EFFECT OF INFRASTRUCTURAL DEVELOPMENT AND SUPPLY CHAIN MANAGEMENT ON OPERATIONS MANAGEMENT IN AN ORGANIZATION

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ABSTRACT

This paper analysis the role played by infrastructure in developing the platform to a successful operation management in an organization. An empirical literature review has been adopted as a way of identifying the relationship between supply chain management, infrastructural development and operations management. Practitioners in the supply chain sector need to constantly and consistently embrace and train in new information technology method that connects infrastructure and businesses. Businesses operating in the competitive trading environment are continuously developing customer demand linkage and competitive sourcing through computer technology to stay ahead of the competition. This acts as a direct link to a successful supply chain management and hence effective operations management in an organization.

Key Words: *Infrastructural development, supply chain management, operations management*

Introduction

Galloway & Naylor (1951) defined Operations management to consist of activities which are concerned with the acquisition of raw materials, their conversion into finished product, and the supply of that product to the customers. Operation management is also concerned with creating, operating and controlling a transformation system that takes inputs and a variety of resources, and produces outputs of goods and services needed by the customer or consumers. The role of operations management is crucial to the success of any organization as it seeks to improve effectiveness and to ensure that operations are carried out so as to meet customer requirements and to improve efficiency. Operations management concerns itself with organizations aspects such as planning, organizing and controlling the production process.

Martin Murray (2006) identifies Supply chain management, then, as the active management of supply chain activities to maximize customer value and achieve a sustainable competitive advantage. It represents a conscious effort by the supply chain firms to develop and run supply chains in the most effective & efficient ways possible. Supply chain activities cover everything from product development, sourcing, production, and logistics, as well as the information systems needed to coordinate these activities.

The organizations that make up the supply chain are “linked” together through physical flows and information flows. Physical flows involve the transformation, movement, and storage of goods and materials. They are the most visible piece of the supply chain. But just as important are information flows. Information flows allow the various supply chain partners to coordinate their long-term plans, and to control the day-to-day flow of goods and material up and down the supply chain. The complexity of the supply chain will vary with the size of the business and the intricacy and numbers of items that are manufactured. A simple supply chain is made up of several elements that are linked by the movement of products along it. The supply chain starts and ends with the customer.

Relation between effective supply chain management in an organization and operational management is brought out when Operational decisions are made with awareness of the strategic and tactical decisions that have been adopted within a company (Hummels ,2000; Evans, Harrigan, 2003). These higher level decisions are made to create a framework within the company’s supply chain operate and to the best competitive advantage. The day to day operational supply chain decisions ensure that the products efficiently move along the supply chain achieving the maximum cost benefit. A number of examples of operational decisions can be identified in manufacturing, supplier relationships and logistics.

Infrastructure involves Transport infrastructure (roads, railways, airports, seaports etc.) and the services provided by the transport and logistics sector, and also telecommunications networks and the services provided over such networks. These are the sectors involved in physical infrastructure that are crucial for moving goods and services from exporting to importing countries. Financial services are therefore also part of the infrastructural services that support trade. They include Payments for goods and services flow in the opposite direction from importers to exporters. Finally, a number of business services play an important role in intermediating between or matching exporters and importers. They provide logistics services that reduce the transaction costs of international trade and are, therefore, also trade-supporting infrastructural services. Having established that infrastructure and related services play a crucial role in the flow of international trade, it is important to highlight how to make infrastructural services more efficient and effective. Infrastructural services are, to a varying degree, subject to market imperfections that require government regulation, but technological changes over the past decade or so have changed the competitive environment of these services, particularly in telecommunications.

Making infrastructural services more efficient, therefore, may involve government policy measures and possibly regulatory reforms. These are complementary to organizational policies because gains from trade often depend on the quality of infrastructure and related services. Physical infrastructure can at least partly be considered as public good and government intervention is necessary for

Obtaining efficiency; these infrastructural services support organizational trade whether or not they themselves are trading. Increasingly, however, they are tradable and traded, and opening up to trade in these services is one channel through which quality can be improved and costs reduced. Interface between domestic and international regulation when infrastructural services are traded, focuses on how to improve effectiveness and efficiency.

Infrastructure growth plays an important role in business and is important part of Supply chain. Companies can invest millions in creating an internal infrastructure mixed with high end ERP technology to very strong supplier base but if there is not enough infrastructural development en route from supplier location to customer location then overall supply chain effectiveness goes for a toss.

Conceptual Approach of Infrastructuaral Development in Supply-Chain Information Flows

Firms engaged in a supply-chain relationship, as customers, suppliers, or providers of services, need to share a great deal of information in the course of their interactions. These diverse data include descriptive information such as quantities, prices, dates, technical specifications, and quality attributes, and significant contractual and legal transactions, such as purchase orders, shipment authorizations, receipt acknowledgment, and payment processing. To understand the types of information flows, it is most convenient to break them down into functional categories. Many different types of information must be exchanged for the supply chain to function efficiently, they include:

- Product descriptions, specifications, and prices;
- Purchase order information such as quantities, required shipment dates, and addresses;
- Planned and actual production, shipment, and delivery dates/times and status against such schedules;
- Technical and engineering data on products, components, and equipment;
- Accounting information such as prices, discounts, allowances, and account numbers; and product quality data, such as test results, performance measurements, and warranties.

Over the years, companies have managed these information flows in a number of ways, including telephone calls, letters, telex, faxes, and electronic data interchange, known as EDI.

Often firms will have several systems in place simultaneously, perhaps more sophisticated ones for normal, high-volume exchanges and manual systems for communicating schedule changes, quality problems, needs for expediting deliveries, canceled orders, or other emergencies. Redundancy is often built in to stop a system failure from leading to a business disaster, such as a plant shutdown or shipment of poor-quality product. Most large first- and second-tier suppliers and original equipment manufacturers (OEMs), along with a smaller fraction of firms in the lower tiers, have installed EDI between each customer-supplier pair for handling high-volume, routine communications such as transactions processing, accounting entries, and billing activities. EDI is also at the heart of most automated inventory control systems, including continuous replenishment (CRP) and vendor-managed inventory (VMI). With effective EDI, human intervention is not required to initiate or operate the periodic communication of information, leading to a low marginal cost of data transmission. Significant fixed-cost investment in high-cost expertise is typically needed to develop and install the systems, to upgrade or troubleshoot each script, and often to translate the EDI data streams into alternate formats required by other information systems within each firm.

Finally, firms are increasingly using the power of the Internet to create XML-based transmission protocols for machine-to-machine communication of the same high-frequency data now handled by EDI. These flexible XML implementations have the potential for lower up-front engineering costs more than can EDI and require lower levels of support in use. They also can be modified much more easily for use with other customers or suppliers by the target firm. Most importantly, the nature of Web-based architecture and protocols offers the potential for better scalability—the degree of effort and cost required to expand coverage to an entire supply chain. Here, scalability is proportional to the number of firms involved, rather than to the much higher number of customer–Supplier pairs, as is the case with EDI.

Electronic Data Interchange (EDI)

If machines are going to communicate, they need a common vocabulary that can be universally understood, and messages must be structured in a standardized way so that they can be properly interpreted and acted on. In the case of EDI, most companies in the United States have adopted ANSI X12 as a common language, whereas, in Europe, Edifact is the accepted standard. With one of these systems, computers at each end of a message can be programmed to understand the letters (bits) of the data stream. Furthermore computers need to know how the message will be formatted (i.e., the exact order of elements, how bits of information will be separated, and what real piece of information each letter or word represents). For example, if the message is a purchase order, the pieces must be properly arranged and coded to ensure that a part number is not misinterpreted as a quantity or a delivery date as a shipment address. Because of the requirements for exactness in each EDI transmission, the diversity of business relationships and communications needs has led to a large number of similar but distinct EDI protocols and formats in the industry sectors we are studying.

Each newly established link between a Customer–supplier pair is a custom installation; the particular business and technical needs at the time mean that each link may be slightly different, using nonstandard syntax, unique variables, or reordered transmission. So invoicing and billing systems, vendor-managed inventories, and production schedules shared between an OEM and an important Tier 1 supplier may all use different EDI formats. The complexity of the automobile and electronics sectors' supply chains increases this confusion. Firms with an extended network of customers and suppliers may be forced to support a large number of mutually incompatible EDI implementations. The resources needed for support and the risk of errors from mix-ups increase with the complexity and diversity of EDI protocols installed. As an example, if an OEM like Ford inadvertently sent a high-priority purchase order to Johnson Controls (JCI) in the EDI format used for communications with Visteon, JCI's information systems might not be able to correctly interpret the order. A great deal of additional effort would be required by both parties to make sure the proper products were made and delivered on the timing required. In the absence of this additional manual effort, it is likely that Ford's needs would not be met.

Extensible Markup Language (XML)

A standardized XML implementation offers the opportunity to address many of these issues. One extremely flexible feature of XML is that it is self-referencing: the label attached to the bit of data describes the type of information contained within. For instance, in an EDI purchase order, the receiving computer may be programmed to interpret the third bit string in the message to be a part number and the fourth an order quantity for that part. If these strings are sent out of order, or if an extraneous word is added, the recipient will not be able to interpret it correctly. An XML-based purchase order could have a piece of data labeled "1stpart" and a second one labeled "1stpartqty." The instruction that contained the label and associated numerical data could be located anywhere within the XML data stream, and the computer would interpret the instruction correctly. As a result, XML messages can be easily expanded or modified to meet specific needs. Although the emergence of XML offers opportunities for flexible, adaptable implementations, it does not reduce or eliminate the need for standardization. Vocabularies must be established and adopted, labels need to be assigned agreed-upon meanings, and change-control procedures must be established. As we describe in the next several sections, the most likely outcome of pure private-sector SCI is the creation of a number of competing, incompatible systems, each one adopted incompletely within industry sectors. NIST and RTI have identified the excess costs of this type of outcome in the communication of engineering design information in the automotive and other industries

Physical Infrastructural Development Effect on Operation Management

When new transportation infrastructure is built, companies take advantage of the new capacity by adjusting their logistics processes and supply chains to improve service and reduce costs. In the short term, they change purchasing and operations behavior. In the longer term, they make input substitutions and reconfigure production processes to take advantage of transportation system improvements. For example, new transportation connectors, gateways, and intermodal links allow shippers to source from more distant suppliers at a lower cost; to reduce transportation costs by forming "hub and spoke" networks that connect multiple distribution points through central operating hubs; and to reduce inventory by switching from bulk shipments to smaller, more frequent orders. Other ways shippers benefit from adjusting their supply chains in response to more efficient transportation systems include:

Lower sourcing costs: Companies want to source from a more diverse base of lower-cost suppliers because it increases their margins. Often this involves offshore sourcing, a strategy that requires managing logistics and transportation over long distances. The lower transportation and logistics costs achieved through efficient freight flows can make it economically rewarding for companies to source from overseas suppliers. High transportation and logistics costs, caused in part by inadequate infrastructure (and the resulting congestion), can make it uneconomical for shippers to do so.

Lower transport costs and an efficient transportation network also help shippers source from fewer locations. Because it is more affordable to ship longer distances from each facility, they are able to reduce the number of plants they operate and thereby increase their return on assets.

Reduced fleet, warehousing, and inventory costs: Infrastructure improvements increase a transportation system's capacity and reduce or eliminate congestion, thus improving the system's reliability. This, in turn, reduces variability in transit times, making it possible to predict on-time performance with greater accuracy. As a result, shippers need fewer vehicles to maintain service levels on congested roadways and can downsize their fleets.

Improved reliability also allows shippers to consolidate warehouses that had been holding inventory to buffer against the congestion-related unreliability of inbound shipments. Moreover, when line-haul transportation flows freely (and therefore predictably), shippers can replace traditional warehouses with efficient cross-dock operations that keep inventory in transit instead of putting it in storage.

With better transit time visibility—that is, information about where shipments and vehicles are located and when they will arrive at their destinations— shippers can safely postpone final assembly or configuration. This production strategy allows them to not only decrease inventory but also increase customer satisfaction (and sales) by providing a broader product mix with shorter lead times.

Increased revenue: Perhaps the biggest—albeit indirect—supply chain benefit of a transportation infrastructure project is the potential enhancement of revenues through the adoption of new business models. Shippers can take the savings they realize as a result of infrastructure improvements and reinvest in more competitive pricing. Infrastructure improvements can also help companies reach a broader market, facilitating increased sales. Alternatively, they may decide to offer higher service levels (shorter order-to-delivery lead times) instead of, or in addition to, pocketing the savings.

It is not easy to quantify the relationship between infrastructure investment and increased revenues for shippers. There is no question, however, that such investments improve supply chain efficiency. When one considers that some of the most successful companies are those that use their supply chains as competitive weapons—Zara, Wal-Mart, Dell Computer, and Amazon.com are just some that come to mind—it seems likely that investing in transportation infrastructure will provide economic benefits, including sales growth, for the companies using that infrastructure.

Infrastructural Development on Inventory Management as a Concept of Operation Management

Highway infrastructure investments produce economic benefits by affecting firms' logistics—that is, the way they move and store finished goods and materials through all stages of the production process. Highway investments could reduce these costs by lowering freight rates and improving delivery times and reliability. Households' benefits, measured by their value of travel time savings, are not included in GDP and traditional productivity measures; thus, they have not been included in previous studies. As noted later, these benefits are also likely to be much smaller than the benefits to shippers.

In the production-smoothing model, improvements in the speed or reliability of transportation have no effect on inventory behavior. But some of the model's theoretical results conflict with stylized facts about inventories. For instance, output is generally observed to be more variable than sales. Theoretically, production smoothing implies that sales should fluctuate much more than (smoothed) production. Sales and inventory investment are also observed to be positively correlated—firms add more inventory when sales are high, expecting greater sales in the future and fearing lost sales if inventory is not on hand. But if production were smoothed, sales and inventories would have a negative correlation because high sales would lead to depleted inventories, and low sales would lead to accumulations.

Blinder and Maccini (1991) came to terms with these contradictions by pointing out that inventories of manufactured finished goods account for less than one-sixth of total manufacturing and trade inventories. Retail inventories, wholesale inventories, and manufacturers' holdings of materials and supplies are larger than finished goods inventories. Moreover, Blinder and Maccini argued that the productive activities associated With accumulating materials and supplies inventories consist of transporting goods, not making them; hence, the presumption that production is subject to increasing marginal costs is not persuasive.

Firms accrue several costs from holding and replenishing inventories that can be reduced by improvements in highway transportation. The target inventory level is influenced by a firm's expectations of future sales and the costs of holding larger inventories. Obviously, the more sales that are expected the larger the desired inventory. Firms, however, incur capital costs from goods tied up in inventory and must pay for physical space to store them, insurance, and taxes, and absorb the loss in the value of their goods depending on the depreciation rate. A firm's reorder point protects against shortages or stock-outs that arise when demand for the product exists but none is in inventory.

The costs created by stock-outs include expedited delivery costs (backorder costs) and possibly lost sales. If the good is an input, production delays may result in additional costs. Firms that expect greater sales and variability in sales will raise the reorder point to prevent stock-outs. Faster and more reliable highway transportation enables firms to lower their reorder point because orders will be received more quickly with less uncertainty. Firms will therefore reduce inventory levels and inventory holding costs. At the extreme, if orders could be received instantaneously, then firms would not have to keep any inventory and could eliminate inventory holding costs.

In addition to inventory costs, logistics costs comprise order costs and transportation costs. Because frequent orders increase costs, firms have an incentive to place fewer orders and hold larger inventories. By doing so, firms also may be able to arrange for full truckload shipments and obtain discounts on their transportation rates. Subject to the costs of holding larger inventories, firms choose and to minimize the costs associated with placing orders, stock-outs, and the (possibly declining) unit costs of transportation. In practice, firms must choose an order quantity that is expected to achieve the target inventory level once the shipment is received. Firms determine an optimal cost minimizing inventory policy by trading off the higher order costs, transportation costs, and stock-out costs that are associated with smaller, more frequent orders against the lower inventory holding costs.

Improvements in the highway system that lower transportation costs (rates) directly lower logistics costs and may enable firms to substitute transportation for inventory holdings to reduce logistics costs even further. As noted, improvements that facilitate faster and more reliable transportation reduce stock-out and inventory holding costs

Case Example of Coca-Cola Information Flow Knowledge Gap

When it comes to the world's most powerful brands, Coca-Cola is still number one. The iconic beverage maker, which has dominated the global soft drink market for more than a century, continued its 12-year reign at the top in 2011, according to Interbrand's latest global rankings.

For Coca-Cola, achievements like this are byproducts of a vision and an operating framework that is built on excellence. At Coca-Cola Enterprises (CCE), the exclusive Coca-Cola bottler for its territories in Western Europe, the company's goal is to be the number 1 or strong number 2 choice in every category it competes in. But on the road to long-term, sustainable growth, CCE faces similar challenges to many other manufacturing and logistics businesses. A top priority is replacing dated systems with a modernized platform across markets to create a cohesive view of metrics and streamlined processes.

Driving regional expansion with IT

As part of its Genesys program, CCE set out to deploy a new supply chain management solution at all 17 of its European plants. The new system would replace and automate many of CCE's supply chain processes and required new skill sets to ensure the required speed of deployment. CCE needed a partner to help deliver this new SAP-enabled business transformation. This would involve not only delivering a technology solution, but also training users on the new processes to ensure the full benefits were realized.

Capital investment on initialization of the system also presented a big challenge since the Plants within a region CSC was selected was big. The human resource that needed training on the new system also presented a big budget to the company. Prior to Genesys, CSC had already been supporting CCE's applications with SAP, including order processing, manufacturing, financial transactions, human resources, procurement and other related processes. The Gap presented by the new system involved staff application of the supply chain processes in the new system which most of the staff needed training on.

Filling a gap between supply and demand

The Genesys program is an integrated SAP Enterprise Resource Planning (ERP) solution that replaces CCE's legacy systems in the processes of "order to cash," "requisition to payment," and "record to report." Genesys allows CCE to shorten cycle time in these processes and be more productive. It also helps bring more visibility into the business and improve decision making in supply chain and operational process within a plant.

Being a supply chain company, a sales and customer services company, it is very important for CCE to integrate manufacturing plants all the way up to the replenishment of shelves in the retail outlets. Through the information side of the equation, CCE basically ties those two ends of the business process together: the manufacturing side, which drives the supply of our product, and the shelf-replenishment side, which drives the demand part of our product. There are a lot of technology areas that require some capacity that CCE admits they might not have or some technology areas that they might not have the knowledge about. So in cases of knowledge gaps, they turn to strategic partner to fill in.

Summary and Conclusions

The role of movement and storage of materials in and out of the organization in the most effective manner is a crucial contributor to successful operations. Also informational flow among personnel and systems in an organization is crucial in realizing the same. Distribution activities are those that involve movement and storage of goods including movement by sea, air, road and rail. They can also be manifested in information flows between systems in a warehouse to assist in sales processes, and effective technology use to bring reduction in operation costs (Krajewski & Ritzman, 2012).

Improvements in transport infrastructure: The changing and increasingly integrated nature of logistics and supply chain, together with a move to global operations, has meant that practitioners need a more detailed knowledge of transport modes in order to evaluate options available. Owing to this move to globalization more products is moved over greater distances. Long distance supply chains have been established by companies which require careful co-ordination and planning to operate effectively. Developments in areas such as containerization, intermodal transport and the increasing effectiveness of information technology are driving the industry forward and reducing on costs.

Improvements in communication technology Infrastructure: Computer based technologies have revolutionized business over recent years. The growth, power, applications and increasing refinement of information technology has offered a powerful tool for the business organizations. Information processing technologies include any devices that collect, collate, store or distribute information.

The rapid growth in the use of internet-based technologies has allowed organizations to become more flexible in the way they operate. The speed and accuracy of communications brings with it a host of benefits to help improve operations of a business. With the advent of undersea water cable, Kenyan organizations have also been able to experience fast internet connections for their businesses.

Internet technologies offer a wide range of applications to operations management. The interaction between the organizations can lead to data sharing, quotations and order management. Stock management can be integrated between suppliers and manufactures in order to schedule deliveries particularly JIT. Increased competition when linked to increasing customer demands, forces companies to review their product offerings more frequently. The use of computer aided designs and manufacture enables faster product development and manufacture. Organizations that can bring new and innovative quality products to the market can gain a substantial competitive edge over the competition.

Recommendations

Operations managers increasingly operate in complex global markets for goods and services. The broader concept of operations management role involves a proactive approach to management that demonstrates and applies where possible, the knowledge gained by monitoring global trends (Slack, chambers & Johnston, 2010). Infrastructural growth has brought with it Globalization and the nature of supply chain, owing to this, careful planning and coordination is needed by operation managers to help select the transport modes to be selected so as to meet customer needs.

Even with the Growth of IT infrastructure, there are a number of concerns that still must be borne in mind. Breaches in security of web-servers and the internet overall is widely known and organizations must seek to protect and keep their own systems updated. Reliability of connections is also a shortcoming. Standards should be developed and adopted bearing in mind that IT is continuously growing.

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