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Supply Chain Visibility, Supply Chain Collaboration, and Supply Chain Performance in Ugandan Pharmacies During Covid-19.

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Abstract

Supply chain management is important World over since it provides guidance in material flow with an optimum cost and time generally. Many sectors focus on supply chain management optimization and qualifications to construct a better network of suppliers for their end consumers. The COVID-19 pandemic has highlighted the critical role of efficient and resilient healthcare supply chains in ensuring the availability of essential medications and medical supplies. This study aims to investigate the relationships between supply chain visibility, supply chain collaboration, and healthcare supply chain performance in Ugandan pharmacies during the COVID-19 crisis. A quantitative cross-sectional research design was adopted, and data was collected using self-administered questionnaires. The study population consisted of 298 pharmacies, particularly wholesalers, in Kampala district, with a sample size of 168 respondents. Simple random sampling was employed to select the sample from pharmaceutical companies in Kampala. Data collected was processed, analyzed using the 23.0 version of Statistical Package for Social Scientists (SPSS), and descriptive and inferential statistics were obtained. Pearson correlation analysis was used to determine the relationship between study variables, while regression analysis was conducted to assess the predictive capacity of supply chain visibility and collaboration on healthcare supply chain performance.

Keywords Health and Supply Chain Management, Supply Chain Visibility, Supply Chain Collaboration, Healthcare Supply Chain Performance, Uganda, COVID-19.

Introduction

Supply chains have come to be understood as relatively stable groups of firms engaged in the sequence of production and distribution activities required to serve the end customer. For example, Christopher (1998) explains that; supply chains are a network of organizations that are involved, through upstream and downstream linkages in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer. As such, enterprises cannot be competitive without considering supply chain management and performance activities (Papageorgiou, 2009). Previous scholars such as Li et al. (2006) reveal that supply chain performance has become a potentially valuable concept for securing a competitive advantage and improving organizational performance at large.

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Organizations enhance their supply chain performance because it allows better competitiveness by minimizing fewer value-adding activities, unsatisfactory delivery times, non-compliant quality, and overproduction in the event of disruptions (Lehyani et al., 2021). Recently, the outbreak of covid-19 at the end of January 2020 affected the operations of all business types and sizes globally (Sunday et al., 2021), thus posing special cases of supply chain disruptions thus affecting its supply chain performance (Ivanov, 2020). As such, the global context of the COVID-19 pandemic has spawned a nascent research cluster focused on the implications of COVID-19 for supply chains (Ivanov & Das, 2020; Queiroz et al., 2020). Inter alia, these studies focused, for instance, on resilience. (Ivanov & Das 2020; Ivanov & Dolgui, 2020), decision support (Govindan et al., 2020; Currie et al., 2020), or production recovery plans (Chowdhury, 2020). However, there is limited attention on the criticality of maintaining optimal medical stock levels, especially in the pharmaceutical supply chains in developing countries (Labaran & Adam, 2021). As the COVID-19 pandemic's impact escalated, unprecedented uncertainty and risk surrounding the availability, access, and affordability of medical supplies led to panic buying and stockpiling of medical supplies, creating unanticipated demand shocks, stock-outs, and systematic disruptions of HCSCs. For humanitarian logistics, private businesses, and governments, medical stockouts escalated the challenges of delivering medical relief and increasing life or death risks for COVID-19 patients and their communities (Mack, 2020; Besiou & Van Wassenhove 2020; Schiffling et al., 2020).

For example, in Uganda, though pharmacies and drug outlets were allowed to operate during the pandemic, some of the measures taken to curb the spread of Covid-19 such as restricted movements, totally disrupted the pharmaceutical supply chain and health care service delivery system (Kamoga, 2020). Further, the Independent (2021) reported that during covid19 lockdown, some pharmacies and drug outlets were selling expired drugs, smuggling drugs into the country, illegally dealing in unlicensed drugs, and poor storage systems and untimely delivery, especially for highly sensitive drugs and this lowers service delivery, customer satisfaction leading poor performance levels. Supply chain collaboration (SCC) is two or more autonomous firms that form long-term relationships and work closely to plan and execute supply chain operations toward common goals, thereby achieving more benefits than acting independently (Simatupang & Sridharan 2005, Sheu et al. 2006). It is a partnership where the parties work together, share information, resources, and risks, and make joint decisions to accomplish mutually beneficial outcomes (Bowersox et al. 2003).
Supply chain visibility (SCV) refers to the extent to which actors within the supply chain (SC) have access to the timely and accurate information that they consider to be key or useful to their operations (Barratt & Oke, 2007; Barratt & Barratt, 2011). Improved visibility about customer demands and inventory levels increases the accuracy of demand forecast, accelerates the adjustment of production plans to match changed demands, improves delivery performance, and reduces the amount of inventory in all levels of the supply chain (Bartlett et al., 2007; Bottani et al., 2010; Goel, 2010; Kim et al., 2011; Barratt & Barratt, 2011; Rai et al., 2012).

Literature Review

This chapter covers the theoretical review of the subject of the study and a review of the literature on the relationships between supply chain visibility and supply chain performance, supply chain collaboration and supply chain performance, and the combined effect of supply chain visibility and collaboration on supply chain performance in the pharmaceutical industry.

Dynamic Capabilities Theory

This study was underpinned by the dynamic capabilities theory which was proposed by Teece and Pisano (1994) as an extension of the resource-based view of the firm (Barney, 1991). Teece et al. (1997) define dynamic capabilities as the ability of a firm to integrate, build, renew, and reconfigure resources and competencies either internally or externally to adapt to the changing environment. As such, the dynamic capability of a firm is regarded as an organizational capability to resolve supply chain disruptions, scan opportunities, and mitigate threats through the re-creation of resources and capabilities, to remain relevant and competitive in a turbulent environment (Barreto, 2010; Di Stefano et al., 2010). Over the years, the need to strategically position supply chains to be able to gain better outcomes has been key for managers and academics (Dubey et al., 2018; Baah & Jin, 2019; Baah et al., 2020, Baah et al., 2021). This contributes to the reasons why current competition arenas capture supply chains other than individual firms. The relational view which was proposed by Dyer and Singh (1998) posits that critical resources span across firm borders and as such, supply chain collaborations should be enhanced to enjoy abnormal profits. Dubey et al., (2020) further explained that supernormal profits come in the form of rents that cannot be generated by individual firms. Thus, the authors recommended the need for firms to create collaborative alliances to create not only internal rents but also relational rents. Dubey et al. (2020) in agreement with Feizabadi et al. (2019) suggested that relational rents are possible when collaborating partners combine and exchange knowledge, assets, and capabilities through joint investments, inter-firm knowledge-sharing initiatives, complementing resources, effective governance mechanisms, among others. Thus, the relational view posits that collaborations in supply chains enable joint value creation, which would have been impossible on an individual firm basis, and also projects gain for mutual benefits. This relational view was further supplemented by the resource-based view by giving a detailed perspective on collaborative efforts in supply chains and how they accrue diverse and important benefits for partners (Cao & Zhang, 2011; Barney, 2012; Yang et al., 2019).

The resource-based view connotes those differences in firm outputs can be explained by differences in strategic resources, capabilities, and assets. Most importantly, core competence, dynamic capabilities, and absorptive capacity of firms precede all from the resource-based view perspective in that firms that can master these in addition to a unique combination of resources will achieve greater advantages than competing firms (Cao & Zhang, 2011; Collins, 2021). Therefore, firms that excel in core competencies and capabilities in addition to owning strategic resources will likely see greater outputs (Barney, 2012). Practically, the resource-based view explains that companies that form collaborations and other forms of alliances that go to the core of joint assets investments can lead to building competitive advantages due to their rare, valuable, non-imitable, and non-substitutable nature

(Barney, 2012). In addition, the study further exposes the indirect roles of supply chain visibility and supply chain collaboration on supply chain performance (Prakash et al., 2017; Baah et al., 2021; Singh et al., 2021).

Supply chain visibility and supply chain performance

Information sharing as explained in the literature review forms a vital component in enhancing supply chain visibility, collaboration, and performance (Barrat & Oke, 2007; Sezen, 2008; Cao & Zhang, 2011; Blome et al., 2013; Eckstein et al., 2015; Brusset, 2016). These past studies indicate that information sharing allows supply chain partners to efficiently and effectively work as a single unit in responding to customer needs, market changes, and competitive demands. Due to current competitive markets, stressing information sharing as a critical weapon in gaining competitive advantages due to how it promotes long-term cooperation and coordination which leads to improved supply chain and firm performances cannot be overemphasized (Lofti et al., 2013; Aslam et al., 2018). Thus, the need to create, share and use relevant information is key to attaining improved supply chain performance in current business environments. The authors further asserted that the important role of information sharing in supply chains is that it enhances benefits while reducing costs such as initial information systems investment, for example, electronic data interchange, and enterprise resource planning, among others. Dubey et al. (2020) explained that as competition deepens, information technology and processing also evolve and as such, firms have the responsibility of becoming integrated to be able to achieve agility and competitive gains while improving supply chain performance. Additionally, Aslam et al. (2018) emphasized that effective information-sharing practices in supply chains are crucial for developing dynamic capabilities which enhance supply chain practices and performance.

Dubey et al. (2018) in harmony with Cao and Zhang (2011) espoused that information-sharing projects collaborative and competitive advantages through effective supply chain collaborations, and agility. Supply chain visibility has mostly been associated with information sharing as indicated by Barrat and Oke (2007) and Brusset (2016). Moreover, visibility in supply chains as captured by Blome et al. (2013) require information sharing to achieve its objectives. Thus, information sharing in supply chains improves visibility which also improves collaborations, agility, and ultimately performance (Blome et al., 2013; Dubey et al., 2018, 2020). Moreover, information sharing boosts collaborations in supply chains which also significantly impacts competitive advantage as detailed by Feizabadi et al. (2019) and Cao and Zhang (2011) established how supply chain collaborations based on effective information sharing improve relational rents in addition to others leading to elevated competitive positions obtained from collaborative advantage and improve firm performance. From the above, it is without question that information sharing disperses enormous benefits in supply chains from visibility to performance and as such needs further probing to expand knowledge on the wider scope and impact of information sharing in supply chains. This leads to the following hypothesis;

H_1: Supply chain visibility positively influences the supply chain performance of pharmacies.

Supply Chain Collaboration and Supply Chain Performance.

Past research has shown the contribution of supply chain collaboration (SCC) towards supply chain performance in firms (Arshinder et al., 2011; Gunasekaran et al., 2015; Chauhan et al., 2022). For example, Arshinder et al. (2011) assert that SCC can enhance the performance of supply chains and provide the greatest benefits to supply chain members. As such, SCC can be utilized to improve performance by redesigning workflows and promoting resource sharing between supply chain members (Arshinder et al., 2011). Similarly, Chauhan et al. (2022) posit that more effective SCC strategies can boost the sustainable operating performance of the supply chain by enhancing capacity building and resource utilization. Since supply chain performance is also assessed in terms of quality, costs, and timeliness and, with the relevant resource utilization such as information, firms can project how much is desired, and produce it on time, making it possible to deliver on time and eliminate the bullwhip effect, creating a supply chain with good performance (Taylor, 2000). Availing of accurate inventory information minimizes costs incurred due to stock outs and overstocking and ensures that deliveries are made on time (Yao, Evers & Dresner, 2007; Achee et al., 2022). Information sharing shortens product and delivery lead times making products available on time to customers (Tachizawa & Ginemez, 2007; Alzoubi et al., 2022). Access to information enables channel members to plan how much to stock for a given period (Fasanghari, Roudsari & Kamal, 2008). Information sharing further leads to improved supply chain performance through improved supply chain planning, reduced lead times, improved customer service, increased flexibility, on-time delivery, and improved quality of products (Vereecke & Muylle, 2006). Thus, we propose the following hypothesis:

H_2: Supply chain collaboration positively influences the supply chain performance of pharmacies.

Supply Chain Visibility, Collaboration, and Supply Chain Performance

Supply chain visibility depends on the propagation of relevant and up-to-date information among network partners to achieve goals of enhanced collaboration and performance (Barrat & Oke, 2007; Blome et al., 2013; Dubey et al., 2020). Past studies indicate that supply chain visibility, which is dependent on sharing of meaningful information across supply chains, presents benefits for supply chain collaborations and performance than supply chains that lack information sharing (Barrat & Oke, 2007; Brusset, 2016; Caridi et al., 2014). Visibility in supply chains improves collaborations since it makes supply chain partners feel updated and integrated into supply chain initiatives leading to the building of trust and commitment. The presence of trust and commitment in supply chains will likely ensure superior supply chain performance because when supply chain partners work together as a single unit, it breeds resilience to uncertainties as well as risks (Braunscheidel & Suresh, 2009). Practically, visibility in supply chains enhances flexibility, which makes adaptations to market changes and trends faster, easy, and less costly. As such, the influence of visibility in supply chains is very robust and significant, especially in supply chain performance.

Blome et al. (2013) emphasized that improving supply chain performance is crucial for organizational growth and survival in current competitive environments and as such, firms needed to evaluate and improve supply chain practices to improve overall performance. From

this perspective, supply chain visibility which relies on efficient information sharing will likely promote or improve supply chain collaborations and performance because through visibility, relevant data relating to customer orders, preferences, and perceptions as well as competition trends and dynamics can easily be disseminated across the supply chain for fast decision making and response to these changes thus enhancing collaborative efforts and performance in supply chains. From the discussion, it is evident that supply chain visibility has critical impacts on supply chain collaboration and supply chain performance. Hence, this leads to the following hypothesis;

H_3: Supply chain visibility and supply chain collaboration positively influence the supply chain performance of pharmacies.

Methodology

Research Design

The researcher adopted a quantitative cross-sectional survey research design. A quantitative research approach was selected for simplicity and precision purposes when it comes to addressing objectives aimed at examining the effect and relationship between variables (Williams, 2007). A cross-sectional survey was used because it enables the collection of a considerable amount of data in a snapshot (Bryman, 2004).

The Population of the Study

The study population comprised 298 pharmaceutical outlets particularly wholesale pharmacies in Kampala licensed by the National drug authority as of 1st August 2022 (www.nda.go.ug). Kampala was preferred because it has the majority of pharmaceutical companies compared to other regions in Uganda. The unit of analysis was a pharmaceutical company and the unit of inquiry was Supply chain managers, operations managers, purchasing coordinators, or pharmacists. These were selected because of their vast knowledge of supply chain operations.

Sample Size

The sample size was 168 pharmaceutical companies which were determined using the sample size determination formula below (Yamane, 1967);

$$n_r = \frac{N}{1+N(e)^2}$$

Where; n_r is the desired sample size,
N is the population
e is the allowable error, taken as 5%

Sampling Technique for Quantitative Method

Simple random sampling was applied to select a sample of the pharmaceutical companies in Kampala. This is a natural starting point in a discussion of sampling because it is the simplest form of random sampling and it serves as the foundation for many other random sampling methods. Simple random sampling is a technique with the property that every element within a population has an equal chance of being included in the sample. (Groves et al., 2009; Kish 1965; Peters & Eachus 1995). This involved use of the good old ‘‘hat method.’’ We made

one slip of paper for each pharmacy in the population and put them into the hat, each slip of paper was identical to every other slip (for example size, shape, number of folds, and weight). Therefore, in order to make sure that each piece of paper had an equal chance of being chosen, we mixed them all up and choose one slip of paper which was the first sample member. Then shacked up all the slips in the hat and drew another slip, and repeated the entire process until 168 pharmacies were selected. This process provided a simple random sample of 168 pharmacies (n = 168) from a population size of 298 (N = 298).

Data Collection

The study was a survey based on primary data. Primary data was used because it provides first-hand information to the researcher. Data was collected using self-administered structured questionnaires rated using a 5-Point Likert scale ranging from; 5-strongly agree, 4-agree, 3-Not sure, 2-disagree, and 1-strongly disagree. The scale was selected to provide respondents with the extent to which they agree with the different notions (Likert, 1961). Only closed-ended questions were used. All questionnaires were hand delivered or emailed to the respondents and filled questionnaires were retrieved for further analysis. The questionnaire was divided into key sections to address precisely each variable. These included; background information of the respondents, supply chain visibility constructs, supply chain collaboration, and supply chain performance. Hence, the questionnaire instrument was embraced because it enables obtaining data from a large sample, and it is the most appropriate tool.

Validity and Reliability of the Instrument

The validity of the study was concerned with the extent to which the data collection instruments accurately measure what they intend to (Amin 2005). In this study, expert judgment and content validity index (CVI) was used. After drafting the questionnaire, it was shared with academic supervisors to provide comments regarding the suitability and understandability of the items containing in the instrument. Based on their comments, the questionnaire was amended. The research instrument was given to 6, 6 and 9 research supervisors respectively in MUBS who were selected purposively by the researcher. These supervisors were requested to indicate which items were relevant and not relevant. While computing CVI, only responses that are relevant were considered. Content validity was computed as the responses for relevant items were added and divided by the total number of items. According to Creswell (2014), a CVI of 0.7 and above is considered valid. Cronbach Alpha coefficient was used to determine Reliability of the instrument. According to George and Mallery (2003), if the reliability result is above 0.9 it is excellent, if it is above 0.8 it is good and if it is above 0.7 it is acceptable. These were presented in Table 1.

Table 1 Validity and Reliability

Variables	Cronbach Alpha Coefficient	Content Validity Index	Number of Items
Supply Chain Visibility	.828	.68	6
Supply Chain Collaboration	.878	.77	6
Supply Chain Performance	.973	.72	9

Source*:* Primary Data

The results in the table above indicates that the data collection instrument was both valid and reliable, generating Cronbach Alpha coefficient and content validity index values above 0.70 respectively. This implies that the instrument delivered accurate and consistent results even when subjected several times to the field, hence valid and reliable.

Data Processing, Analysis, and Presentation

The data collected was compiled, sorted, classified, and entered into the computer and analyzed using the 23.0 version SPSS. Descriptive statistics and inferential statistics were obtained. Pearson correlation analysis was applied to establish the relationship between study variables. Regression analysis was used to determine the degree to which supply chain visibility and collaboration predict supply chain performance.

Discussion of Findings

Correlation Analysis

Pearson's correlation analysis was conducted to measure the strength of linear associations between the study variables and is denoted by r. Pearson's correlation coefficient, r, can take a range of values from +1 to -1. A value of 0 indicates that there is no association between the two variables. A value greater than 0 indicates that there is a positive association; that is to say, as the value of one variable increases, so does the value of the other variable. A value less than 0 indicates a negative association; that is to say, as the value of one variable increases, the value of the other variable decreases. The study variables were measured on a continuous scale and therefore, Pearson correlation was found to be the most appropriate to test the relationship between variables.

Table 2 Pearson's correlation results

Variables	Supply chain visibility	Supply chain collaboration	Supply chain performance
Supply chain visibility	1		
Supply chain collaboration	.546	1	
	.608**	.487**	1

Supply chain performance	.

Source: Primary data

The Relationship Between Supply Chain Visibility and Supply Chain Performance

The results in the table indicate that there is a positive significant relationship between supply chain visibility and supply chain performance of Ugandan Pharmacies in Kampala (r=.608, p<.01). This implies that any positive change in supply chain visibility may likely result in a positive change in supply chain performance.

The Relationship Between Supply Chain Collaboration and Supply Chain Performance.

The results in table indicates that there is a positive significant relationship between supply chain collaboration and supply chain performance in Ugandan pharmacies in Kampala (r=.487, p<.01). This means that any positive change in supply chain collaboration results in a positive change in the supply chain performance of Ugandan pharmacies in Kampala.

Regression results (supply chain performance was regressed on supply chain visibility and supply chain collaboration).

Table 3 Regression analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	11.542	1.767		6.533	.000		
	Supply chain visibility	.871	.138	.487	6.299	.000	.702	1.425
	Supply chain collaboration	.143	.050	.220	2.846	.005	.702	1.425
R square=0.403, Adjusted R Square=0.395								

Source: Primary data

Conclusions

This study was intended to investigate the relationship between supply chain visibility and supply chain performance in Ugandan pharmacies using correlation analysis and it was found that there was a positive significant correlation (r=.608, p<.01) between the two variables. This can therefore be concluded that any positive change in supply chain visibility can result in a positive change in supply chain performance.

Regression Analysis
To assess the combined effect of supply chain visibility and supply chain collaboration on supply chain performance in Ugandan pharmacies.

Supply Chain Performance was Regressed on Supply Chain Visibility and Supply Chain Collaboration.
The dependent variable (supply chain performance) was regressed on supply chain visibility and supply collaboration. According to adjusted R^2, both supply chain visibility and supply chain collaboration explain 39.5% of the variance in supply chain performance. This means that 39.5% of supply chain performance is accounted for by supply chain visibility and supply chain collaboration. This shows that other factors contribute to 60.5%. The results further indicate that supply chain visibility (β=0.487, $p<0.01$) and supply chain collaboration (β=0.220, $p<0.01$) are all significant predictors of supply chain performance but supply chain visibility is the most influential predictor of supply chain performance represented by its highest Beta value.

This study was also intended to assess the relationship between supply chain collaboration and supply chain performance in Ugandan Pharmacies using correlation analysis and it was found that there is a positive significant relationship indicated in the coefficients (r=.487, p<01) between supply chain collaboration and supply chain performance. This can also be concluded that any positive change in supply chain collaboration results in a positive change in the supply chain performance of Ugandan pharmacies in Kampala. This implies that information sharing, incentive alignment; resource sharing, and joint knowledge creation among others can be improved. Finally, the study was also designed to assess the combined effect of supply chain visibility and supply chain collaboration on supply chain performance in Ugandan pharmacies using regression analysis and this was found that adjusted R^2, for both supply chain visibility and supply chain collaboration explains 39.5% of supply chain performance. This means that 39.5% of supply chain performance is accounted for by supply chain visibility and supply chain collaboration. This shows that other factors contribute to 60.5%. Therefore, it can be concluded that supply chain visibility (β=0.487, $p<0.01$) and supply chain collaboration (β=0.220, $p<0.01$) are all significant predictors of supply chain performance but supply chain visibility is the most influential predictor of supply chain performance represented by its highest Beta value.

Recommendations
It should be recommended that supply chain partners should ensure that there is visibility or transparency and accessibility of information to ascertain and plan for the business in terms of demand, supply, and market situations. This enables partners to have information that can guide the process of decision making and this automatically improves the supply chain performance of pharmaceutical businesses in the region. It can also be recommended that efforts to improve the collaborative relationships among stakeholders in the business should be improved through joint knowledge creation, goal congruence, resource sharing, and incentive alignment among others by ensuring that they are in businesses that have enough resources for proper continuity and making it compulsory to share information among themselves concerning the changes in the market like on supplies, demand forecasts and any

other factor that can affect their businesses and this will at the end improve on the supply chain performance.

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