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Effect of logistics on supply chain performance in private pharmaceutical sector in Rwanda. Case of pharmaceutical wholesales-Nyarugenge District

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Abstract: *Pharmaceutical supply chain is a key pillar of a successful healthcare system and logistics is a cornerstone of strong supply chain where Private sector contributes enormously. Though the private pharmaceutical sector is a key pillar of the healthcare system in Rwanda, few or no studies have assessed the quality of the practices in the sector. The purpose of this study was to analyze the effect of logistics on the performance of the supply chain in private pharmaceutical sector in Rwanda. A cross-sectional study design was adopted. A questionnaire was used and data was analyzed using inferential statistics. The results of the study revealed logistics to be a predictor of supply chain performance in private pharmaceutical supply chain in Rwanda and for 1-unit increase in logistics performance there is 0.48-unit increase in Supply chain performance. The findings revealed a positive and statistically signification relationship between transportation and supply chain performance (B=0.705, p<0.005). Finally, they showed that inventory management, warehousing and information sharing have a positive but no statistical significant relationship with supply chain performance.*
More studies are needed to back our findings and a continuous professional development of pharmacists in the area of logistics for better decision taking is recommended.

Keywords: Logistics, Supply chain performance, Private pharmaceutical sector.

I. INTRODUCTION

1.1. Background

A strong supply chain system allows timely and proper planning of each activity hence achieving compelling results. It encompasses an effective logistic management system which ensures that the right quality product, in the right quantities, and in the right condition is delivered to the right place, at the right time, for a reasonable cost [1].
Logistics is a key component of a strong and successful supply chain either at upstream or downstream. The implementation of best practices in logistics allows firms to gain competitive advantages at all fronts. Logistics enables timely availability of raw materials for production, elimination of wastes in inventory, maximization of warehousing effectiveness and efficiency; which allow firms to maximize resource utilization hence cope better with the growing competition. Furthermore, logistics creates the value chain across the supply chain by enhancing the inbound logistics and outbound logistics performance [2].

The role of logistics can as well be highlighted by the cost uncured by companies in logistical activities. In order to overcome the burden of expensive logistics infrastructures and to increase the performance of the logistics activities; companies tend to outsource logistics services to third part logistics operators [2] [3].

Pharmaceutical logistics is highly essential for availing lifesaving products to people in different locations of the globe. Logistics allows the timely availability of medicines of desired quality and to keep the quality unaltered throughout their movement across different regions and facilities before landing in hands of the end users [1].

Most of developing and middle income countries rely much on imported pharmaceuticals due to few local manufacturing industries [4]. The effectiveness and efficiency of supply chain in these countries depend largely on the

performance of upstream suppliers, the development of logistical infrastructures and the leanness of logistics management of downstream.

Private pharmaceutical supply chain in Rwanda is a pillar for a sustainable health system. Rwanda counts 135 registered wholesale pharmacies with nearly 75 operating in Nyarugenge district. The district represents the general picture of the private pharmaceutical supply chain in Rwanda [5]. As the manufacturing capacity is still at embryonic stage, all distributors rely solemnly on imported pharmaceuticals. The performance of the supply chain is entirely dependent of the logistics performance.

The evidence of inefficiencies in Rwandan pharmaceutical supply chain have been documented by different researchers. The assessment in 2013 of the drug availability at national warehouse revealed that the order fill rate was at 47% and all studies available singled out the role of underperforming logistical activities as the root cause of the supply chain poor performance [6]. The study on availability, prices and affordability showed a better availability in private sector than in public pharmacies with a rate of 71.3% [7].

Most scholars in medical supply chain have concentrated their efforts on public pharmaceutical supply chain. To remain profitable and competitive, onboarding best practices in logistics in private sector can make greater difference on the performance of the entire supply chain and make it more efficient and responsive. Failing to address the effect of logistics on supply chain in private sector is considering the private pharmaceutical sector as standalone and with no impact on the pharmaceutical supply chain. Therefore, this study addresses the knowledge gap in regards to the effect of logistics on supply chain performance in private pharmaceutical sector.

The purpose of this study was to analyze the effect of logistics on pharmaceutical supply chain performance in private pharmaceutical sector in Rwanda. The study had four independent variables were considered: Inventory management, warehousing and information sharing.

II. REVIE OF RELATED LITERATURE

2.1 Theoretical review

Lean theory has guided us in assessing the relationship between logistics and supply chain performance. First crafted and elaborated by Krafcik John (1988), the theory is based on the elimination of loss through identification and total elimination of waste. The elimination of waste leads to reduction of cost and time allocated to activities thus improving profitability and performance in general [8].
The application of lean theory in logistics "Lean logistics" suggests the elimination of waste from production logistics till the delivery to end customers is completed. Overall, it is centered on the improvement of all logistical processes of the entire cycle; maintaining time, place, quality and cost in line being the target (Anna, 2004). In logistics, the areas of emphasis on lean logistics go from logistic service and customer support, demand forecasting, procurement and purchasing, inventory management, packaging of materials, warehousing management and communication [9].

2.2 Empirical review

2.2.1 Inventory management and supply chain performance

Different researchers have analyzed the relationship between inventory management and the overall performance of the supply chain. In a descriptive study entitled effects of inventory management on organizational effectiveness conducted on selected organizations in Enugu, Nigeria showed that there is statistically significant relationship between effective inventory management and organizational effectiveness. The study concluded that Inventory Management is very vital to the success and growth of organizations. The entire profitability of an organization is tied to the volume of products sold which has a direct relationship with the quality of the product; The study further recommended that Organizations should diversify their inventory system to suit specific needs of production, and that management should closely monitor and manipulate their inventory system to maintain production consistency for organizational profitability and effectiveness [10].

The effect of inventory management on performance was further assessed in a study with a sample size of 285. It concluded that inventory management contributes to inventory cost reduction and customer satisfaction which makes it an essential pillar in the successful operations of any business [11]. The importance of good inventory management in

medical supply chain has been assessed in Kenya and the results showed that there is a strong relationship between inventory management and supply chain performance [12].

Furthermore, in their studies Wadhwa et al. (2009) and Fleisch and Tellkamp (2005) respectively concluded that inventory performance has a positive effect on the quality of the product and increased forecasting errors and decreased re-planning frequencies affect supply chain services. Their findings highlight the impact of inventory management on the performance of the supply chain [13] [14].

Q1: What is the effect of inventory management on supply chain performance in private pharmaceutical sector?

2.2.2 Transportation and supply chain performance

The Transportation is the part of logistics that deals with the forward and/or reverse flow of materials either raw materials for production, equipment, work in progress or finished products. It is the activity of moving goods from the location of origin to the location where they are needed. Transportation links companies to their suppliers and customers. It is rare that the product is consumed uniquely at the location where it is produced because companies, suppliers and customers are geographically scattered. Transportation plays a very important role in supply chain [15].

An effective transportation system is crucial in a performing supply chain since it allows to gain a fair transportation cost and selection of an efficient mode of transportation. Overall, a strong transportation system allows to meet customers' needs within required time, with reduced cost and maintained quality [16]. Rwanda is a consumer economy, the capacity of production is very low in almost all domains and in pharmaceutical sector the supply chain relies solemnly on importation. The logistics is very critical to the success of supply chain and more important in non-production system.

Different researches on logistics role on supply chain performance or organization performance have emphasized the role of a strong transportation system as an important logistical activity toward achieving effectiveness and efficiency [15]. In his study on the impact of logistics on customer satisfaction which is one of the indicator of a performing supply chain, Amina and Gabriela concluded that logistics highly influence customer satisfaction with its ability to reduce transportation cost and waiting time [16].

Q2: What is the effect of transportation management on supply chain performance in private pharmaceutical sector?

2.2.3 Warehousing management and supply chain performance

Warehousing has been spotted as a possible source of cost improvement in logistics hence it gives companies a cost advantage. The assessment of the effect of warehousing on organization performance revealed a strong correlation between warehouse operations improvements and organization performance. The results of the descriptive study entitled effect of integrated warehouse operation efficiency on organizations performance concluded that an improvement on warehouse operation increases the performance of the organizations [17].

The assessment of warehouse management system on supply chain concluded that warehousing influences the performance of the entire chain with an effect on customer service level, lead times and cost structure of the organization. It further concluded that warehouse management system (WMS) is an enabling factor of warehouse efficiency and effectiveness through cycle time reduction [18].

In addition, Jermsittiparsert et al. (2019) in their study assessing warehouse attributes and warehouse operations influence on the supply chain efficiency highlighted that the attributes of warehouse have a positive influence on supply chain performance [19].

Q3: What is the effect of warehousing management on supply chain performance in private pharmaceutical sector?

2.2.4 Information sharing and supply chain performance

The benefits of information sharing in supply chain include inventory reduction and cost reduction, to reduce uncertainties, elimination of bullwhip effect, improving resource utilization, proactive detection of problems and increasing responsiveness for better performance of the supply chain members [20].

The link between information and supply chain performance has been examined by different researchers. A descriptive study conducted by Mahdie et al. (2018) assessing the role of information sharing on the performance of drug supply chain in Iran; among 31 experts included in the study most of them responded that effective information sharing has a positive impact on supply efficiency, performance and drug increase the quality of drug distribution [21]. In their review of existing studies, Kumar and Pugazhendhi (2012) concluded that though sharing information in supply chain is critical; its impact on performance depends on the type of information shared, how it is shared and the people to whom it is shared [20]. Overall, when information is accurate and used accurately it has a positive impact on the performance of the supply chain.

Q4: What is the effect of information sharing management on supply chain performance in private pharmaceutical sector?

III. METHODOLOGY

The study employed a cross-sectional research design in examining the relationship between independent and dependent variables while the study sample size comprised of 60 pharmacists in charge of logistics. Five point Likertscale close ended structured questionnaire were used as a data collection instrument for transportation assessment, warehousing assessment, information sharing assessment while inventory management was assessed using two point Likert scale questions. Inferential statistics were used to draw inferences from the data. Multiple linear regression analysis was to respond to the research questions, the model was expressed as;

$Y=a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + e$Where,

Y= Supply chain performance

$a_{1,}a_{2,}a_{3,}a_4$= Coefficients of estimates

x_1= Inventory management performance

x_2= Transport management performance

x_3= warehousing performance

x_4 =Information sharing performance

a_0= Constant

e: Error term

IV. DATA ANALYSIS

4.1. Correlation analysis

The findings of the correlation analysis revealed that there was a positive and signification correlation between inventory performance and supply chain performance and (r= 0.46, p<.003). A strong positive correlation was observed between transport performance and supply chain performance r= 0.6, p<.001)

The correlation between warehousing and supply chain performance was also positive and statistically significant (r= 0.35, p<.03). A medium positive correlation was observed between information sharingand supply chain performance (r= 0.44, p<.004). overall a strong positive correlation between logistics performanceand supply chain performance (r= 0.65, p<.001). It can be concluded that inventory management, transport management, warehousing, information sharing and logistics in general are positively correlated to performance of the supply chain at 0.05 level of significance.

Table 1: Correlation table

	N	Supply chain performance
Inventory performance	43	.459**
Transportation performance	43	.614**
Warehousing performance	43	.348*
Information sharing performance	43	0.441*
Logistics performance	43	.655**

Source: Field Data,2021

**. Correlation is significant at the 0.01 level (2-tailed), *. Correlation is significant at the 0.05 level (2-tailed).

4.2 Regression analysis

A multiple linear regression was computed to examine whether inventory performance, transportation performance, warehousing performance and information sharing performance could significantly predict supply chain performance. The results indicated that approximately 48% of the variance of supply chain performance is accounted for the model (R^2 =0.477) and that the model was a statistically significant predictor of supply chain performance; F (4, 38) =8.7, p<0.001.

In addressing the research questions, the model revealed that transport performance contributed significantly to the model (B=0.705, p<0.005). While inventory performance (B=0.429, p>0.05), warehousing performance (B=0,392, p>0.05) and information sharing performance (0.196, p>0.05) did not. For a one-unit increase in transportperformance; we would expect a 0.7-unit increase in supply chain performance.

Table 2: Inferential statistics

Model	Unstandardized coefficients		Standardized coefficients		
	Beta	Std. Error	Beta	T	Sig.
Constant	10.306	5.434		1.897	.066
Inventory management	.429	.288	.211	1.491	.144
Transportation management	.705	.227	.424	3.098	.004*
Warehousing	.392	.682	.079	.576	.568
Information sharing	.196	.120	.210	1.631	.111

Model summary

R	R Square	Adjusted R Square	Sig.
.691[a]	.477	.422	**.000**

a. Dependent Variable: Supply chain performance

***: P-value is statistically significant (p≤0.05)**

V. CONCLUSION AND RECOMMENDATIONS

The objective of this study were to assess the effect of logistics on supply chain performance in private pharmaceutical sector in Rwanda. A statistically significant relationship was found between transportation performance and supply chain performance. Inventory management performance, warehousing performance and information sharing performance do not have a significant relationship with supply chain performance in private pharmaceutical sector in Rwanda.

This work provides reasonable evidence that could be of significant benefit for private pharmaceutical sector to consequently implementing supply chain performance considering that logistics performance has a positive association with supply chain performance.

For the design, the population and the sample of the study, the study setting, findings of this study cannot be generalized to private pharmaceutical sector in the Rwandan community and the researcher cannot assume any causal relationship between inventory performance, transportation performance, information sharing performance and supply chain performance.

From the results of this study, pharmacists' bodies should regularly organize training on logistics and supply chain.

Future researches are recommended to explore supply chain problems in private pharmaceutical sector, logistics issues in private pharmaceutical sector, Knowledge, attitudes and practices of effective supply chain and logistics in private pharmaceutical sector.

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