivers in to the fleet | | | | | |
| Develop efficient drivers schedules to maximize profit | | | | | |
| Managing drivers to they adhere to strict schedules | | | | | |
| Ensuring strict servicing and maintenance times to minimize downtime and | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| maintenance schedule | | | | | |
| Utilize GPS system to monitor drivers and track vehicles in case of theft | | | | | |
| SOPs are available at DUs/wards and warehouse to control the data quality in LMIS. | | | | | |
| Arrange vehicles for delivery as requested size which fitted to the order fulfillment | | | | | |
| **SUPPLY CHAIN PERFORMANCE (SCP)** | | | | | |
| **Responsiveness** | | | | | |
| There is transportation schedule which aligned the supply chain schedule of the agency | | | | | |
| The pharmaceuticals delivery conducted on meeting the standard lead time which set by the organization | | | | | |
| There is optimized delivery route which reduce the delivery time in the agency | | | | | |
| Vehicles are scheduled in the right size for the volume of product to loaded for delivery | | | | | |
| Product quality are maintained during delivery on the right protective measures of transportation | | | | | |
| Integrated products are delivered as requested by the customers on promising time | | | | | |
| Pharmaceutical products are delivered on their resupply period at their delivery routes | | | | | |

**Thank you for your time and Response!!!**

# Annex-II

## Interview Guide

### INTERVIEW QUESTIONS

### FOR MANAGERIAL BODY/HIGHER OFFICIALS OF THE AGENCY

1. How do you evaluate the transportation management practices of the agency on the practical aspects?

- Route planning_____
- Vehicle Scheduling _____
- Vehicle tracking _____
- Vehicle repair and maintenance_____
- Fleet and distribution expertise é é é é é é é é é é é é é é é é é é é é é .

2. What likes the trends transport management of the agency on supporting the performance pharmaceuticals supply chain?
3. What the agency faced challenges/bottlenecks on its transportation management?
4. Any other points to be mentioned on the agency transport management, fleet and distribution expertise, and its supply chain performance

# Appendix III: Statistical output

**Descriptive Statistics**

| | Mean | Std. Deviation | Analysis N |
|---|---|---|---|
| Route Planning | 3.75 | 1.285 | 113 |
| Vehicle Scheduling | 3.85 | 1.136 | 113 |
| Vehicle tracking | 3.65 | 1.280 | 113 |
| Vehicle Repair & Maintenance | 3.54 | 1.310 | 113 |
| Fleet & Distribution Management | 3.99 | 1.048 | 113 |
| Supply Chain Performance | 4.05 | 1.007 | 113 |

**Model Summary[c]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .641[a] | .411 | .406 | .663 | .411 | 77.516 | 1 | 111 | .000 |
| 2 | .808[b] | .654 | .637 | .518 | .242 | 18.717 | 4 | 107 | .000 |

a. Predictors: (Constant), Fleet & Distribution Management

b. Predictors: (Constant), Fleet & Distribution Management, Vehicle Scheduling, Route Planning, Vehicle tracking, Vehicle Repair & Maintenance

c. Dependent Variable: Supply Chain Performance

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 34.082 | 1 | 34.082 | 77.516 | .000[b] |
| | Residual | 48.803 | 111 | .440 | | |
| | Total | 82.885 | 112 | | | |
| 2 | Regression | 54.172 | 5 | 10.834 | 40.376 | .000[c] |
| | Residual | 28.713 | 107 | .268 | | |
| | Total | 82.885 | 112 | | | |

a. Dependent Variable: Supply Chain Performance

b. Predictors: (Constant), Fleet & Distribution Management

c. Predictors: (Constant), Fleet & Distribution Management, Vehicle Scheduling, Route Planning, Vehicle tracking, Vehicle Repair & Maintenance

**Correlations**

| | | Route Planning | Vehicle Scheduling | Vehicle tracking | Vehicle Repair & Maintenance | Fleet & Distribution Management | Supply Chain Performance |
|---|---|---|---|---|---|---|---|
| Route Planning | Pearson Correlation | 1 | .787** | .782** | .714** | .766** | .739** |
| | Sig. (2-tailed) | | .000 | .000 | .000 | .000 | .000 |
| | N | 113 | 113 | 113 | 113 | 113 | 113 |
| Vehicle Scheduling | Pearson Correlation | .787** | 1 | .844** | .717** | .718** | .779** |
| | Sig. (2-tailed) | .000 | | .000 | .000 | .000 | .000 |
| | N | 113 | 113 | 113 | 113 | 113 | 113 |
| Vehicle tracking | Pearson Correlation | .782** | .844** | 1 | .711** | .720** | .764** |
| | Sig. (2-tailed) | .000 | .000 | | .000 | .000 | .000 |
| | N | 113 | 113 | 113 | 113 | 113 | 113 |
| Vehicle Repair & Maintenance | Pearson Correlation | .714** | .717** | .711** | 1 | .632** | .713** |
| | Sig. (2-tailed) | .000 | .000 | .000 | | .000 | .000 |
| | N | 113 | 113 | 113 | 113 | 113 | 113 |
| Fleet & Distribution Management | Pearson Correlation | .766** | .718** | .720** | .632** | 1 | .726** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | | .000 |
| | N | 113 | 113 | 113 | 113 | 113 | 113 |
| Supply Chain Performance | Pearson Correlation | .739** | .779** | .764** | .713** | .726** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | |
| | N | 113 | 113 | 113 | 113 | 113 | 113 |

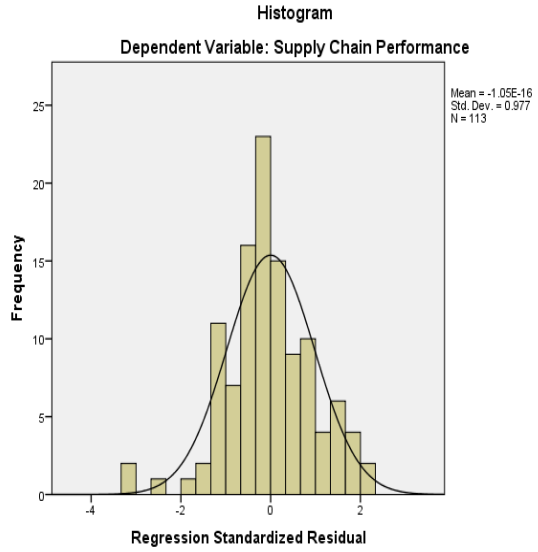
**. Correlation is significant at the 0.01 level (2-tailed).

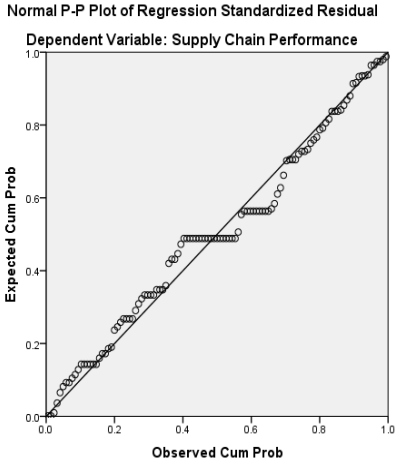
**Excluded Variables[a]**

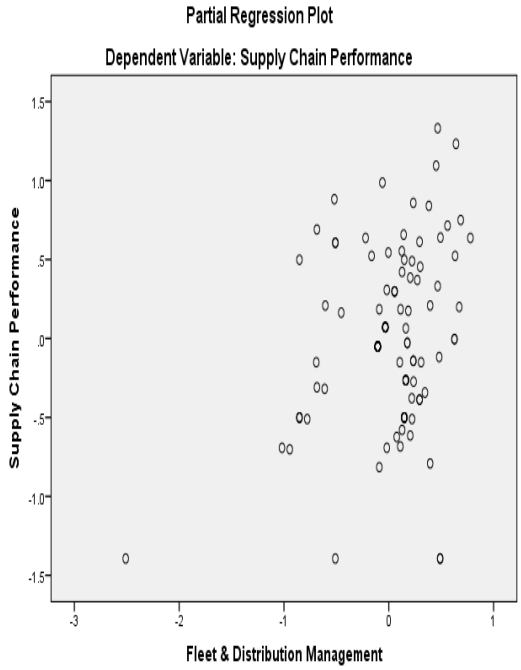
| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Tolerance | VIF | Minimum Tolerance |
| 1 | Route Planning | .439[b] | 5.418 | .000 | .459 | .643 | 1.554 | .643 |
| | Vehicle Scheduling | .531[b] | 7.673 | .000 | .590 | .729 | 1.372 | .729 |
| | Vehicle tracking | .394[b] | 4.832 | .000 | .418 | .665 | 1.505 | .665 |
| | Vehicle Repair & Maintenance | .440[b] | 5.881 | .000 | .489 | .728 | 1.374 | .728 |

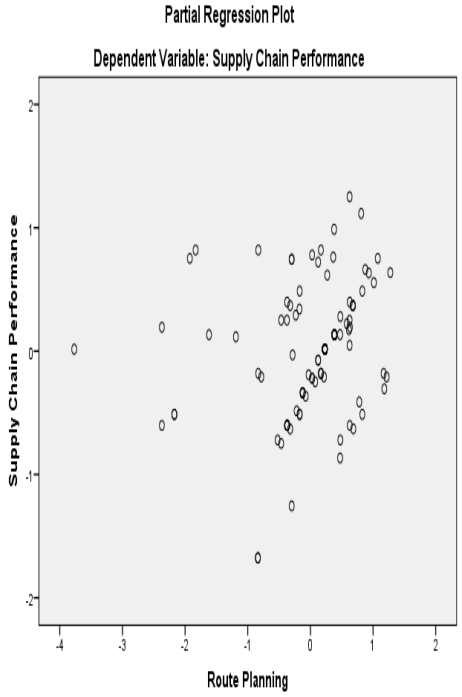
a. Dependent Variable: Supply Chain Performance

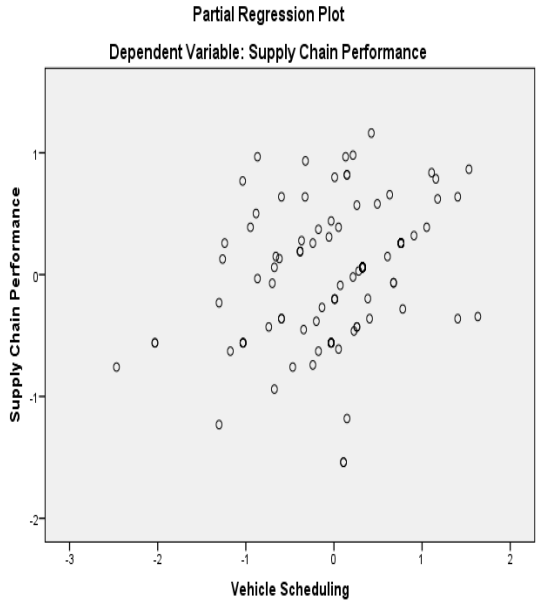
b. Predictors in the Model: (Constant), Fleet & Distribution Management

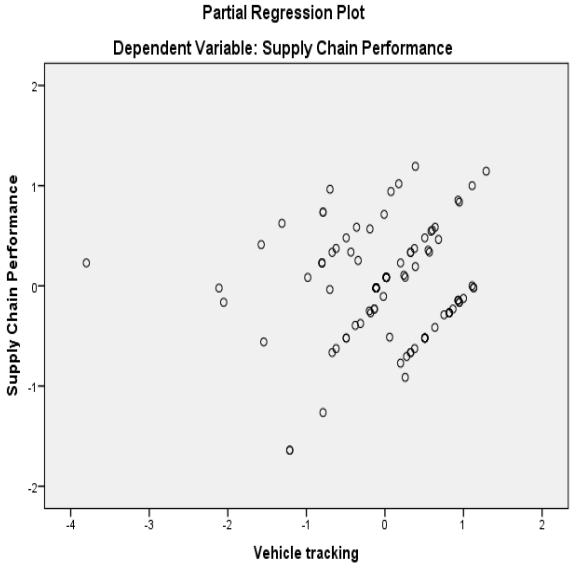


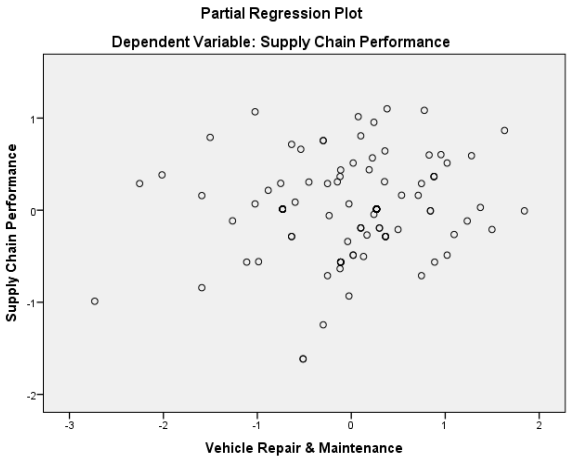




Partial Regression Plot
Dependent Variable: Supply Chain Performance
Supply Chain Performance
Fleet & Distribution Management


Partial Regression Plot
Dependent Variable: Supply Chain Performance
Supply Chain Performance
Route Planning


Partial Regression Plot
Dependent Variable: Supply Chain Performance
Supply Chain Performance
Vehicle Scheduling


Partial Regression Plot
Dependent Variable: Supply Chain Performance
Supply Chain Performance
Vehicle tracking




**Factor Matrix[a]**

| | Factor |
|---|---|
| | 1 |
| Route Planning | .886 |
| Vehicle Scheduling | .901 |
| Vehicle tracking | .894 |
| Vehicle Repair & Maintenance | .798 |
| Fleet & Distribution Management | .819 |
| Supply Chain Performance | .867 |

Extraction Method: Alpha Factoring.

a. 1 factors extracted. 4 iterations required.

**Total Variance Explained**

| | Component | Initial Eigenvalues[a] | | | Extraction Sums of S Loadings | | |
|---|---|---|---|---|---|---|---|
| | | Total | % of Variance | Cumulative % | Total | % of Variance | |
| Raw | 1 | 5.743 | 78.782 | 78.782 | 5.743 | 78.782 | |
| | 2 | .456 | 6.259 | 85.041 | | | |
| | 3 | .362 | 4.973 | 90.013 | | | |
| | 4 | .327 | 4.491 | 94.505 | | | |
| | 5 | .218 | 2.986 | 97.491 | | | |
| | 6 | .183 | 2.509 | 100.000 | | | |
| Rescaled | 1 | 5.743 | 78.782 | 78.782 | 4.698 | 78.297 | |
| | 2 | .456 | 6.259 | 85.041 | | | |
| | 3 | .362 | 4.973 | 90.013 | | | |
| | 4 | .327 | 4.491 | 94.505 | | | |
| | 5 | .218 | 2.986 | 97.491 | | | |
| | 6 | .183 | 2.509 | 100.000 | | | |

Extraction Method: Principal Component Analysis.

a. When analyzing a covariance matrix, the initial eigenvalues are the sa
across the raw and rescaled solution.

## Table A3 The *t*-distribution

The table gives critical values of $t$ for significance at various levels, in a two-tailed/non-directional or a one-tailed/directional test, for different numbers of degrees of freedom. These critical values are the values beyond which lies that proportion of the area under the curve which corresponds to the significance level.

| | *Significance level: two-tailed/non-directional* | | | | |
|---|---|---|---|---|---|
| | *0.20* | *0.10* | *0.05* | *0.02* | *0.01* |
| *Degrees of freedom* | *Significance level: one-tailed/directional* | | | | |
| | *0.10* | *0.05* | *0.025* | *0.01* | *0.005* |
| 1 | 3.078 | 6.314 | 12.71 | 31.82 | 63.66 |
| 2 | 1.886 | 2.920 | 4.303 | 6.965 | 9.925 |
| 3 | 1.638 | 2.353 | 3.182 | 4.541 | 5.841 |
| 4 | 1.533 | 2.132 | 2.776 | 3.747 | 4.604 |
| 5 | 1.476 | 2.015 | 2.571 | 3.365 | 4.032 |
| 6 | 1.440 | 1.943 | 2.447 | 3.143 | 3.707 |
| 7 | 1.415 | 1.895 | 2.365 | 2.998 | 3.499 |
| 8 | 1.397 | 1.860 | 2.306 | 2.896 | 3.355 |
| 9 | 1.383 | 1.833 | 2.262 | 2.821 | 3.250 |
| 10 | 1.372 | 1.812 | 2.228 | 2.764 | 3.169 |
| 11 | 1.363 | 1.796 | 2.201 | 2.718 | 3.106 |
| 12 | 1.356 | 1.782 | 2.179 | 2.681 | 3.055 |
| 13 | 1.350 | 1.771 | 2.160 | 2.650 | 3.012 |
| 14 | 1.345 | 1.761 | 2.145 | 2.624 | 2.977 |
| 15 | 1.341 | 1.753 | 2.131 | 2.602 | 2.947 |
| 16 | 1.337 | 1.746 | 2.120 | 2.583 | 2.921 |
| 17 | 1.333 | 1.740 | 2.110 | 2.567 | 2.898 |
| 18 | 1.330 | 1.734 | 2.101 | 2.552 | 2.878 |
| 19 | 1.328 | 1.729 | 2.093 | 2.539 | 2.861 |
| 20 | 1.325 | 1.725 | 2.086 | 2.528 | 2.845 |
| 21 | 1.323 | 1.721 | 2.080 | 2.518 | 2.831 |
| 22 | 1.321 | 1.717 | 2.074 | 2.508 | 2.819 |
| 23 | 1.319 | 1.714 | 2.069 | 2.500 | 2.807 |
| 24 | 1.318 | 1.711 | 2.064 | 2.492 | 2.797 |
| 25 | 1.316 | 1.708 | 2.060 | 2.485 | 2.787 |
| 26 | 1.315 | 1.706 | 2.056 | 2.479 | 2.779 |
| 27 | 1.314 | 1.703 | 2.052 | 2.473 | 2.771 |
| 28 | 1.313 | 1.701 | 2.048 | 2.467 | 2.763 |
| 29 | 1.311 | 1.699 | 2.045 | 2.462 | 2.756 |
| 30 | 1.310 | 1.697 | 2.042 | 2.457 | 2.750 |
| 40 | 1.303 | 1.684 | 2.021 | 2.423 | 2.704 |
| 60 | 1.296 | 1.671 | 2.000 | 2.390 | 2.660 |
| 120 | 1.289 | 1.658 | 1.980 | 2.358 | 2.617 |
| $\infty$ | 1.282 | 1.645 | 1.960 | 2.326 | 2.576 |

## Table A9 The Pearson product–moment correlation coefficient

The table gives the critical values of the Pearson product–moment correlation coefficient, $r$, for different numbers of pairs of observations, $N$. For significance, the calculated value of $r$ must be *greater than or equal to* the critical value.

| | *Significance level: two-tailed/non-directional* | | | |
|---|---|---|---|---|
| | *0.20* | *0.10* | *0.05* | *0.01* |
| | *Significance level: one-tailed/directional* | | | |
| *N* | *0.10* | *0.05* | *0.025* | *0.005* |
| 3 | 0.951 | 0.988 | 0.997 | 1.000 |
| 4 | 0.800 | 0.900 | 0.950 | 0.990 |
| 5 | 0.687 | 0.805 | 0.878 | 0.959 |
| 6 | 0.608 | 0.729 | 0.811 | 0.917 |
| 7 | 0.551 | 0.669 | 0.754 | 0.875 |
| 8 | 0.507 | 0.621 | 0.707 | 0.834 |
| 9 | 0.472 | 0.582 | 0.666 | 0.798 |
| 10 | 0.443 | 0.549 | 0.632 | 0.765 |
| 11 | 0.419 | 0.521 | 0.602 | 0.735 |
| 12 | 0.398 | 0.497 | 0.576 | 0.708 |
| 13 | 0.380 | 0.476 | 0.553 | 0.684 |
| 14 | 0.365 | 0.458 | 0.532 | 0.661 |
| 15 | 0.351 | 0.441 | 0.514 | 0.641 |
| 16 | 0.338 | 0.426 | 0.497 | 0.623 |
| 17 | 0.327 | 0.412 | 0.482 | 0.606 |
| 18 | 0.317 | 0.400 | 0.468 | 0.590 |
| 19 | 0.308 | 0.389 | 0.456 | 0.575 |
| 20 | 0.299 | 0.378 | 0.444 | 0.561 |
| 21 | 0.291 | 0.369 | 0.433 | 0.549 |
| 22 | 0.284 | 0.360 | 0.423 | 0.537 |
| 23 | 0.277 | 0.352 | 0.413 | 0.526 |
| 24 | 0.271 | 0.344 | 0.404 | 0.515 |
| 25 | 0.265 | 0.337 | 0.396 | 0.505 |
| 26 | 0.260 | 0.330 | 0.388 | 0.496 |
| 27 | 0.255 | 0.323 | 0.381 | 0.487 |
| 28 | 0.250 | 0.317 | 0.374 | 0.479 |
| 29 | 0.245 | 0.311 | 0.367 | 0.471 |
| 30 | 0.241 | 0.306 | 0.361 | 0.463 |
| 40 | 0.207 | 0.264 | 0.312 | 0.403 |
| 50 | 0.184 | 0.235 | 0.279 | 0.361 |
| 60 | 0.168 | 0.214 | 0.254 | 0.330 |
| 70 | 0.155 | 0.198 | 0.235 | 0.306 |
| 80 | 0.145 | 0.185 | 0.220 | 0.286 |
| 90 | 0.136 | 0.174 | 0.207 | 0.270 |
| 100 | 0.129 | 0.165 | 0.197 | 0.256 |
| 200 | 0.091 | 0.117 | 0.139 | 0.182 |

## Table A10 The Spearman rank correlation coefficient

The table gives the critical values of the Spearman rank correlation coefficient, $\rho$, for different numbers of pairs of observations, $N$.

| | *Significance level: two-tailed/non-directional* | | | |
|---|---|---|---|---|
| | *0.20* | *0.10* | *0.05* | *0.01* |
| | *Significance level: one-tailed/directional* | | | |
| *N* | *0.10* | *0.05* | *0.025* | *0.005* |
| 5 | 0.800 | 0.900 | 1.000 | — |
| 6 | 0.657 | 0.829 | 0.886 | 1.000 |
| 7 | 0.571 | 0.714 | 0.786 | 0.929 |
| 8 | 0.524 | 0.643 | 0.738 | 0.881 |
| 9 | 0.483 | 0.600 | 0.700 | 0.833 |
| 10 | 0.455 | 0.564 | 0.648 | 0.794 |
| 11 | 0.427 | 0.536 | 0.618 | 0.755 |
| 12 | 0.406 | 0.503 | 0.587 | 0.727 |
| 13 | 0.385 | 0.484 | 0.560 | 0.703 |
| 14 | 0.367 | 0.464 | 0.538 | 0.679 |
| 15 | 0.354 | 0.446 | 0.521 | 0.654 |
| 16 | 0.341 | 0.429 | 0.503 | 0.635 |
| 17 | 0.328 | 0.414 | 0.488 | 0.618 |
| 18 | 0.317 | 0.401 | 0.472 | 0.600 |
| 19 | 0.309 | 0.391 | 0.460 | 0.584 |
| 20 | 0.299 | 0.380 | 0.447 | 0.570 |
| 21 | 0.292 | 0.370 | 0.436 | 0.556 |
| 22 | 0.284 | 0.361 | 0.425 | 0.544 |
| 23 | 0.278 | 0.353 | 0.416 | 0.532 |
| 24 | 0.271 | 0.344 | 0.407 | 0.521 |
| 25 | 0.265 | 0.337 | 0.398 | 0.511 |
| 26 | 0.259 | 0.331 | 0.390 | 0.501 |
| 27 | 0.255 | 0.324 | 0.383 | 0.492 |
| 28 | 0.250 | 0.318 | 0.375 | 0.483 |
| 29 | 0.245 | 0.312 | 0.368 | 0.475 |
| 30 | 0.240 | 0.306 | 0.362 | 0.467 |
| 35 | 0.222 | 0.283 | 0.335 | 0.433 |
| 40 | 0.207 | 0.264 | 0.313 | 0.405 |
| 45 | 0.194 | 0.248 | 0.294 | 0.382 |
| 50 | 0.184 | 0.235 | 0.279 | 0.363 |
| 55 | 0.175 | 0.224 | 0.266 | 0.346 |
| 60 | 0.168 | 0.214 | 0.255 | 0.331 |