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Intermodal Transportation and Supply Chain Efficiency: A Kenyan Perspective

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Abstract
Globalization has forced many firms to restructure their supply chains. Firms now not only operate within national boundaries but across international boundaries. Intermodal transportation holds the solution for this movement within national and across international boundaries. This study was conducted to establish the effect of intermodal transportation among Kenyan firms. A total of 71 Kenyan firms from manufacturing, Distribution and Logistics sectors were involved in the survey. The study findings reveal that Several Kenyan firms utilize more than one mode of transportation to move goods to and from various destinations. Road transport is the most popular mode of transport due to its ability to deliver door to door transportation services. Rail transport is the second most popular mode of transport because of the cost involved in moving goods by rail. It is cheaper than road and air modes. However rail transport suffers from network disadvantages since it serves a few regions in the country. Air transport is also used though by a few firms because it is the most expensive mode of transport. It is commonly used by firms that are engaged in horticultural farming. Water transport is also among the popular modes of transport that is used to transport bulky goods to and from other countries. It is also considered cheaper than all the other modes of transport. Intermodal transportation has enabled most firms to reduce supply chain costs, reduce lead times, engage in cheaper global sourcing of goods and materials, reduce downtimes and maintain steady flow of goods. It has also enabled the firms to get value for money spent.
Keywords: Intermodal, Transportation and Efficiency

1. Introduction

The global business environment is going through tremendous transformations that include high level technological changes. This implies that organizations have to remain highly agile for them to merge the changes that are part of the contemporary business environment. Dewitt and Clinger (n.d) assert that intermodal transportation of freight across the globe is one of the areas where technological improvements have been greatly witnessed. The various changes that have been witnessed since the early 20th century to the present moment such as containerization, in the 1900, deregulation of business activities and renewed focus on global supply chains necessitates increased utilization of intermodal transportation (Dewitt and Clinger, n.d). Besides these changes, consumers are more informed and demand efficient and timely delivery of goods and services hence the need for firms to employ various strategies of ensuring that customer expectations are not only met but exceeded.

Intermodal transport is defined as the activity of moving or transporting goods using different modes of transportation such as road, inland water, sea transport, air, road transport and railway without necessarily handling the goods themselves even as the modes are changed frequently. (OECD Outlook, 2000). This implies that the goods involved are transported in standardized containers right from the point of origin to point of destination without breaking them into smaller unit loads. The merchandise therefore move in ISO containers, semi-trailers and specially designed freight containers of corresponding size which are normally regarded as load units. Under intermodal transportation, the unit loads must change between transport modes at least once between sending point and receiving point; and the shipper shall only need one contract between the consignor and the consignee (Woxenius 1998).

The primary objective of intermodal transportation is to consolidate loads for efficient long-haul transportation through rail or large ocean vessels. This is mainly done with the sole purpose of taking advantage of the efficiency of local pick-up and delivery operations by truck. This explains the importance of container-based transportation. Freight intermodal transportation is indeed often equated to moving containers over long distances through multimodal chains. Intermodal transportation is not restricted, however, to containers and intercontinental exchanges. It also involves other items such as express and regular mail that are also transported by several modes of transportation such as air, land, rail or land. The goods involved must also be picked up from local terminals and then transported by other modes of transportation (Crainic and Kim, 2007).

An integrated transport system is very essential in the successful running of supply chains more especially in this age of globalized supply chains. For this level of success to be achieved there is need to integrate the activities of the organizations involved in intermodal transportation to facilitate information sharing and faster transaction processing. Intermodal transportation has the ability of reducing the supply chain costs

incurred by various players and also to improve on the time taken to deliver products to various destinations (Dewitt and Clinger, n.d). However, intermodal transportation can only prove to be efficient and effective in regions and countries where the various modes of transportation are well developed and economical to use. In Kenya there seems to be overreliance on a few modes of transportation. This paper looks at use of intermodal transportation in Kenya and how it impacts on supply chain efficiency.

2. Literature Review

Modes of transportation

Modern supply chains have become more responsive due to globalization. Movement of goods from the point of origin demands the utilization of a number of transportation modes than ever before. Players have at their disposal a variety of transportation modes that can be utilized depending on the perceived benefits and cost involved in using each one of them. There are four main modes of transportation that can be used to improve the efficiency and effectiveness of the flow of goods from manufacturers to end users: road transport; water transport; rail transport and air transport.

Road transport involves the movement of small batches of products or containers from one point to another by road. Road transport is the most popular means of transport all over the world because of the variety of benefits it offers to both firms and users of various products. Most producers of goods as well as users are accessible to some road network. This makes it possible for rapid movement of loads from light industries to other modes of transportation or terminals where they can be picked for further transportation. Road transportation is also important in the sense that it provides for door to door picking and delivery of products thus making it easier for goods to move both in upstream and downstream the supply chain. The introduction of containerization in supply chain has made road transportation even more important since standardized containers can now move by road to various destinations (Slack, Rodrigue and Comtois, 2003).

The other mode of transport is water transport. Water transport involves both rivers and seas or oceans. Water transport is the cheapest and the oldest form of transport for heavy goods and bulk cargoes. Waterways are the natural gifts, hence it does not require large amounts of capital expenditure for the construction of road and railway tracks, except canal transport, as in the case of land transport. In addition to that the cost of running is also very less. However it is important to note that river transport which was highly developed during the pre-railway days currently plays a very minimal role in transportation. On the other hand, ocean transport has become popular since it is cheaper and makes it easier for firms to transport bulky and heavy products. It also offers lower container handling costs (Baird, 2002).

Railway transport is also among the modes of transport that are used to transport goods from and to various destinations. Railway has been the pioneer of modern mechanical transport. It has brought the greatest revolution in transport. It accelerated commercial and industrial development of various countries. Until the introduction of Motor Transport, Railway had the monopoly as the Land Transport. In some countries such as India, railway transport is very popular hence the most commonly used to move goods and people across the country to several destinations. It is estimated that approximately 80 per cent of goods traffic and over 70 percent of passenger traffic are move by rail in India. Rail transport was initially highly regulated but the introduction of containerization has transformed this mode of transportation (Rodrigue, 2006).

Air transport is the last mode of transport that we discuss briefly in this article. The air mode of transportation, just like the water transport, serves across intercontinental boundaries. The main difference is that air transport is not container oriented like water transport. Air transport is perhaps the fastest but expensive mode of transport. Nissalke (n.d.) asserts that air transportation is a very important component in the global transportation system. He further argues that air transportation plays a very significant role in the economic development of many countries by moving people and goods across long distances. By doing so, air transportation significantly enhances the Gross Domestic Product (GDP) of many countries around the globe. However, air transportation by its nature requires heavy investment in infrastructure such as airports and there have been concerns on the environmental effects of air transport due to noise and emissions Nissalke (n.d.).

Supply Chain Efficiency

According to Christopher (1998) a supply chain refers to an interconnection of organizations that work together in both upstream and downstream activities that produce value in the form of delivery of goods and services to the end user. For any supply chain to be efficient and effective, there is need for proper management of the same. This leads to a concept known as supply chain management. According to Simchi-Levy, Kaminisky and Samchi-Levy (2000) a Supply Chain represents a number of approaches that are used to efficiently integrate suppliers, manufactures, warehouses, and stores, to assist in production and distribution of merchandise at the right quantities, to the right locations, and at the right time, in order to minimize system wide costs while satisfying service level requirements.

Supply chain efficiency is more concerned with how the resources of the organization relating to supply

chain management are utilized. The purpose of supply chain management is to ensure that the organization incurs minimal costs in order to enhance its profitability. It may not be possible for a firm to earn the most from its supply chain if there are no best possible internal and external performance measures. Internal supply chain measures refer to activities that affect the organization operations within such as yield and production lead-time. On the other hand, external performance measures include lead time, customer service and price of the product. For a firm to properly manage the efficiency of its supply chain there is need to measure the supply chain performance (Annelie, 2008).

Traditionally most firms used financial measures in measuring the performance of supply chains and also the entire organization. However, Kaplan and Norton (1996) introduced the Balanced Score Card which focuses on both financial and non financial measures broken down into four categories. The first category relates to financial measures that focus on economic value added and return on investment. The second category refers to Customer-related measures representing customer satisfaction and market share. The third category of measures relates to internal performance and includes quality, response time and cost measures. The last is the learning category which includes employment aspects such as skill development, retention and information technology. The BSC has since been used as one of the measures of supply chain efficiency.

The BSC is not the only measure of supply chain performance that is available. The Supply Chain Council also developed another measure known as the Supply Chain Operations Reference (SCOR). The purpose of this model is to provide a standard language for SCM that can be used cross-industry, facilitate external benchmarking, establish a basis for analyze of Supply chains and compare the current Supply chain with the target for the future. This model is based on 12 metrics that assist in measuring supply chain performance. They include: delivery performance, fill rate, order fulfillment lead time, perfect order fulfillment, supply chain responsiveness, production flexibility, Total logistic management cost, value-added employee productivity, warranty cost, cash to cash cycle time, inventory days of supply as well as asset turns (Huan et al., 2004).

Intermodal transportation and Supply Chain Efficiency

Studies have been carried out linking intermodal transportation and supply chain efficiency. Cambra-Fierro and Ruiz-Benitez (2009) carried out a study on the advantages of intermodal logistics platforms. The study focused on actual experiences and insights from the Spanish platform. The study focused on the real advantages that Spanish companies have enjoyed from intermodal transportation. The study findings revealed that intermodal transportation can provide a number of competitive advantages to a firm. The study recommended that firms should consider the option of intermodal transportation and the integration of some of the activities of its supply chain in order to decrease transportation costs and lead time, and increase customer service, among other advantages.

Another study was also carried out by Kartunnen et al., (2013) focusing on the cost-efficiency of intermodal container supply chain for forest chips. The study focused on transportation of forest chips in Finland. The study utilized site-dependent information for forest biomass transport that was integrated into a simulation model to calculate the cost-efficiency of logistic operations related to forest chips transportation in central Finland. The model was tested with several truck and railway transportation scenarios for varying demand of forest chips at the case power plant. The total costs of traditional supply chains were found to be 5–19% more expensive than container supply chain scenarios. The total unit costs of forest chips varied between 15.3 and 20.0 €/MWh depending on the scenario. The study findings established that intermodal light-structure container logistics and railway transportation could be developed as a viable option for large-scale supply of forest chips.

Dewitt and Clinger (n.d) equally carried out a study on intermodal freight transportation in the United States of America. The purpose of the study was to explore the importance of intermodal transportation and supply chain efficiency. The study reveals that with the recent developments in technology, intermodal transportation plays a very integral role in the successful operation and implementation of supply chains. The study also recommended that the competitive world of the future may well be centered between global supply chains and their supporting modal and intermodal capabilities.

Bektas and Crainic (2007) conducted a study on an overview on intermodal transportation. The purposes of the study was to present intermodal transportation from both the supplier and carrier perspectives, and also identify important issues and challenges in designing, planning and operating intermodal transportation networks. The study reveals that contrary to the conventional transportation system where different transportation modes operate independently, intermodal transportation integrates various modes and transportation services to improve the efficiency of the entire distribution process.

3. Findings

Modes of Transport and extent of use in Kenya

The study sought to establish the various modes of transportation that are used in Kenya. It was established that

there are four main modes of transport that are used to transport both goods and people in Kenya. The findings are presented next.

Road Transport

It was evident from the study that most of the firms utilize road transport to a very large extent. The results indicate in the table below reveal that road transport is popular among most business enterprises in Kenya.

Table 1: Frequency of road transport utilization

Response	Frequency	Percent
Most Frequently	42	59
Frequently	21	30
Less Frequently	5	7
Occasionally	2	3
Not at all	1	1
Total	**71**	**100**

The findings tabulated above reveal that 59% of the firms in Kenya most frequently utilize road transport whereas 30% frequently utilize this mode of transport. This implies that approximately 89% of the firms in Kenya depend greatly on road transport for them to be able to move goods and raw materials to various destinations. This high rate of dependency on road transport makes it the most popular mode of transport in the country. The firms also revealed that the main reason why road transport is more popular is its ability to serve a larger percentage of the population and also provides room for door to door delivery of products. It was also established that the ambitious plan by the government of Kenya to improve road infrastructure has enhanced the popularity of road transport utilization.

It was further clear that road transportation in Kenya play a very important role of linking up other countries in the region that are land locked such as Rwanda, Burundi and South Sudan. Most of the road transport companies are Kenyan based but provide road transport services that span across East and Central Africa. The firms that participated in the study predicted that road transport is likely to be utilized to an even greater extent than it is currently used since the government is still improving road infrastructure.

Water Transport

The study sought to establish whether water transport is used in Kenya by firms to transport goods to and from various destinations. The findings are illustrated in table 2 below.

Table 2: Inland and Sea Transport

Response	Sea Water Transport	Inland Water Transport
Most Frequently	60	0
Frequently	25	0
Less Frequently	10	5
Occasionally	3	15
Not at all	2	80
Total	**100**	**100**

It is evident from the findings tabulated above that 60% of the firms indicate that they use sea water transport most frequently whereas 25% of the firms use it frequently. This is a confirmation that 85% of the firms in Kenya rely on sea water transport to move products to and from various destinations. It was further established that 80% of the firms do not rely on inland water transport. The study sought the reasons for this large variation in the use of both water and sea transport among firms. It was revealed that sea transport is popular among firms for several reasons. One of the main reasons why sea transport was found to be popular among firms is because Kenya has got access to the coast and seaports are available for docking of sea vessels that transport goods from other countries. The firms also indicated that sea transport is far much cheaper than all the other means of transport especially when transporting bulky items for long distances. The study further established that some Kenyan firms especially in the manufacturing sector rely on imported raw materials hence the need to transport them using sea water transport.

The study also established that inland water transport in Kenya is not very popular because only a few lakes and inland waterways can provide the services that firms require. Most firms therefore prefer using road transport due to navigation challenges that are posed by inland waterways. However, the study established that some lakes such as Lake Victoria provide inland water transport though not to a very large extent.

Air Transport

Air transport was also found to be one of the modes of transport that are used in Kenya. The results on the use of air transport are presented in table 3.

Table 3: Air mode of Transport

Response	Frequency	Percent
Most Frequently	18	25
Frequently	7	10
Less Frequently	4	5
Occasionally	14	20
Not at all	28	40
Total	**71**	**100**

The study findings reveal that only 25% of the firms in Kenya use air transport for movement of goods. The study revealed that 40% of the companies do not utilize air transport at all. It implies that although a few companies utilize air transport, most of the companies do not use this mode of transport especially in transportation of goods to and from various destinations. Upon further investigation on the reasons for lower extent of air transport utilization, the study revealed that air transport is very expensive compared to road, water and rail transport. The firms indicated that the use of air transport was only favorable for those firms that deal in horticultural farming of fruits, vegetables and flowers since they are highly perishable and need to be moved faster to the markets. It was therefore established that most of the firms that rely on air transport deal in perishable products that are moved to market outside Kenya such as the United Kingdom. Air transport was also favourable for transporting other goods that are not heavy in mass.

Rail Transport

Rail transport is also among the modes of transport used by several firms in the country. The results on rail transport are presented next in table 4.

Table 4: Extent of Rail Transport utilization

Response	Frequency	Percent
Most Frequently	30	42
Frequently	22	31
Less Frequently	10	14
Occasionally	8	12
Not at all	1	1
Total	**71**	**100**

The research findings reveal that Railway transport is one of the popular modes of transporting both goods and passengers in Kenya. It is clear from the findings that 42% of the firms utilize rail transport most frequently whereas 31% utilize rail transport frequently. This implies that rail transport is actually the second most popular mode of transport in Kenya after road transport. Most of the respondents indicated that it is very cheap to move goods through rail from one destination to another. However, the study established that rail transport is faced with a number of challenges such as limited rail network that serves a few areas and regions. The study established that rail transport has got great potential of becoming the most preferred mode of transport if the government puts in place more ambitious plans of expansion such as the construction of the Standard Gauge Railway currently in progress.

Intermodal Transportation and Supply chain Efficiency

It was clear from the study results that the use of intermodal transportation by Kenyan firms has several implications on the efficiency of their supply chains. The respondents confirmed that use of intermodal transportation first and foremost enables the firms to reduce their supply chain costs by close to 30%. It was established that reduction of supply chain costs enables the firms to drastically reduce their production and operational expenses thus providing them with a competitive advantage. It was further evident that reduction of supply chain costs enables the supply chains of firms to be more profitable.

The study also established that the use of intermodal transportation has made it possible for some Kenyan firms to deliver highly perishable products to distant markets. For instance the respondents indicated that Kenya is one of the countries where flowers and some horticultural plants are grown. The market for these products is mostly found in Europe and the products must get to the market when still fresh. It was established that the use of both road and air transport has made it possible for the firms involved to overcome losses in their supply chains that may result due to perishability. It makes it possible for the firms to achieve faster delivery of their products to the market thus providing them with better returns.

The study further established that the use of intermodal transportation has also made it possible for firms in Kenya to engage in global sourcing of finished goods and materials at cheaper prices. The study reveals that globalization has made it possible for the firms to get competitive prices for goods and materials. The firms also utilize intermodal transportation to deliver their products into the local market. It was revealed that at both sourcing and transportation stages of the supply chain, the firms are able to get value for the money they spend. It also emerged that technology intermodal transportation has made supply chains of these firms more vibrant

and responsive.

The research findings also reveal that intermodal transportation has enabled several Kenyan firms to drastically reduce lead times. Most of the firms indicated that the use of more than one mode of transportation has enabled them to deliver products within the expected duration. They indicated that this has enabled many firms to maintain steady flow of goods in the production and distribution process. Reduction of downtimes and related costs are some of the benefits the firms confirmed to be getting from reduced lead times.

4. Conclusions

Intermodal transportation is a very important aspect of the business fraternity in Kenya. Several Kenyan firms utilize more than one mode of transportation to move goods to and from various destinations. Road transport is the most popular mode of transport due to its ability to deliver door to door transportation services. Rail transport is the second most popular mode of transport because of the cost involved in moving goods by rail. It is cheaper than road and air modes. However rail transport suffers from network disadvantages since it serves a few regions in the country. Air transport is also used though by a few firms because it is the most expensive mode of transport. It is commonly used by firms that are engaged in horticultural farming. Water transport is also among the popular modes of transport that is used to transport bulky goods to and from other countries. It is also considered cheaper than all the other modes of transport. Intermodal transportation has enabled most firms to reduce supply chain costs, reduce lead times, engage in cheaper global sourcing of goods and materials, reduce downtimes and maintain steady flow of goods. It has also enabled the firms to get value for money spent.

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