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SYNCHRONIZATION OF LOGISTICS DRIVERS FOR OPTIMIZING SUPPLY CHAIN OPERATIONS IN TANZANIA: A DESCRIPTIVE SURVEY

Barnabas Bitta MAAGI
College of Business Education, Tanzania

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Abstract:
The purpose of this study was to assess on use of synchronized logistics drivers towards optimized supply chain operations by using Tanzania among the developing country as a case study. On methodology, the study employed descriptive survey design and population of the study involved registered logistics service providers in Tanzania whose list were obtained from Tanzania Revenue Authority's data base. Quantitative data from 126 respondents were analyzed by using descriptive analysis presented in form of frequency and percentages and also the relationships between synchronized logistics drivers and optimized supply chain operations were tested by using correlation analysis. The results indicate that majority of respondents agreed on the role of synchronized logistics drivers towards optimization in supply chain operations whereby after testing the results by using regression model the information system variable was found significant among the three tested variables (p = 0.002). The study concluded that synchronized information systems play significant role in achieving optimized supply chain operations thus the study implication on practice and social is that synchronization of logistics drivers will enhance optimization in supply chain operations. On originality, most of the past reviewed studies have concentrated on the aspect of synchro modality which is one component of logistics driver (modes of transport); this study establishes a new foundation by studying synchronization in the inclusion of more logistic drivers in supply chain operations (information, transport and warehousing).

Keywords:
Synchronization, Logistics Drivers, Optimization, Supply Chain

1. Introduction
Customer requirements are ever-increasing, thus calling delivery of high-quality customized products in short time as a strategy to overcome global competition which is becoming more and more intense (Reinhart et al, 2012). Business organizations are confronted with increasing demand for a wide variety of products, which in turn gives rise to a high-level complexity of their logistics systems (ElMaraghy, 2013). The synchronization of activities across logistics systems appears to be an appropriate technique to cope with variety and cost efficiency at the same time. The potential of synchronized activity for increasing the performance of logistics systems has necessitated change in modus operandi of activities in production and supply chain logistics as part of the just-in-time philosophy, inventory optimization strategies and mitigation of the bullwhip effect (Chankov et al, 2014).
Synchronization primarily relates to activities occurring at the same time; it is the ability to organize, manage and coordinate the supply chain activities so as to make them operates at the same time or in the same manner. In other words, it is the situation whereby members within the supply chain decide to work together by integrating their plans, systems and operations for the purpose of ensuring optimum value in the supply chain operations (The 2009). Synchronization of logistics drivers such as material flow, transportation, warehousing, production processes and information systems is an important thing in supply chain management because alignment of such logistics drivers among the supply chain partners facilitates smooth flow of materials from source of materials (upstream) to ending customers (downstream) and hence contributing to value addition in the business undertaking.
According to Bauyrzhan et al (2022), synchronized logistics improves flexibility, collaboration between supply chain partners and resource utilization which in turn creates value addition in the business processes. In addition, a well aligned and coordinated supply chain activities among stakeholders ensures fully utilization of containers, reduced transport costs through shared mode of transport, reduced order cycle time, lower inventory levels, increased order

fill rate, improved customer service and satisfaction levels. This indicate that synchronization of the logistics drivers among supply chain partners is an important aspect for improving efficiency in logistics management because according to Kong et al (2017), logistics operations account to 40% of the product price in moving products from manufacturers towards the ending customers.

In order to improve efficiency, supply chain partners need to establish aligned systems, processes and operations in terms of sharing infrastructures, transport services and other logistics services which will enhance timely and economical delivery of materials along the supply chain network (Turban et al, 2018). Despite of these benefits accrued from synchronizing the logistics drivers, scholars have reported that the logistics industry still encounter some challenges which affects smooth flow of supply chain operations. For example, according to Tanzania Logistics Risk Report (2016), the Tanzania's logistics network face several challenges including port congestion, increasing cost of import and export, poor transport infrastructures which consequently exacerbates risks of cargo damage and shipment delays. Furthermore, the report indicates that the logistics risks in Tanzania is 28.6% which puts many business organizations at a crisis of underperformance and threatening investors to invest in business activities in Tanzania.

In USA, the report of the Council of Supply Chain Management Professionals (CSCMP) (2022) revealed that the supply chain industry has been facing many challenges such as supply shortage, labour shortage, capacity shortage and congested transportation network which in totality cause disruption in supply chain and increase the business logistics costs by 8% of the country's GDP. Furthermore, the report highlighted that these disruption in logistics systems is associated with lack of synchronized system which led to severe mismatch between supply and demand in terms of raw materials, transportation, warehousing capacity and labour. Following these mismatches in supply chain, many business organizations were consequently entrenched into crisis including rise in inventory carrying cost by 25.9% and transportation cost by 21.7%.

Unsynchronized logistics among supply chain partners brings difficulty in managing logistics activities and hence deterring value addition in processing and moving goods to ending customers in the supply chain. In other words, when the buyer establishes his own plans, systems and operations without considering the logistics used by the supplier it means there will be a mismatch of logistics which at the end will affect both parties in terms of production schedules, delivery timing, vehicle utilization, information sharing and other logistics in supply chain. Non-aligned systems and operations among supply chain partners has affected organization processes, transportation times and scheduling systems resulting in a lack of real-time information exchange among the partners which ultimately affects the ending supply chain operations (Liu et al, 2018).

Following existence of that problem, several studies conducted research for the aim of coming up with a solution including Leung et al, (2018) who proposed use of a cloud-based technology to overcome the problem in order fulfillment process. On a similar attempt to solve the problem, Alawneh et al, (2018) examined inventory logistics synchronization mechanism of order fulfillment in warehouses in serving customers while other studies focused more on examining optimization structures in shipment of products and disruption risks involved in supply chain. These studies were more focused to address challenges which affects supply chain such as fragmented systems of operations among supply chain partners which at the end affects efficiency in performing supply chain activities (Van der Heide et al, 2018).

Despite the effort done by these previous studies, most of their attempts were case specific which makes difficult to make generalization of their findings. That is, it is not clear if there is any study attempt that examined synchronization of logistics drivers of supply chain (information, transport and warehousing) using descriptive survey design in Tanzanian context. In this view, specifically this study aimed to examine the usefulness of synchronized information systems, transportation systems and warehousing systems towards optimized supply chain operations in Tanzania using a descriptive survey design as a strategy to reach generalization of the findings.

2. Theoretical Literature Review

2.1. Logistics Concepts and their relation to Synchronization

Logistics means ensuring the availability of the right goods, in the right amount, in the right condition, at the right place, at the right time for the right customer at the right costs. This means that in order to improve service delivery to the customer based on these objectives time taken to perform every activity in each workstation must be determined and made in a uniform manner across all the workstations. When the cycle time is the same for all

stations it ensures that the products move in a synchronized way, as a result, the paced assembly line can be considered to serve as a role model of a highly synchronized logistics system which is faster and economical in supply chain operations. Another well-established logistics concept related to synchronization is the just-in-time (JIT) philosophy which means that the right parts needed for a certain logistics process are delivered only at the time they are needed and only in the amount needed (Chankov et al, 2014). The synchronized supply chain system eliminates one ordering decision point from the supply chain and thus connects two or more tiers directly among supply chain partners. According to Tavasszy et al, (2017), "a collaborative supply chain simply means that two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation". They define supply chain coordination as the extent to which participating actors become involved in information sharing and decision synchronization by having joint-decision making (e.g., resolving conflicting objectives) between the customers and other supply chain actors. The concept of synchronized logistics system becomes more important for business organizations that operates international business characterized by surge demands which consequently leads into supply chain disruptions. This calls for better coordination and management of supply chain operations through use of synchronization approach which enables all operations of different supply chain partners to be integrated as a single point and operated at the same time period along the supply chain network. For example, the warehousing and cross docking operations can also be associated with synchronization due to the timely transshipment of goods moving product through distribution centers without storing it" (Piotr & Kinga, 2023).

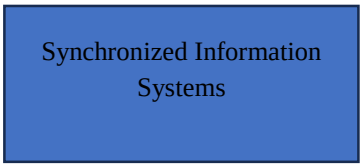
2.2. Link from Logistics Concepts to Synchronization

The just-in-time philosophy and the synchronous manufacturing concepts correspond directly to the synchronization definitions available in the logistics literature. Delivering the right parts exactly when they are needed requires flow-oriented coordination as well as corresponds to an output-input coupling between two consecutive logistics processes. Synchronized supply, however, is a notion which does not have an explicit link to the synchronization definitions. The elimination of one decision point does not correspond to a form of interaction, correlation, coupling or adjustment of rhythms. The same holds for the SCM terms (collaboration, coordination and integration), which represent strategic considerations, but do not cover synchronization phenomena per se. Here we can speak about neither correlation between states, nor common operation regime, nor adjustment of rhythms. Instead, these qualitative terms provide strategic advice about certain managerial activities such as increased communication and information sharing.

Finally, the cross docking strategy brings a different perspective. Synchronization between the incoming vehicles and the outgoing vehicles is required for its implementation. This form of output-input coupling ensures very small or even no storage time of the product in the warehouse. Following the customer demand, the taken time determines how much time each of the assembly line workstations has available to execute its task. A change in the time would lead to changes in the times for all workstations; hence organization need to make adjustment in its operations so as to prevent unnecessary interruptions in supply chain. The just-in-time philosophy and the synchronous manufacturing concepts aim at delivering the right parts exactly when they are needed requires flow-oriented coordination as well as corresponds to an output-input coupling between two consecutive logistics processes. Synchronized supply is a notion that provide strategic advice about certain managerial activities such as increased communication and information sharing between the incoming vehicles and the outgoing vehicles. This form of output-input coupling ensures very small or even no storage time of the product in the warehouse.

2.3. Benefits of synchronized logistic system

Synchronized logistics system helps business organizations to overcome demand disruption in time hence being a solution to mitigate the bullwhip effect in supply chain. This is done by establishing a pool of inventory at multiple points in the supply chain and then using strategic points for placing and using inventories timely and at low cost. Lack of synchronization leads to high costs of operations in the organization due to inefficiencies in every stage of the supply chain activities from manufacturing, transportation up to the ending customers. Synchronized information flow enables all supply chain partners to easily see and manage the end-to-end flow of products, service and information at the same time.



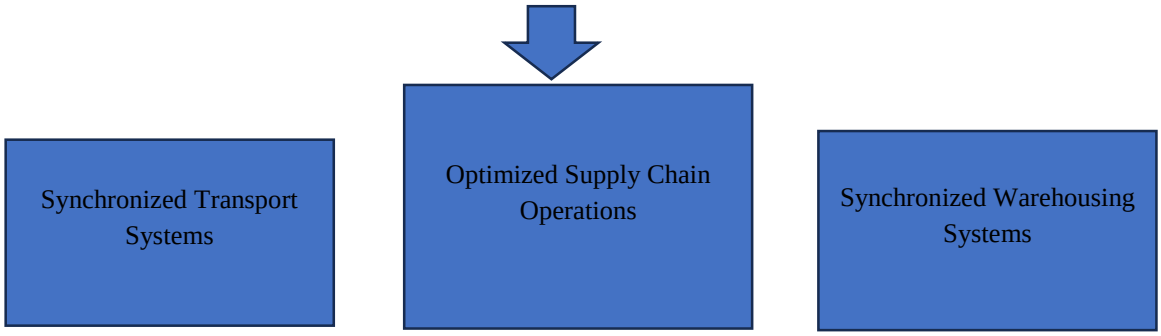


Figure 1: Conceptual Framework of Synchronized logistics Drivers
Source: Developed from a Theoretical Literature Review

3. Methodology

In order to address the issues of synchronized logistic drivers and determine how it leads to optimized supply chain operations, this study has employed a descriptive survey design involving major private third-party logistic providers importing goods from abroad to Tanzania. This population of the study was considered appropriate because logistics operations accounts to 40% of the product price (Kong et al, 2017). The list of registered transporters, telephone numbers and their emails were obtained from Tanzania Revenue Authority (TRA) Customs Department data base which indicated a list of 243 registered Clearing and Forwarding Agents (URT, 2023). Upon getting the population number, the study used Yamane formula (1967) to calculate the sample size which enabled to arrive at a sample size of 152 respondents. The study employed a convenient sampling technique to access the required number of respondents. In this case, respondents that were easily accessed and confirmed participation through telephone were sent e-mails to fill the questionnaires. The study has used quantitative approach whereby a structured questionnaires were prepared and pre-tested to 10 transporters to check its validity before collecting the actual data. From pre-testing, the tools were more modified by simplifying the language and giving option to use the local language (Swahili). After validating the tools, the questionnaires were submitted to respondents through their e-mails using Google Forms whereby the respondents were required to open the established link and respond to the provided questions. From a total number of 152 respondents communicated, 126 managed to respond and submit the filled questionnaires which made a response rate of 83%. Upon getting the data, data analysis was performed by using descriptive statistics in form of frequency and tables as well as Regression analysis to determine if synchronized logistic drivers have significant relationships with optimized supply chain operations. The data were computed with aid of SPSS computer software version 25 whereby the obtained results were interpreted to get a reflection on use of synchronized logistics drivers towards optimized supply chain operations. The formula for determining the sample size is presented below:

$$n = \frac{N}{1 + N(e)^2}$$ ..... Equation (1)

4. Results and Discussion

4.1 Descriptive Statistics

4.1.1 Synchronized Information System

Respondents were asked to respond to the given structured questionnaires regarding use of synchronized information systems towards optimized supply chain operations. The results are presented in the following Table:

Table 1: Synchronized information systems towards optimized SC operations

		Frequency	Percent	Cumulative Percent
Valid	Strongly Disagree	7	5.6	5.6
	Disagree	21	16.7	22.2
	Neutral	13	10.3	32.5
	Agree	54	42.9	75.4
	Strongly Agree	31	24.6	100.0
	Total	126	100.0	

The results in Table 1 indicates that majority of the respondents 85 out of 126 (67%) agreed that the use of synchronized information systems enhances optimized supply chain operations. The results concur with observation raised by Schulte et al. (2017) that sharing real-time information among stakeholders enables every supply chain partner to leverage, especially those concerned with planning, forecasting, and risk management, leading to improvement in the overall quality and visibility of the supply chain. For instance, to avoid empty truck trips and to reduce emissions, truck appointment systems can be used to coordinate and create collaboration among truck drivers. Therefore, it is necessary to organize integration and data sharing to maximize advantages for all stakeholders without harming others' interests. In addition, Corman et al (2017) argues that real-time information can be used to control and reschedule railway traffic or to update the routing and scheduling plans of fuel supply vessels that serve customer ships outside ports (Christiansen et al., 2017). In other words, the integration of information systems among supply chain partners helps to establish a good relationship between the members as well as enabling more flexibility to meet demand when disruptions occur. The concept of synchronization of logistics becomes more important for organization that frequently export and import goods across the world whereby the organization can make full utilization of the available resources from other partners instead of single entities operating on their own, which requires great effort and coordination between stakeholders. For example, when organizations use the common information system which is regarded by other partners as a standard technology it means organizations will be able to coordinate and exchange data with its customer and thus improve efficiency and take logistics to a higher level. In that view, organizations should make synchronization an essential pre-condition for optimal and sustainable transportation in business operations (Christiansen et al., 2017).

4.1.2 Synchronized Transport Systems

Respondents were also requested to rate their agreements on the provided statement in relation to use of synchronized transport systems towards optimized supply chain operations as indicated in Table 2 below:

Table 2: Synchronized Transport systems towards optimized SC operations

		Frequency	Percent	Cumulative Percent
Valid	Strongly Disagree	10	7.9	7.9
	Disagree	16	12.7	20.6
	Neutral	7	5.6	26.2
	Agree	51	40.5	66.7
	Strongly Agree	42	33.3	100.0
	Total	126	100.0	

With regard to synchronized transport systems, the results in Table 2 shows that majority of the respondents 92 out of 126 (73%) supported the statement that by synchronizing the transport systems among the logistics providers will enhance optimum supply chain operations. The results are in harmony with reviewed literature on synchronization including Dong et al. (2018) who pointed out that synchronization of logistics drivers has the potential to enable coordination of several activities of supply chains which at the end makes an organization achieve optimum operations and sustain in the competitive business.

4.1.3 Synchronized Warehousing systems

Another aspect was synchronized warehousing systems whereby respondents were asked to respond on the given statement regarding use of synchronized warehousing systems in supply chain operations as shown on Table 3 below:

Table 3: Synchronized Warehousing systems towards optimized SC operations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	8	6.3	6.3	6.3
	Disagree	15	11.9	11.9	18.3
	Neutral	4	3.2	3.2	21.4
	Agree	52	41.3	41.3	62.7
	Strongly Agree	47	37.3	37.3	100.0
	Total	126	100.0	100.0	

The results presented in Table 3 shows that majority of the respondents 99 out of 126 (78.6%) were in agreement that by synchronizing the warehousing systems among the logistics providers helps in achieving optimum supply chain operations. The result is also backed up by Tavasszy et al, (2017) who raised similar observation that synchronization of logistics drivers including warehousing systems is crucial for enhancing service quality and meeting customers" needs. In other words, when logistics providers decide to integrate their warehousing systems, operations and plans it will help them to achieve optimality in supply chain. For example, when the parties use common warehousing facilities or schedule their time table in a way that warehousing facilities from other service providers are free such a strategy will relieve other parties from difficulties of getting storage services. Therefore, Synchronization enables companies to harmonize their operations during demand disruptions by planning and

scheduling activities in a uniform manner so as to mitigate the infamous bullwhip effect. By harmonizing warehousing operations organizations can perform functions timely and, in a cost-effective manner thus helping firms move to a demand-driven environment that is better equipped to deal with uncertainty.

4.2 Regression Analysis

In order to determine the existing relationships between the independent and dependent variables, the results are presented in the table below:

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.280[a]	.078	.056	.85694

a. Predictors: (Constant), Synchronized information systems towards optimized SC operations, Synchronized Warehousing systems towards optimized SC operations, Synchronized Transport systems towards optimized SC operations

With regard to testing model fitness, the results indicates that the overall model explains 7.8 per cent of the variance (.078 × 100).

Table 5: Anova

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.624	3	2.541	3.461	.019[b]
	Residual	89.590	122	.734		
	Total	97.214	125			

a. Dependent Variable: Optimized supply chain operations

b. Predictors: (Constant), Synchronized information systems towards optimized SC operations, Synchronized Warehousing systems towards optimized SC operations, Synchronized Transport systems towards optimized SC operations

The ANOVA table indicates that the model as a whole (which includes both blocks of variables) is significant [F (3, 122) =3.46, p<.05).

Table 6: Regression Analysis

Statement	B	Std. Error	T	Sig
(Constant)		.444	7.793	0.000
Synchronized Transport systems towards optimized SC operations	.030	.062	.346	0.730
Synchronized Warehousing systems towards optimized SC operations	.061	.061	.700	0.485
Synchronized information systems towards optimized SC operations	.273	.065	3.114	0.002

The relationship between logistics drivers (as measured by the average of logistics drivers) and optimized supply chain operations (as measured by the optimized supply chain scale) was investigated using regression analysis. With regard to transport variable, the results in Table 6 indicates that the beta coefficient is 0.3 meaning that a unit change in synchronizing transport systems will positively cause optimization of supply chain operations by 30%. However, the results indicates insignificant relationships between the variables ($p = 0.73$); on part of warehouse variable, the results indicates that the beta coefficient is 0.06, $p = 0.485$ which means that a unit change of synchronized warehousing systems will lead into optimized supply chain operations by 48.5%. With regard to information systems, the results show that the beta coefficient is 0.273 which means that a unit change of synchronized information system will cause optimized supply chain operations to increase by 27.3%. In addition, the variable has a p-value of 0.002 which imply that there is a significant relationships between synchronized information system and optimization of supply chain operations. In other words, the results supports that integrated information systems in supply chain are crucial elements in achieving optimum performance. Under the traditional system activities were not synchronized which made supply chain managers handle uncertainty through buffering – i.e., maintaining pools of inventory at multiple places in the supply chain. In inventory management perspective, a synchronized information system establishes scheduled programs of supply chain operations by separating baseline demand from demand surges and then using strategic points in the supply chain for the placement and use of capacity and inventory. Firms that aren't synchronized often find that they have higher costs than firms and supply chains that have some degree of synchronization in their supply chain (Dong et al, 2018). The higher costs result from unplanned activities done independently by individual firms from manufacturing stage to consumption stage along the supply chain so by synchronizing the logistic drivers it enables business firms to have a common working platform that enables activities to be done in the same way, process, systems and using same resources. This concept of resource sharing in logistic management is termed as synchronization which enables activities from other supply chain members to be done at the same period or in similar manner thus enhancing optimized supply chain operations among the responsible supply chain members.

5. Conclusion

Based on the obtained results the study concludes that synchronized logistics drivers play significant role in achieving optimized supply chain operations. In other words, the integration of operating systems such as information, transport and warehousing among supply chain partners is a solution for efficient and sustainable supply chain management. The study has provided contribution by examining synchronization of logistics drivers in supply chain operations in Tanzania using a descriptive survey design which enabled generalization of the findings as compared to other studies which mostly used case study approach.

6. Study Implication

On practice, the study imply that synchronization of information systems between procurement practitioners and other supply chain partners will significantly enhance optimization of supply chain operations

On social, the study imply that synchronization of logistics drivers will lead to significant saving in time and cost of operations.

7. Areas for further research

This study has focused on synchronization of logistics drivers in supply chain in the context of Tanzania. Further study is suggested by making a comparative study between synchronization practices in Tanzania and synchronization practices from other advanced country among developing countries.

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