

Assessing the Last Mile delivery logistics of the Zambia Medicines and Medical Supplies Agency

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ABSTRACT

Transportation is crucial in the delivery of medicines and medical equipment world over. In Africa, the challenge of poor road infrastructure and limited options of delivery channels restrict delivery to road transportation. In Zambia, the Zambia Medicines, and Medical Supplies Agency (ZAMMSA), faces these challenges to deliver medicine to the Last Mile. It would be useful to know how exactly ZAMMSA has responded to the logistical challenges that relate to last mile system. Therefore, the main objective for this research was to evaluate the last mile delivery logistics process performance at ZAMMSA, to investigate challenges of the transportation system in use in relation the Last Mile delivery process, to assess the Last Mile delivery performance at ZAMMSA and to address any challenges pertinent to transportation. A quantitative approach was used, and data was collected using semi-structured questionnaires. Purposive sampling technique was adopted and 50 employees from ZAMMSA were selected. The data was presented through tables, graphs and charts and standard deviation was used to analyse the responses. Data was analysed using Microsoft excel. The main findings of the research were that ZAMMSA uses a combined transportation system of own and outsourced vehicles and the challenges of the Last Mile system at ZAMMSA lead to operational inefficiencies. The implication of these results is that the Last Mile logistics system is particularly ideal for organisations that pursue the profit-making objective. However, the Last Mile system can still be used by any logistics Organisation to improve efficiency in the Supply Chain. To improve efficiency and the operation of the Last Mile system at ZAMMSA, it was recommended that staff be trained to understand how the concept is operationalized.

Key words

Cross-docking, Last Mile, Logistics, Medicine, supply Chain Management

1. Introduction

Globally Last Mile logistics is an emerging research area with growing interest from scholars and practitioners, especially over the past five years (Cárdenas, et. al., 2017). The mainstay of the health system stems from a well-organized supply chain of vaccines, medicines delivery, and other health commodities. In developing countries, health product supply chains are characterised with many problems which negatively affects the overall health care system (Yadav, 2015).

Transportation in Logistics Management is a fundamental part of the supply chain of goods and services from the point of origination to the destination (Tseng et. al., 2014). Multi-national companies such as Coca-Cola and international pharmaceuticals such as Johnson & Johnson, Novartis and Bayer have demonstrated how they depend on a reliable transport system for their deliveries. (Tseng et. al., 2014). Further, change in techniques and management concepts increases moving load, distribution speed, and quality of service, running costs, facilities usage, and energy savings therefore making transportation to be a key aspect of logistics utilization (ibid).

In health logistics, transporting health commodities to the Service Delivery Point (SDP) and ensuring they reach the Last Mile is a critical component of the systems that support the availability of health products (Yadav, 2013). In South Africa, Zimbabwe and Nigeria, the Last Mile system involves distribution to urban health Centre's by truck, while in rural areas delivery might necessitate the use of ox-drawn carts through flooded grounds to reach a remote health facility. Although most recently, some medicines have been distributed by use of drones in South Africa to reach facilities in the Drakensberg farming block (Yadav, 2015).

“The delivery process from the moment the parcel is shipped from its last distribution centre to the moment it is received at a customer's home, or a collection station is called the Last Mile in the whole delivery operation” (Gevaers et al., 2014). In the health sector, the Last Mile delivery system goes beyond the physical distribution of commodities (Village Reach, 2004).. Medicines move toward the end user while logistics information needs to flow backwards to the distributor(*ibid*). Program Managers at the national level need to know the consumption rate of each health commodity to input data into their procurement plan and to make decisions on the restocking levels for each SDP during the next delivery cycle. However, this planning cycle faces challenges relating to the last mile: lack of access to communication technology at the SDP, lack of proper training in data collection and reporting by health Centre workers, and, most significantly, failure to balance typical health work and data collection and reporting.

Several studies (Edwards, McKinnon, and Cullinane, 2010; Yadav, 2013; Dube & Shivanandan, 2016; Nakagawa and Beale, 2019) found that primary distribution of drugs and health commodities is largely reliable and effective in Africa. Their studies did not consider secondary distribution but found that internal operational arrangements such as opting for In-house vehicle fleets leads to struggles with high costs and low utilization. The above scholars also found that bad road terrains in some African countries affect the performance of the Last Mile system. The notable gap is that these studies do not state the actual impact on the healthcare by producing statistics on the impact and effect that Last Mile model has had since its introduction.

Yadav's (2013) qualitative investigations revealed that there were Inadequate distribution fleet at ZAMMSA as well as poor road network in Zambia making Last Mile delivery expensive. However, the researcher did not investigate the efficacy of other logistical options.

Therefore, the study aimed at establishing whether the Last Mile delivery principle has improved performance and increased access delivery to the last destination and identified challenges in the Last Mile delivery. The study added to information availability on ZAMMSA distribution matters and could improve public trust in the management of health distribution in health Centres.

1.1 Zambia Medicines and Medical Supplies Agency (ZAMMSA)

The MSL, now renamed and re-established as ZAMMSA under Act No. 9 of 2019, was established in 1976 as a semi commercial, limited company under the Companies Act to carry out procurement, storage and distribution of all essential drugs for Zambia's public health sector. The ZAMMSA's shareholders are the Ministry of Health (2%) and the Ministry of Finance (98%) who have delegated the responsibility for the procurement, storage and distribution of health supplies to public run health facilities on behalf of the Ministry of Health (IDC, 2017). The main objective of the establishment of ZAMMSA was to furnish the nation with good quality drugs, medical equipment and other commodities in a timely and consistent manner (IDC, 2017). To achieve its mandate, ZAMMSA incorporated the 'Last Mile' delivery principle to deliver to its serviced facilities. These facilities include regional hubs constructed with support from government and cooperating partners. These are Chipata - Eastern Province, Choma-Southern Province, Mongu-Western Province and Ndola-Copper-belt Province.

All commodities are delivered from central warehouse at ZAMMSA in Lusaka to the regional hubs for storage and onward distribution to the various health facilities in that region as illustrated in Figure 1. Generally, the goal is to shorten the distance travelled for Last Mile distribution of drugs and other medical provisions as well as to guarantee that access to public health and medical products is made easier.

According to Mangiaracina et al., (2016), Last Mile logistics comes with cost related challenges. The pump price of fuel in remote parts of the country is marginally higher compared to places closer to the distribution facilities. The existence of such a challenge leads to the assessment of how ZAMMSA is responding to such limitations and the overall performance of the Last mile logistics system. The following questions guided the study:

- i. What transportation system is in use at Medical Stores Limited Zambia, and does it affect the Last Mile delivery process?
- ii. To what extent has the Last Mile delivery system affected the performance at ZAMMSA since inception?

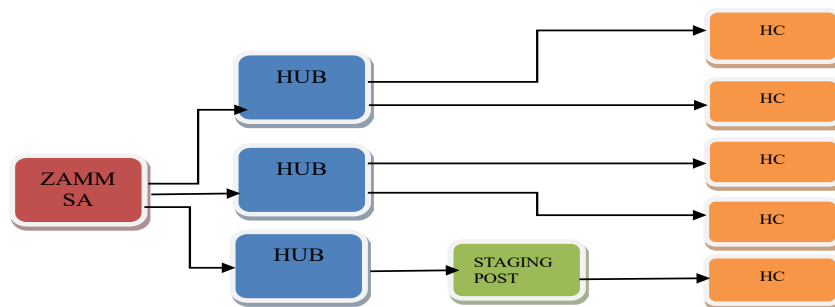


Figure 1. Distribution Network Structure for ZAMMSA.

Source, MSL, (2016)

1.2 Distribution network and Transportation systems used at ZAMMSA

i. Distribution

The process of moving products from the supplier to the customer is called distribution process and distribution is the most important process in the final part of any logistics service (Chopra & Peter, 2011). Warehouse management, distribution centre and Last Mile delivery make up the highest cost hard to reduce in the logistics industry. Secondary distribution is the responsibility of District Health Management Teams and remains a challenge. The distribution of commodities from district stores to approximately 1500 health facilities is the responsibility of District Health Management Teams (DHMTs) reporting to the MOH. Secondary distribution is particularly challenging in Zambia because typical loads to individual health facilities are very small, the destinations are geographically spread out, and the roads to reach health facilities often require specialist off-road vehicles. Significant problems in the secondary distribution include access to transport, lack of dedicated logistics staff at the district level, and challenges in communication throughout the supply chain (Yadav et. al., 2011).

The majority of MoH distribution systems use ZAMMSA for distribution, which usually operate autonomously from MoH logistics. This situation hinders a coordinated, coherent, and efficient national procurement and distribution plan (Yadav et. al., 2011). An effective management of ordering, receipt, storage, distribution and resupply at each level of the distribution network is necessary. The solution could be to have a proposal of having MoH handle the distribution of medical personnel as well as medical equipment and other Capital-intensive materials whereas ZAMMSA handles the commodities (Dube & Shivanandan, 2016).

Research suggests two different distribution network approaches, Intermediate tiers being used as a cross-dock facility or intermediate tiers being completely bypassed (USAID Deliver Project, 2011). The two approaches focus on improving logistics capacity at the district level and reducing number of stockholding points. The first tier approach uses the Provincial Medical Hubs as a cross-docking facility, where already packed and fulfilled orders for individual Health Centre's are delivered to and from there to Health Centres or collected by Health Centres, which reduces some administrative tasks. The facility is used to store and transport medicine and to collect data from the health centre (Yadav et. al., 2011). This approach allows stock holding at the district level and introduces a Commodity Planner (CP) to enhance planning capacity and is responsible for coordinating orders from the health facilities and stock management at the district (USAID Deliver Project, 2011). The planner ensures that requisitions are sent every month by each health facility to the district store and performs picking and packing operations at the district level to fulfil the order requisitions of health facilities under that district. The Planner also estimates the overall requirements and places orders to ZAMMSA for the stock needed to maintain the desired inventory level at the district store. Pharmacy Technologists hold the logistics responsibilities at the district level where this position is filled; while external Planners, hired directly under ZAMMSA, are contracted, and trained in districts where the Pharmacy Technologist's position is vacant (Yadav et. al., 2011).

The second approach uses two tiers and delivery order fulfilment is done directly from National Medical Store to Health Centres (Dube & Shivanandan, 2016). This approach eliminates the intermediate storage of drugs at the district level. The District Store is converted into a "cross-dock", point of transit, wherein it receives shipments from ZAMMSA that are pre-packed for individual health facilities. Under this option, the district does not carry any stock or perform any secondary picking and packing. This system has the potential to reduce the scope for pilferage and leakages as it enables better shipment tracking (ibid). However, it hinges on order requisitions from the health facilities being transmitted to ZAMMSA every month to allow for the assembling of packages to individual health facilities. Table 1 illustrates the roles, responsibilities, and linkages of supply chain members

within ZAMMSA.

Table 1: Roles, Responsibilities and Linkages

<u>ZAMMSA -Lusaka</u>		<u>ZAMMSA -Hub</u>		<u>Health Centre</u>
Procurement		Transshipment / cross docking		Stock management
Inbound Logistics		Data Management		Raising and transmitting monthly purchase orders
Order Processing		Receipt and processing of facility orders through MACS/eLMIS		Capturing consumption data
Outbound logistics		Last mile transport and scheduling		Processing returns
Picking, packing, labelling and dispatching individual facility orders	→	Receipt of expired stocks/receipts	→	Pallet returns
Trunking /Transport inventory management		Data collection from facility		Raising emergency orders
Central repository and data management				
Forecasting and quantification				
Customer service management				

Source: Author 2020

ii. Transportation

Lack of well-functioning transport is a barrier to public sector supply chains due to lack of transport planning, poor vehicle maintenance and inappropriate use of vehicles (Pronello et al., 2016). In Kenya, instead of owning and operating a government fleet of trucks, third party transport providers distribute stock from the Central Medical Stores to the health facilities (Yadav et al., 2011). Depending on the geography, overall economic situation, maturity of the transport market and structuring of the price and service level contracts, a third-party logistics provider can offer better service at rates comparable to the full loaded cost of owning and operating a government fleet, though strong government capacity is required for monitoring and enforcing pre-established performance standards with the transportation operator (ibid).

iii. Vehicle fleet management

The management of the delivery vehicle fleet is a critical component of the entire business and operation. Fleet management activities, ranging from maintenance, telematics, fuel management, speed management and maximising fleet performance, for the trunking and Last Mile fleet are jointly managed by ZAMMSA HQ and respective Hub Managers (USAID Deliver Project, 2011). The Transport Manager based at ZAMMSA in Lusaka has the overall responsibility of the entire vehicle fleet and works with the Hub Managers to control and manage the fleet and ensure efficiency. The key functions that need to be established are the Last Mile fleet refuelling and maintenance points. To run an efficient fleet, ZAMMSA performs the below:

- Establishing the fuelling arrangements (fuel accounts through retailers or own fuel facility)
- Establishment of audit and control procedures for fuel and other consumables and spares
- Installation of security features (indelible marking/modifications) on all new vehicles
- Establishing the repairs and maintenance providers in the respective hub locations
- Establishing basic/minor vehicle maintenance and tyre repair facilities at respective hub locations
- Recommendation and implementation of fleet management technologies that have a real time communication link at hub and head office level (GPS System)
- Determination of hardware requirements
- Installation and maintenance of fleet management hardware & software
- Determination of human resource requirements

iv. Logistic Outsourcing

Outsourcing of logistic functions is an emerging industry in the world and the market continues to grow (Kersten, 2016). Logistics outsourcing is an important option for companies that perceive the existence of gaps between what they want to accomplish with their logistics operations, and what they can achieve with their in-house expertise, (Chopra and Peter, 2011). According to Kersten (2016) Logistic outsourcing is a relationship in which the service provider offers at least two services that are bundled and combined, with a single point of accountability using distinct information systems that is dedicated and integral to the logistic process. Cahill (2017) defined the concept of logistics outsourcing as “Long- and short-term contracts or alliances between manufacturing and service firms and logistic service provider”.

As documented in ZAMMSA implementation plan (2013), the trunking to the cross-docking hubs and Last Mile distribution is performed by ZAMMSA with options for engaging SMMEs, Social Enterprises or 3PLs. Further, the MoH through ZAMMSA, introduced 3PL providers to improve logistics capacity, resulting in ZAMMSA achieving at least 80% coverage of last mile distribution, from 50% in 2019 (PAC Report, 2020).

a. Third Party Logistics (3PL)

Outsourcing 3PLs and contract logistics generally means the same thing as it involves the use of external companies to perform logistics functions, which have traditionally been performed within an organization (Kersten, 2016). The functions performed by 3PLs can encompass the entire logistics process or selected activities within that process (Cahill 2017). A key rationale for such outsourcing is that with intensified global competition, firms concentrate on core activities. (Cahill 2017). These activities are offered to the customers in an integrated way, not on a standalone basis, hence co-operation between the shipper and the external company is an intended continuous relationship.

b. Service Provided by 3PL

The 3PL starts work when manufacturing is completed, providing asset-based services to companies such as warehousing, transportation, freight forwarding or customs brokerage. A summary of 3PL services discussed by (Rushton et al, 2017) Is illustrated in Table 2.

Table 2: Service offered by 3PL Providers

Major Function	Sub-Function	Service Idea
Warehousing and Storage	Distribution depot operation	All standard functions in distribution depot, including goods inward, reserve storage, pick, pack and consolidation of delivery.
	Excess Storage	Externally owned general warehouses were used to store, due to lack of storage space.
	Cross-docking	Immediate delivery of finished goods after production.
	Transshipment	Sorting and onward delivery of ready-picked orders
	Break Bulk	Containers or full vehicle loads are received from abroad for final delivery in a country
Stock and Inventory	Inventory Management	Stock control, stock rotation, stock replenishment obsolescence and other related activities
	Specific Stock Responsibility	Control and vision of the finished goods inventory
Transport	Primary Transport	Moving the product at minimum cost, which generally involves using as large vehicle as possible and making sure that vehicle is filled to capacity.
	Secondary Transport	Loaded vehicles are sent directly to customer's premises without transshipment.
	Merchandising	Preparation of the product for display and sale (labelling and packaging) and also involves the review of stock levels in the shop as well as the arrangement of the goods.

Adapted from Rushton et al, (2017)

c. Benefits of 3PL

In this era of volatile business environment that is changing rapidly, organizations must compete globally to meet customer demands for quality products, superior service, expeditious delivery, and better value (Green et al, 2018). At the same time, 3PLs can help Organisations to achieve among others, cost reduction via more efficient operations, product seasonality control (via outsourcing during peak periods), improved customer service through more timely and frequent deliveries, ability to focus on core competencies, free up resources and access to resources not available at one's own organization (Bahr and Sweeney, 2019).

1.3 Theoretical Review

Two theories, Transaction Cost Economics and Resource Based View theory have adopted for the study.

1.3.1 Transaction Cost Economics (TCE)

Williamson (1975) developed TCE, which was originally outlined by Coase (1937). Transaction Cost Economics (TCE) is an economic theory that provides an analytical framework for investigating the governance structure of contractual relations within a supply chain. Many businesses can benefit from setting up the appropriate governance structure (contracts) to enter into agreements with other entities. For instance, MoH can take advantage of the unique capacities of ZAMMSA (Medicine Hubs) and CHAZ (Motor Vehicles and Medical Facilities) in this case. Transaction Cost Economics has been widely used in many business disciplines to explain inter-company governance (Williamson, 1979), channel structure (George and Weitz, 1988), integration (Chen et al., 2009), mode of entry in the foreign market (Anderson and Gatignon, 1986), collaborative relations (Richey and Autry, 2009), and selection of suppliers (Hsu et al., 2006).

1.3.2 Resource-Based View (RBV)

Barney (1991) broadly described and promoted the RBV, although it is rooted in Wernerfelt (1984) and Penrose (1959)'s earlier work. RBV recognizes the company's owned (valuable, unique, imitable, and non-replaceable) capital as the basis of the firm's sustainable competitive advantage. In this case the fleet of automobiles and the hubs for drugs. Extensions of the theory have provided a range of theoretical refinements, including the firm's knowledge-based view (Grant, 1996), core competency (Prahalad and Hamel, 1990), theory of capabilities (Helfat and Peteraf, 2003) and view of dynamic capabilities (Tece et al., 1997).

This analysis shows that Last Mile logistics work typically lacks theoretical lenses. Despite that finding, a diverse range of theories, mainly imported from other disciplines (economics), can be found in the literature. Previous research concludes that in supply chain management there is a lack of unified theory which can be confirmed for Last-Mile logistics (Halldorsson, 2007).

2. Research Methodology

This research cycle was split into three different stages; pre-study, case study, and final review as depicted in figure 2. The findings during the two preceding stages were consolidated, analysed and concluded during the last phase, named final analysis.

2.1.1 Pre-study

An exploratory pre-study was carried out at ZAMMSA with the intention of evaluating the Last Mile distribution logistics process efficiency. During this process, an abductive research approach was used (Bryman & Bell 2011). The method chosen assisted with, gaining insight into the Last Mile supply chain dynamics and its significance to the health community in Zambian.

In this iterative cycle the author was obliged to constantly re-evaluate and improve the set of theories and assumptions. Although this approach consumed a great deal of time, it led to a simple understanding that was also used for structuring, scaffolding and direct analysis. Ultimately, this method contributed to isolation of the area being examined and provided the basis for a more conclusive case study design (Blomkvist and Hallin, 2015).

2.1.2 Case Study

The primary reason for using a case study, was to gain a thorough understanding of the phenomenon itself, but also to capture the context in which it operates. Although a single case study gives wealth and scope to the field, it builds ideographic awareness such as a propensity to define rather than generalize (Bryman & Bell 2011). Therefore, a single case study requires extensive background analysis (Blomkvist and Hallin, 2015). It is another reason for the extensive pre-study as it helps to reduce the possibility of misinterpretation, while avoiding misrepresenting the findings in the context of the case. Since a fundamental part of the case study consisted of reflecting on the empirical reality by mapping out a particular supply chain structure in the region, involving actors and the flow of information and material from the supply chain, the first part of the case study analysis was very descriptive.

2.1.3 Final analysis

Data analysis consisted of a systematic approach to analysing, organizing and synthesizing the information collected during the two previous stages with the aim of defining trends and relationships between theory and reality (Collis and Hussey, 2019).

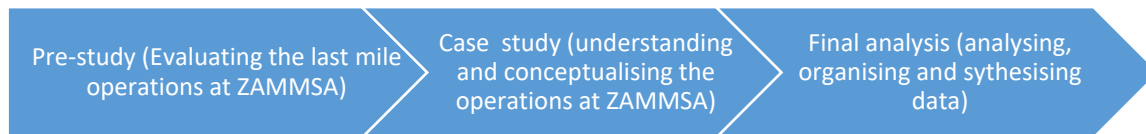


Figure 2. Research process for the study

Source: Author 2020

The research population for the study was ZAMMSA 's entire logistics staff, and three MoH staff based at ZAMMSA. According to ZAMMSA human resource records, there were 75 logistics members of Staff at the time of the research (MSL, 2019). The total population for the study was 78.

The researcher sampled the entire population of 78 respondents through purposive sampling using a questionnaire. A Sampling the entire population gives the researcher an advantage in maintaining data accuracy where possible (Cárdenas, Beckers & Vanelslander, 2017).

To ensure internal reliability of the data, Cronbach alpha test was conducted. Cronbach alpha should be at least 0.70 or higher to maintain appropriate variables of the scale (Miller et. al., 2012).

3. Findings

Out of the 78 respondents selected 50 questionnaires (representing a 64% response rate) were successfully filled. From the analysis the Cronbach's alpha for the twenty (20) questions was found to be 0.79 which is above the standard of 0.70.

The surveyed population was male dominated accounting for 41(82%) compared to 9 (18%) for females. Confirming global trends of transportation being a male dominated field. The surveyed population was of the age 40-50 (66%) suggesting that most employees in the transport and logistic field is above forty (40) years.

3.1 The type of transportation system used at ZAMMSA

To determine the type of transportation system used at ZAMMSA, most of the respondents indicated that ZAMMSA used own vehicle fleet. This is indicated in table 3 showing that out of 50, 32 respondents agreed to the use of own vehicle fleet represented by a mean score of 3.28 and a standard deviation of 1.45. The other mode of transportation is 3PL represented by a mean score of 3.03 and standard deviation 1.40.

Table 3: Respondents view on the type of transportation system in use at ZAMMSA

Description	Total	Own Vehicle Fleet	Third Party(3PL) Logistics'	Both	Don't know
Number(N)	50	32	18	-	-
Mean	-	3.28	3.03	-	-
Standard Deviation		1.45	1.40		

Source: Author, 2020

To ascertain how the challenges of the transportation system in use affected the Last Mile delivery process, the respondents scored a mean of 3.28 for maintenance expenses and a standard deviation of 1.45 showing variable views on maintenance expenses in comparison to the mean of 3.03 and standard deviation of 1.40 for operational expenses (table 4).

Table 4: The challenges of the transportation system in use at ZAMMSA

Description	Total	Inadequate number of vehicles	Maintenance Expenses	Operational Expenses	Other
Number(N)	50	-	32	18	-
Mean		-	3.28	3.03	
Standard Deviation			1.45	1.40	

Source: Author, 2020

The questions in Table 5 were designed for opinion ranking. An attempt was made to obtain a balanced representation and the feedback obtained was categorised to reflect the concomitant influence of the stakeholders using a five-point Likert scale (Strongly agree – 5, partially agree – 4, Indifferent (neither agree nor disagree) – 3, partially disagree – 2, strongly disagree – 1).

Table 5 Summarised questionnaire results

Item	Last Mile Challenges	1	2	3	4	5	Support	Against	Neutral
Q1	Poor rural/urban planning and addressing system by government	0%	5%	15%	55%	25%	80%	5%	15%
Q2	Insufficient national infrastructure, for example, electricity, Inland accessibility (roads, rail), accessible water ways	5%	10%	25%	40%	20%	60%	15%	25%
Q3	Unfavourable policies and legislation and strong political influence limiting governments from investing in the transportation and delivery system	5%	10%	30%	40%	15%	55%	15%	30%
Q4	Loss of trust in the transportation and delivery system by the public and government (low buy-in)	0%	5%	35%	35%	25%	60%	5%	35%
Q5	Internal Bureaucracy and poor processes in transport and logistics department	5%	10%	15%	30%	40%	70%	15%	15%
Q6	Disconnect between transport and logistics stakeholders, for example, ZAMMSA and MoH, management and employees	0%	0%	15%	50%	35%	85%	0%	15%
Q7	Insufficient investment in research and development, human capacity building and human capital building	0%	0%	10%	25%	65%	90%	0%	10%
Q8	Low profit margins due to low cost of services despite high cost of last mile delivery	0%	0%	5%	40%	55%	95%	0%	5%
Q9	High cost of fuel	0%	5%	15%	45%	35%	80%	5%	15%
Q10	Low ICT integration in last mile operations, insufficient ICT infrastructure and poor interconnectivity	0%	0%	20%	55%	25%	80%	0%	20%
Q11	Low/insufficient skilled manpower in transport and logistics at ZAMMSA	0%	30%	35%	20%	15%	35%	30%	35%
Q12	Delays and challenges with international deliveries of medicines due to interlining agreements and customs duty clearance	25%	20%	30%	15%	10%	25%	45%	30%

Note: N= 50 responders, Score Range per question: $n_{max} = 100$, $n_{min} = 50$

Source Author, 2020

The descriptive statistics in Table 5 comparing the views with other opinions indicated that Q8 had the most (95%) supported view followed by Q7 (90%) and Q6 (85%). Low profit margins due to the price of services and the poor

investment in R&D are issues perceived to influence the challenges witnessed in the Last Mile at ZAMMSA. However, most of the respondents did not agree with Q12. Equally, Q12 yielded the most neutral opinions. There were no responses for Q6, Q7, Q8, and Q10. Items Q10, Q1, and Q9 shared the same support ranking (80%) with the highest number of significant opinions recorded.

Based on the feedback received from 50 respondents from the sample population, a single factor Analysis of Variance was conducted (table 6), to identify predictive relationship that could be explored by the ZAMMSA while addressing Last Mile challenges.

Table 6 Analysis of variance: single factor
ANOVA: Single factor

Items	Count	Sum	Mean	Variance	Alpha SS	0.05 Std. Err	Lower	Upper
Q1	50	80	4	0.6315	12	0.2096	3.5611	4.4388
Q2	50	72	3.6	1.2	22.8	0.2096	3.1611	4.0388
Q3	50	70	3.5	1.1052	21	0.2096	3.0611	3.9388
Q4	50	76	3.8	0.8	15.2	0.2096	3.3611	4.2388
Q5	50	78	3.9	1.4631	27.8	0.2096	3.4611	4.3388
Q6	50	84	4.2	0.4842	9.2	0.2096	3.7611	4.6388
Q7	50	91	4.55	0.4710	8.95	0.2096	4.1111	4.9888
Q8	50	90	4.5	0.3684	7	0.2096	4.0611	4.9388
Q9	50	82	4.1	0.7263	13.8	0.2096	3.6611	4.5388
Q10	50	81	4.05	0.4710	8.95	0.2096	3.6111	4.4888
Q11	50	64	3.2	1.1157	21.2	0.2096	2.7611	3.6388
Q12	50	53	2.65	1.7131	32.55	0.2096	2.2111	3.0888

Source, Author 2020

In Table 6 the three most significant mean scores were 4.55, 4.5, and 4.2 for Q7, Q8, and Q6, respectively, namely: (1) insufficient investment in R&D, human capacity building and human capital building (Q7); (2) low profit margins due to low cost of services despite high cost of Last Mile delivery (Q8); and (3) disconnect between stakeholders such as post and community, post and government, management and employees (Q6). The variance for all the variables ranged from 0.368 to 1.713, which once again place Q8 as the most supported condition and Q12 as the least.

4. Discussion of Research Findings

The study established that ZAMMSA use more of their own vehicles than 3PLs. Yadav, (2010) and MSL, (2019) assert that use of a combination of own fleet and 3PL is also acceptable. From the central medical stores to the provincial hubs, ZAMMSA utilises specialised temperature controlled own vehicles and contracts similar vehicles from Churches Health Association of Zambia (CHAZ). This kind of operation is a demonstration of TCE where MoH took advantage of ZAMMSA's Medicine Hubs and CHAZ's Motor Vehicles and Medical Facilities (Williamson, 1979; Richey and Autry, 2009).

From the variance analysis done in Table 6, it is possible that the variance arises from the various types of transport system used. According to Chopra and Peter (2011), a 3PL performs the activities which are carried out by an external company on behalf of a shipper and consists of at least the provision of management of multiple logistics services. These activities are offered to the customers in an integrated way, not on a standalone basis.

Another possible source of variance is the way Last Mile is operationalised at ZAMMSA. Research reviews that ZAMMSA uses two different distribution network approaches.: At times, intermediate tiers are used as cross-docking facilities while at other times they are bypassed.

Dube and Shivanandan, (2016) found a positive correlation between Last Mile delivery logistics system and maintenance costs. Similarly, this study found that 64% of the respondents viewed Last Mile delivery system as expensive in terms of maintenance. Thus, the use of outsourced vehicles reduces the burden that firms usually carry for operations and maintenance of a large fleet. Nakagawa and Beale, (2019), recommend the possibilities of in-house vehicle fleets, but warn of high costs and low utilization in the supply chain. However, outsourced delivery, are expensive but offer professional service leading to increased efficiencies in the long run and reduced

maintenance costs.

The ZAMMSA, being a quasi-government institution does not pursue the profit maximisation objective which is essential for Last Mile delivery system (Yadav, 2013, Nakagawa and Beale, 2019).

The study established that ZAMMSA faces challenges due to a low knowledge base in the transport and logistic department because of low investment in training and development. The RBV theory is applicable as people are a key resource for any transport and logistics system (Chopra & Peter, 2011). Further, the study shows that ZAMMSA routing is not well planned as some deliveries are impromptu and dictated by the trans-shipment of medical suppliers from international suppliers.

5. Conclusion

The study concluded that ZAMMSA uses a combination of own fleet and outsourced third party logistics. Last Mile activity was also found to be quite challenging due to the lack of proper addresses of facilities, thus leading to slow rate of delivery of health commodities to the Last Mile. Last Mile delivery system at ZAMMSA has improved operations due to an increase in the number of vehicles, but it has come with increased operational costs.

One factor affecting the performance of the Last Mile logistical delivery system at ZAMMSA was the lack of training and development for staff in the logistics department. Efficiencies of the system could be improved with training that will bridge the existing knowledge gap identified among the logistical staff.

6. Recommendations

In line with the research objectives, it is therefore recommended that:

1. Zambia Medicines and Medical Supplies Agency invests in other transportation systems that would enhance the effectiveness of the Last Mile delivery system. Airfreight logistics for the Last Mile was found to be a feasible option in South Africa, Nigeria and Uganda (Dube & Shivanandan, 2016);
2. Improvement to vehicle scheduling and routing could be a way to increase the efficiencies of the Last Mile delivery at ZAMMSA. Vehicle routing for the Last Mile is challenging and hard, yet is thought to increase efficiency and reduce operational costs (Gevaers et al., 2014);
3. Zambia Medicines and Medical Supplies Agency invests in training and development for its logistics staff so that the knowledge gap is reduced. This would increase operational efficiencies as was also suggested by Nakagawa and Beale, (2019);

Since Last Mile delivery is such an important phenomenon in transport and logistics, further research in the field is recommended. As such, this study recommends further study on:

1. Ways to improve efficiency in the Last Mile delivery system
2. The effect of vehicle routing in the Last Mile logistics system

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Biographies

Ethel Tembo Mwanaumo works as a Procurement Manager – Capital Items and Contracts at the National Pension Scheme Authority (NAPSA). Previously she worked as a Short-Term Consultant at the World Bank Group, having worked in the Supply Chain Management Environment for over 15 years. She holds an MBA, A Master's in Supply Chain Management, and other qualifications. She is a member of both the Zambia Institute of Purchasing and Supply and the Chartered member of the Institute of Purchasing & Supply. In addition, she is a European Certified Logistician. She has worked with multinational firms such as Johannesburg Development Agency (JDA) and the South African Airlines (SAA) in the global office supporting the Eastern and the Southern Regions. Ethel has further worked with multilateral development organizations such as the United States Agency for International Development (USAID) working in the Procurement Office supporting the various Projects under the Agency, the United States Government in the General Services Officer in Zambia and South Africa, United Nations Development Programme (UNDP) South Africa, and the World Bank in the Zambian office. Other organizations worked for under the Procurement Manager role include the Medical Stores Ltd (MSL) now Zambia Medicines & Supplies Agency (ZAMSA). Ethel is a PhD candidate specializing in Green Supply Chain Management.

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