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Collaboration Arrangements, Internet Technologies and Physical Distribution Service Quality

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Abstract

The paradigm shift from traditional collaborations to E-collaborations is due to the continued developments in internet enabled communication technologies and globalization trends that have complicated supply chain management operations. Because of the dynamic environment and the need for firms to remain competitive, this study focused on establishing the significance of introducing internet technologies to increase the effect of collaboration arrangements on physical distribution service quality. Data was collected from 270 manufacturers and distributors in Kampala District and analysed using SPSS. The findings revealed that Internet technologies have a more significant relationship on collaboration arrangements than Physical Distribution Service Quality. The study also makes numerous contributions through identification of the internet technologies as an intervening variable and also provides practical implications on how to apply internet technologies in collaboration arrangements to improve PDSQ in Uganda's beverage industry.

KeyWords: Collaboration Arrangements, Internet technologies, Physical Distribution Service Quality, Uganda's Beverage Industry

1. Introduction

Collaboration arrangements have proved significant in increasing the Physical Distribution Service Quality (PDSQ) in Uganda's beverage industry, Friday, et al (2011:2012) through improvement in stock levels from 87 to 98 percent, shortened lead times from 21 to 11 days, on-hand inventory cut by two weeks, more consistent orders, elimination of cost of holding inventory and assembling full truckload orders, and providing for savings of about 12 percent on distribution and marketing costs, (Simatupang and Sridharan, 2005). Following suite, supply chain managers have continuously talked about collaboration and its potential benefits like it were part of their organization's value chain and yet it seems that few companies actually optimise the benefits it creates for their supply chains, Soonhong. et al, (2005). This is not any different in Uganda's beverage industry that is producing; carbonated, non carbonated and non alcoholic soft drinks, and relying on the retail businesses to provide end distribution points for customers (Kyamutetera, April 2009; Ohairwe, 2008). Both the manufacturers and distributors practice arms length Collaborative arrangements without optimizing information sharing, decision synchronization and incentive alignment, (Simatupang and Sridharan, 2004). This could explain the low contribution of collaboration arrangements in improving PDSQ given the long delivery cycle times, non availability of products in certain parts of the country and increased customer complaints, (Durgavich, Friday. Et al, 2011; Nabirumbi and Ochaka, 2008; Rabinovich and Bailey, 2003; Ntayi. et al, 2009).

The emphasis on PDSQ is derived from the fact that production to date has outstripped most consumer markets thus the need to seek for distribution performance to increase customer services, Mentzer, et al. (1989). Rabinovich and Bailey, (2003) explain the performance of a physical distribution system using reliability in order fulfillment, inventory availability and timely delivery of

products to end users. These constructs are applicable in Uganda's beverage industry distribution functions; transport, warehousing, packaging, information management, order processing and handling. However, they are faced with a number of challenges including; the poor road network, Bimbona (2008), inadequate cooling/storage facilities, Masiga (January 27, 2009), unreliable power grid and poor Internet technologies following an internet penetration rate of just 4% (African E-Index), (Heloise, 2006). The effect of the challenges is worsened by the wrong demand forecasts based on inadequate customer information shared among the manufacturers and distributors, inability to align incentives and synchronisation of process decisions in the collaboration arrangements, (Friday. et al, 2011:2012; Simatupang and Sridharan, 2004; Okello, 2007).

The introduction of Internet technologies between collaboration arrangements and PDSQ, can be used as a balancing act for companies to seek equilibrium between the costs associated with arm's length relationships and the structural benefits of traditional supply chain management, Yingli, (2012, March 30). According to Caiwei, (2008), the introduction of internet technologies creates a transition from traditional collaborations to E-collaborations that are logical and timely in response to the quick change in the economic and IT environment supply chains operate in today. Weiming, et al. (2012) on the other hand have developed a Collaborative Agent System Architecture (CASA) and an Infrastructure for Collaborative Agent Systems (ICAS) for Internet based collaborative agent systems, that are suitable for managing the Internet enabled complex supply chains. The contribution of internet technologies to the performance of the demand chain can be achieved by applying the following measures: web-enabled service, data reliability, time and cost, e-response, invoice presentation and payment and e-document management metrics. Internet technologies could see an increase in level of information shared, deeper decision synchronization, quicker order processing, more accurate demand forecasts, etc that will see an improvement in the PDSQ in the industry's demand chains, (Heloise, 2006 and Okello, et al. 2007; Sambasivan, et al. 2009; Simatupang and Sridharan, 2004).

While Friday. et al (2011;2012) provides empirical evidence on the effect of Collaborative arrangements on PDSQ, the contribution of this study is evidenced in the introduction of Internet technologies to increase the significance of the relationship between the two variables. Further motivation for the study emanates from the fact that 60% of collaboration studies have focused on the upstream supply chains, thus calling for the need to undertake downstream studies, (Sandberg, 2007). This study is also based on the conceptualization of collaboration by Simatupang and Sridharan, (2002, 2004, 2005), Internet technologies by Sambasivan, et al. (2009) and Physical Distribution Service Quality by Rabinovich and Bailey, (2003), all done in more developed countries. While; Eyaa, et al. (2010); Friday, et al. (2011;2012), Muhwezi, (2008); Ntayi, et al. (2009); Ntayi and Eyaa, (2010) have done studies on collaboration in Uganda, none addresses the significance of Internet technologies to increase PDSQ. Other scholars reveal the need for other mediating variables like trust and commitment between Collaborative arrangements and PDSQ, (Danese, 2007; Goran, 2005; Janjaap and Ghijsen, 2005; Simatupang and Sridharan, 2005; Soonhong. et al, 2005; Zineldin and Jonsson, 2000), these were not considered in this study and therefore provide an opportunity for further research.

This paper is meant to provide empirical evidence on the significance of Internet technologies on the effect of Collaborative arrangements on PDSQ. This will be done by critically analyzing the effect of Internet technologies on information sharing, decision synchronization and incentive alignment for collaborative arrangements and how it also affects timely delivery, availability and the creation of a reliable distribution system in Physical Distribution Service Quality. Other parts of the paper include;

the literature review, methodology, presentation and discussion of findings, research limitations and the related implications of the study.

2. Literature Review

This section focuses on reviewing and summarizing previous studies in line with collaboration arrangements, Internet technologies and physical distribution service quality (PDSQ) in demand chains and is specifically built around Rabinovich and Bailey, (2003); Sambasivan, et al (2009); Simatupang and Sridharan, (2002;2004;2005) conceptualizations.

The increasing complexity of supply chains today is an eminent challenge arising from current globalization trends in business operations, Friday, et al. (2011). Because of this, traditional Supply Chains and measures of supply chain performance have been rendered inadequate, thus calling for adoption of e-supply chains to easily allow the integration of supply chain processes across the globe, and it's from the later that e-supply chain performance metrics have been adapted, Sambasivan, J. et' al. (2009). Manufacturers and Distributors, in the bid to match the complexity paused by global supply chains have developed collaboration arrangements between themselves and other logistical firms (Venus, et al. 2009) with the aid of Internet technologies to allow quick exchange of information, decision synchronization and incentive alignment in order to improve the PDSQ and remain competitive. Collaboration arrangements according to Simatupang, (2004); Wang and Archer, (2007), are an effort by two or more organizations to achieve results that they cannot achieve by working in isolation. On the other hand, Caiwei, (2008) explains collaboration arrangements in three categories: Vertical, Horizontal and Diagonal Collaboration Arrangements. Vertical collaboration arrangements refer collaboration between suppliers and buyers, horizontal arrangements as collaboration between competing companies selling similar products or services and diagonal arrangements as the collaboration where companies in different industries and sectors are working jointly. However, there is a general agreement that the sharing of information, decision synchronization and incentive alignment in the different collaboration arrangements aids the members maximize their market share, minimize running costs and ensure reliable and timely delivery of products to customers, (Gunasekarana, et al. 2004; Sandberg, 2007).

Internet Technologies refer to anything related to computing technology, such as networking, hardware, software such as electronic data interchange (EDI) supported applications, the Internet, or the people that work with these technologies. Developments in Internet Technologies have facilitated the drastic paradigm shift from the traditional supply chains to the more sophisticated e-supply chains that allow quicker and easy integration of supply chain activities through e-sourcing, e-logistics, among others across the globe regardless of the complexity. Implementation of e-supply chains has allowed better, faster and easier cooperation among different supply chain partners, improved roles of customers in product developments and improved customer interaction. Besides integration, internet technologies can be used to manage strategic alliances, increase supply chain efficiency, create efficient information sharing opportunities across the supply chain, (Sambasivan, J. et' al. 2009).

Friday, et al. (2011), in the article Vertical Collaboration and Physical Distribution Service Quality in Uganda's Soft Drinks Demand Chains, Rabinovich and Bailey, (2003) and Rabinovich, et al. (2006) define Physical Distribution Service Quality as a demand chain process concerned with timely and reliable flow of goods from the receipt of an order until the goods are made available to the customer. It requires the optimization of logistics components; production planning and demand forecasting, information management, routing and tracking, transportation, order processing,

material control and warehousing among others to improve the physical distribution of products downstream, (Aguzzoul, 2007; Krauth, et al. 2003).

Conceptual Model

A conceptual frame work showing the positioning of internet technologies is added to provide a better and quicker understanding of the study objective of identifying the contribution of Internet Technologies in Collaboration Arrangements and Physical Distribution Service Quality. (Refer to Figure 1 at the back of the research paper). Conceptually, as shown in Figure 1, this study supposed that the integration of collaboration arrangement constructs; information sharing, decision synchronisation and incentive alignment using internet technologies would increase the level of collaboration among demand chain members. We further presupposed the application of internet technologies in PDSQ constructs; Inventory Availability, Timeliness in delivery and Reliability of the order fulfilment process, would help increase efficiency by cutting down on lead time through quick order processing, faster order picking and provision of accurate and reliable demand information, downstream. (Refer to figure 1.)

2.1 Collaboration arrangements and Internet technologies

According to Yingli, (2012) and Caiwei, (2008), the introduction of internet technologies in collaboration arrangement in the supply chain is a result of the recent advancements in inter-enterprise software and communication technologies along with trends in globalization, networking and digitization, and has resulted to what he terms as E-collaborations, “business-to-business interactions facilitated by the Internet”. In his view, collaboration arrangements are a means of increasing supply chain management intensity and co-operative behavior between or among independent decision making enterprises. In agreement with Simatupang and Sridharan (2005), the introduction of internet technologies will allow interactions in supply chain collaborations to go beyond buy/sell transactions to activities like information sharing and integration, decision sharing, process sharing and resource sharing.

Mason, et al. (2007), shows that integrating the demand chain through strong collaboration arrangements is enhanced by the adoption of developments in information communication technology (ICT). The involved parties share information, synchronize decision making and align incentives (Simatupang and Sridharan, 2005) with the help of internet enabled communication technologies such as Electronic Data Interchange (EDI), Radio Frequency Identification (RFID), Electronic Point of Sale (EPOS), Enterprise Resource Planning (ERP) to facilitate a smooth flow of information exchange necessary for improved collaborations in the demand chain, (Chwen, et al. 2006; McLaren, et al 2002; Soonhong. et al, 2005; Zhenx. et’ al, 2001)

Information sharing is the access to data by all members in a collaboration arrangement to enable the monitoring of the supply chain activities, (Simatupang and Sridharan, 2002). The activities cover data acquisition, processing, representation, storage, and dissemination of demand conditions, end-to-end inventory status and locations, order status, cost-related data, and performance status. According to Simatupang and Sridharan, (2005), the advance of internet enabled information technology is responsible for information sharing becoming the main feature of supply chain collaboration. Using web -enabled technologies, Sambasivan, et al (2009) reveals that information exchange among members in the supply chain can be increased by ensuring that there is; visibility of real time data, development of highly responsive systems that allow for quick retrieval and transmission of information, security of data using different levels of verification steps for data access, etc, to increase the efficiency and effectiveness of the collaborations in the supply chains.

Internet technologies allow information to be managed and shared more effectively, and transported worldwide within seconds in any complex global supply chain. According to Caiwei, (2008), the physical boundaries between brick walls or territories separating entities in different demand chains can no longer block seamless flow of information due to the application of internet technologies. That even with the reduction in face-to-face contact and an increase in the opportunities for paperless offices and people-less factories that have cropped up due the developments in this Information Technology era, E-collaboration have allowed demand chain members to continuously share information more quickly than before. In agreement, (Simatupang and Sridharan, 2002) shows that advancement in Information Communication Technology such as the Internet technologies can be used to convey up-to-date data about planning, product movements, workflow, costs, and performance status to improve the strength of the collaboration arrangements in the demand chain.

Incentive alignment is an aspect in collaboration arrangements that involve sharing costs, risks, and benefits arising from the relationship among the participating members (Simatupang and Sridharan, 2002). It covers calculating costs, risks, and benefits as well as formulating incentive schemes such as pay for performance and pay for effort. According Hossain and Wigand (2004) in their study of ICT Enabled Virtual Collaboration through Trust, reveal that the introduction of internet technologies in collaboration arrangements creates what they called virtual collaborations. In these virtual collaborative environments with geographically dispersed groups, traditional social mechanisms for facilitating communication and decision-making are not present meaning that members must find other mechanisms for to communicate that are based on trust and business principles. However, even with the lack of face to face interactions due to internet communication technologies, members in the collaboration need to know the reciprocal and unilateral benefit of the arrangement.

Internet technologies provide demand chain members in collaboration arrangements with a joint decision-making process for demand planning and order fulfilment, collective performance metrics to evaluate individual performance and collective performance, and information sharing in a mutually beneficial way Simatupang and Sridharan, (2005). In agreement, Sambasivan, et al (2009) reveals that internet technologies provide an opportunity to improve the effectiveness of decision-makers by getting the right information, to the right members in the chain, in the right format, at the right time in order to allow for decision synchronisation. The later forms the basis for management information systems, decision support systems, and e-supply chains.

According to Sagbansua and Alabay (2010), the important issue often raised in practice is the need for a decision-support system to optimize the logistics network. They argue that a thorough logistics network analysis should consider complex transportation cost structures, warehouse sizes, manufacturing limitations, inventory turnover ratios, inventory costs, and service levels. These issues require the use of optimization-based decision-support systems that can solve large scale problems efficiently. A decision support system (DSS) is a computer-based information system that supports business or organizational decision-making activities. DSSs serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions. Typical information that a decision support application might gather and present are: inventories of information assets, comparative sales figures between one period and the next, projected revenue figures based on

product sales assumptions, etc. A follow up on the DSS are the Group Decision Support Systems (GDSS), a collaboration technology designed to support meetings and group work. Lam. K.S.S. (1997), on the other hand argues that there is no significant difference in the decision quality and patterns between group communications using face to face and those applying the Group Decision Support System (GDSS).

In addition, sharing of information in internet enabled collaboration arrangements increases visibility of the demand chain process. According to Simatupang and Sridharan, (2005), visibility of key performance metrics and processes enables the participating members to elicit the bigger picture of the situation to ease conflicts in decision making and allow decision synchronisation in the supply chain operations. In the study, it is also noted that what makes information sharing valuable to the collaborating members is ultimately the ability to make better decisions and to take actions on the basis of greater visibility. From the literature review, the following hypothesizes were developed;

- Hypothesis I:** Internet technologies increase the level of Information exchange in Collaborative arrangements.
- Hypothesis II:** Incentive alignment improves with the application of Internet technologies in collaborative arrangements.
- Hypothesis III:** Decision synchronization among members in Collaborative arrangements increases with the application of Internet technologies.

2.2 Internet technologies and Physical Distribution Service Quality.

The role of internet enabled communication technologies in modern physical distribution according to Sagbansua and Alabay (2010), is following an ever-increasing pattern. As opposed to the previous decades when it was considered to be an extra value to the companies, it is now a compulsory tool without which the companies cannot compete in a market characterized with the current global trends of digitization, virtual markets, liberalization, trading blocs etc. Members in the supply chain realize that the production process has reached high levels of productivity, so companies are left with no option but identifying cost cutting areas without compromising product quality or quantities. The realization of the value of services to end consumers by firms has seen Physical Distribution Management become the focus point where internet technologies are applied to increase their competitive edge. Among the many roles of internet technologies in PDSQ improvement include, Increase of Sensitivity to the Markets, Simplification of the Distribution System, Increased Number of physical distribution Channel Types, Increased Market Size, Widespread Use of E-commerce, and Internationalization and Easier Entry to the Global Markets. They also suggest; IP Tracking Technologies, Geographic Positioning System (GPS), Optimum Route System, Automated Distribution System and Virtual Organization Systems, as the most popular innovative distribution systems enabled by Internet Technologies.

Physical distribution service quality on the other hand is measured using timely delivery and reliability in the flow of goods from the receipt of an order by a manufacturer to the making of goods available to the customer, (Friday. et al; 2011;2012), Rabinovich and Bailey, 2003; Rabinovich, et al. 2006). According to Aguezzoul, (2007); Krauth, et al. (2003); Simatupang and Sridharan, (2005); Soonhong, et al. (2005), PDSQ can be improved through; production planning and demand forecasting, information management, routing and tracking, transportation, order processing, material control and warehousing. All these aspects can be optimized by the application of internet technologies. Mentzer, et al. (1989) on the other hand, reveal that the availability of new computer

capabilities like internet technologies and new analytical methods provide tools to investigate physical distribution alternatives in order to optimise the distribution process.

Timely delivery according to Mentzer, et al. (1989), is the order cycle time performance of the entire distribution system linking buyers and sellers. For the buyer, it is the time elapsed between placing and receiving an order. Timeliness encompasses the duration of one order cycle for a single customer as well as central tendency and variability across multiple order cycles for one or more customers in a given demand chain.

Sambasivan, et al (2009) confirms that internet technologies can improve the delivery time for any demand chain by cutting the time required to perform activities that affect timely delivery. By applying internet technologies measures; time and cost metric, administration time and cost metric, procurement and cycle time metric, and the e-response metric, both the manufacturers and distributors are able to cut down on the time they applied at the different de-coupling points in the chain to meet agreed upon delivery times with customers.

According to Sagbansua and Alabay (2010), the introduction of internet technologies shortens the distribution channel by combining the units involved. The information technologies and power of the retail industry has led the developments in the fields such as virtual supply chains, virtual networks, and e-business by acting as an enabler in this process. Internet businesses such as Amazon.com have obtained major successes in the flow of goods and supply processes by adapting the information flow to the electronic environment. Use of technology responds positively to all of the important factors listed among the distribution channel mix, such as low-cost distribution channels, convenience for the customer, the quality of the goods and services to be delivered to the customer, and most of all increasing the speed of the delivery.

Sambasivan, et al (2009) also proposes supply chain responsiveness through the Supplier-buyer response time in procurement operations and e-Response metrics as means of increasing supply chain responsiveness in order to reduce the delivery time of physical goods downstream. Though Gunasekaran (2008) uses the agility approach to increase responsiveness of the demand chain to customer orders and other demands, both authors agree that the application of internet technologies in the integration of supply chain activities increase the ability of the demand chain to respond faster to customer demands through availing real time information.

Reliability is the ability of the physical distribution system to perform and maintain its functions in routine circumstances, but for this study, reliability will be viewed in the line of a reliable order fulfillment process Rabinovich and Bailey, (2003). Making a distributed system reliable is very important. Failure to efficiently manage a distribution system can result in anything from customers switching to substitute brands or closure of business due to loss of market share. The reliability of a Physical Distribution system can be increased by ensuring that the information available to members in the supply chain and the end users is reliable. Using the data reliability metric, Sambasivan, et al (2009) shows that end users need reliable data to place, track and trace their orders. The manufacturers on the other hand need internet technologies to reduce the transaction error rates by availing accurate data and also reduce on the number of backlog transactions by allowing the supply chain partners to track the number of backlog transactions within their control and scope so that they can resolve issues and take quick actions.

Accurate and frequent communication acquired through efficient communication technologies, is essential to build a high level of trust in manufacturer - distributor collaboration arrangements. Communication fosters confidence in the continuity of the relationship, reduces dysfunctional conflict, bias, thus leading to established of a reliable physical distribution channel based on trust

among the collaborating members in the demand chain, (Janjaap and Ghijsen, 2005). In addition, Rabinovich and Bailey, (2003) reveals that access to information using internet technologies eliminates information asymmetry to allow the development of a reliable order processing system in physical distribution.

According to Mentzer, et al. (1989) Customers are barely interested in understanding the component processes of PDSQ, their concern lays on how reliable distribution system is. To achieve this, the distribution system must develop a level of customer interface that will allow them contact the chain members with the utmost ease. This is where internet technologies have come in to play the part by availing clients with information on just about anything regarding their shipments. This increase in the demand chain visibility for the customers creates delivery reliability.

Availability of products downstream is the proportion of units, order lines, or orders completely filled. Notably, the availability benefit is provided whenever the customer is not required to wait an abnormal length of time, or to place the order again. From the retail perspective, availability is provided if the product is on the shelf for purchase when the customer arrives at the shelf to obtain it, (Mentzer, et al. 1989).

Simatupang, et al. (2002) reveals that coordination of order fulfillment process using internet technologies can lead to customer satisfaction through achievement of customer delivery times and at lower logistics costs. Coordination of logistics processes using internet technologies like the EDI to exchange information on order fulfillment helps track slow moving items and allows the chain to respond quickly to replenishment resulting into product availability. Mentzer, et al. (1989) on the other hand points a key aspect on the increasing application of electronic order processing systems linking buyers and sellers; that to what extent will the access to electronic information the availability of a product? That under what circumstances will informing customers about expected product availability mitigate the damage caused by delayed damaged goods during delivery to increase availability? Implying that, customers can still have access to real time information using internet communication technologies and still find no products on the retailers' shelves given that the given that the information can not immediately fix a backlog on the order or damage to the goods during transit.

Weiming, et al. (2012, 1st May) view supply chains as a world-wide network of suppliers, factories, warehouses, distribution centres and retailers through which raw materials are acquired, transformed into products which are then delivered to customers. In these supply chains, structural elements including production, distribution and transportation are considered as agents in the chain process. And using control elements inventory, demand, supply, flow and information controls, members in the chain can coordinate the distribution or flow of products in an efficient manner using electronic messages.

Internet enabled collaboration arrangements allow distributors enter the same web and share data bases on sales and inventories with manufacturers. These distributors provide accurate information received from consumers inform of orders, compliments, complaints or suggestions for new product development, redesign or actual termination of the existing products on the market. This accurate and timely information has made demand forecasts and planning much easier and therefore allowed collaborators to make available what is exactly required by the consumers downstream, (Caiwei, 2008). From the literature review, the following hypothesizes were developed;

Hypothesis IV: Internet technologies increase timeliness in the distribution of soft drinks in the demand chain.

Hypothesis V: Internet technologies increase on the reliability of the physical distribution function in the demand chain.

Hypothesis VI: Internet technologies improve on the availability of soft drinks for distribution in the demand chain.

2.3 Collaborative arrangements, Internet Technologies and Physical Distribution Service Quality.

In agreement with other authors like; Mentzer, et al. (1989) and Sambasivan, et al (2009), Sagbansua and Alabay (2010) revealed that distribution as a function of marketing, consisting distribution channel management and physical distribution, has significantly improved the physical distribution as a result of developments in the field of information and communication technologies (ICT). Internet enabled communication technologies have helped create alternatives for physical distribution for consumers by facilitating the improvement of transportation and communication technologies. They further noted that the developments in information technologies have affect the delivery of services more than products by introducing more intermediaries in the distribution channels.

Processes such as collaborative planning, forecasting and replenishment (CPFR) between manufacturers and distributors in collaboration arrangements lead to improvement in the PDSQ due sharing of accurate and timely information, synchronization of decisions and incentive alignment in the demand chain. Through integration of logistical components; transportation, production scheduling, inventory management, trucking and routing among others, in the operations of the different supply chain members involved in collaboration arrangements with the aid of internet technologies will see an overall improvement in the performance of the Physical Distribution system downstream, (Friday, et al. 2011:2012; Rabinovich and Bailey, 2003; Sandberg, 2007).

The recent invention of web-based technologies e.g. XML and sophisticated middleware have made it more flexible and less costly in intra- and inter-enterprise systems connection. This resulted in timely information sharing, process automation, reduction of lead time and inventory, and increased responsiveness to customer demand (Yingli, 2012, March 30) and a result led to the improvement in PDSQ. Having developed the collaborative agent system architecture (CASA) and the infrastructure for collaborative agent systems (ICAS), Weiming et al. (2012, 1st May) believe that demand chain managers will be able to create internet enabled supply chains characterised with Shorter product development time, faster product delivery and with a collaborative culture to fully leverage corporate global resources that will aid in increasing their PDSQ;

Increasing inventions in web-based technologies could be as a result of the minimal collaboration arrangements among members in the demand chain downstream because of the barriers of logistical collaborations that have not been successfully tackled; those related to internet technologies and human beings, (Sandberg. 2007). Demand chain collaboration arrangements require technologies; EDI, Bar coding, EPOS, ERP, RFID, in their information structures to allow a seamless flow of information exchange among the members to build stronger collaborative relations, (Chwen, et al. 2006; Zhenxin, et al. 2001). Capitalizing on collaboration arrangement opportunities, that is; better demand planning, inventory visibility, reduced inventory and cost saving and increased responsiveness, requires information sharing through EPOS data to improve PDSQ, (Soonhong. et al, 2005).

A high degree of web-based demand chain integration can lead to the high levels of operational performance for manufacturers in terms of; faster delivery times, reduced transaction costs, greater profitability, and enhanced inventory turnover, (Vereercke and Muylle. 2006). Brynjolfsson, (1994), identified increased quality, variety, customer service, speed and responsiveness (Ntayi, et al. 2009)

as some of the benefits accruing to demand chains as a result of integration of logistical activities in the demand chain with internet enabled communication technologies.

It should be noted that the management of logistical activities like; transport, warehousing, order processing, routing and trucking of fleet consignments, among others, is more effective with the use of internet enabled communication technologies like; Radio Frequency Identification (RFID), ERP, EDI, to enhance trust, visibility and security of the distribution system. Strategic collaboration alliances between transport and distribution firms require the deployment of internet technologies to achieve a timely and reliable physical distribution system, (Venus, et al. 2009).

The sharing of inventory data precludes information distortion thus minimizing the bull whip effect whose implications include: excess costs, excess inventories, slow response and lost profit, to increase the quality of the physical distribution system, (Ntayi, et al. 2009; Vereercke and Muylle, 2006; Zhenx, et al. 2001). The elimination of the bull whip effect that creates uncertainties in production and distribution in the demand chain given its effect on demand forecasting, order batching, and rationing inventory, allows demand chains to create reliable and timely physical distribution systems, (Zhenxin, et al. 2001). It was observed that, among the means to reduce delivery costs, is through application of automation alternatives that are supported by internet enabled communication technologies like the EDI and EPOS, (Gunasekarana, et al. 2004).

The impact of internet technologies on the relationship between vertical collaboration and physical distribution service quality points to the importance of the communication technologies in facilitating information exchange in collaboration arrangements, asserting that; reliability, timeliness and availability of products, can be achieved through integration of logistical activities using web-enabled communication technologies. Internet resolves traditional supply chain integration tradeoffs and allows all the members to exchange information on order placement and processing efficiently, (Sambasivan, et al. 2009). Entities in smaller countries, small organisations and Multinational Corporations, (MNCs), will optimise the collaboration arrangements by adopting internet technologies to gain access to a much larger markets than in their own territories due to the increasing development and application of internet technologies, (Caiwei, 2008). Caiwei, (2008) reveals that internet enabled close demand chain collaborations need to be strategic where members get to share both the benefits and risks arising from the relationship such arrangements can lower inventory risks and costs and improve physical distribution service quality and customer satisfaction and retention. From the discussion, the following is hypothesized;

Hypothesis VII: Collaborative arrangements coupled with internet technologies increase on the level of physical distribution service quality.

2.4 Conclusion

The adaption of E-collaboration arrangements is no longer a strategy but a must if supply chain members are to improve their PDSQ. Just as businesses appreciate the development of E-Supply chains today, the introduction of E-collaborations can never be timelier than now if they to do away with the traditional supply chains. The reasons why enterprises adopt E-collaboration are mainly driven by the increasing need of information visibility and sharing along the supply chain, cost reduction, process automation, and the need to increase the flexibility and adaptability of the demand chains. The recent trend initiative in Supply Chain Management intended to increase PDSQ such as; Vendor Managed Inventory, (VMI), Cross docking, among others, have proved that e-collaboration can fundamentally change the inter-organisational processes, remodel collaborative

relationships among organizations and bring about reliability and competitive delivery times in the physical distribution of a given supply chain.

3. Methodology

The study adopted the quantitative research design and was limited to Kampala given that 61.4% of the beverage manufacturing firms are located in that area, (Uganda Business Register of 2006/2007). According to the Uganda Bureau of Statistics Business Register (2008), there are 31 manufacturers and 664 distributors of soft drinks in Kampala, giving a population size of 695. Using the Krejcie and Morgan (1970) sample size table, the sample was randomly selected from the population. For details of the population and sample size, refer to table 3.1.

Measurement scales for the variables were obtained and adapted from previous studies. Scales for information sharing, decision synchronization and incentive alignment were acquired from Simatupang and Sridharan (2005), Simatupang and Sridharan (2004), Soonhong et al., (2005) and Vereercke and Muylle (2006). Physical distribution service quality was measured using scales of availability, timeliness, reliability obtained from Rabinovich and Bailey (2003) while Internet technologies was measured using; web - enabled service metric, data reliability metric, time and cost metric, E - response metric, invoice presentation and payment metric, E - document management metric, (Sambasivan, et al. 2009). Measurement scales were tested for reliability using the Cronbach Alpha coefficient and all coefficients were above the acceptable cut – off point of 0.5 by Cronbach (1951).

For ethical research reasons, the researchers ensured that the responses received from the respondents were treated with utmost confidentiality. In a bid to protect the respondents from any backlash arising from their participation, research instruments were answered unanimously with no trace of identification. The researchers only kept a record of the visited organisation.

The required data was collected from the respondents using a structured questionnaire anchored on a five (5) point Likert scale. (1 – Strongly disagree, 2 – disagree, 3 – neither agree nor disagree, 4 – agree, 5 – strongly agree). After pre-testing the questionnaire, research assistants were given introduction letters in order to make it easy for the respondents to identify them. Appointments were made to determine the convenient time when the questionnaire could be administered and for each company, permission was sought from the administrators in charge before the questionnaire was administered. The responses were then coded and entered into the SPSS (Statistical Package for Social Scientists) software (version 17) for analysis.

A correlation was run to determine the strength of the relationships between the independent, internet technologies and the dependant variable. A hierarchical ranking regression analysis was carried out to determine the predictive strength of the independent variables on the dependant variable.

4. Discussion of Research Findings

In this section, we present and discuss the findings of our study. In the first part of this section, we present the characteristics of the respondent firms. In the second part, we present the results of the correlation and regression analysis. In the third and last part, we discuss the findings of the study.

4.1. Characteristics of Respondent Firms

From the findings, majority of the 270 respondent firms were distributors (95.4%) while manufacturers accounted for 4.6% of the firms. Most firms had between (5-50) employees (88.7%) with distributors dominating this (92.6%). The age group 25 – 35years dominated the sample (56.2%) while the category of those above 55yrs had the least (0.4%). It was noted that the male

category had a higher number of aged respondents in the 46 – 55yrs category as compared to the female (90.0%) and (10.0%) respectively.

4.2. Correlation Analysis

A correlation analysis was done to determine the strength and direction of the relationships between the variables. (Refer to table 4.1 for the results on the correlation analysis). The results in the table 4.1 revealed a significant positive relationship between Collaboration Arrangements and Internet Technologies ($r = .355^{**}$, $p < .05$); collaboration arrangements and physical distribution service quality ($r = .342^{**}$, $p < .05$); Internet technologies and Physical distribution service quality ($r = .254^{**}$, $p < .05$).

4.3. Regression Analysis

A hierarchical regression analysis was run to determine the impact of each independent variable on physical distribution service quality. (Refer to table 4.2). It was noted from table 4.2 that the variables can only predict a 13.1% change in Physical Distribution Service Quality (Adjusted R Square = .131). In Model 1, collaboration arrangements could only predict an 11.4% change in PDSQ (Adjusted R Square = .114). When Internet Technologies was added, the predictive strength increased from 11.4% to 13.1% (Adjusted R Square = .131, Model 4), making a contribution of 1.7%. It was also noted that Internet Technologies have a higher predictive strength on Collaboration Arrangements (Adjusted R Square = .123) as compared to Physical Distribution Service Quality (Adjusted R Square = .061). The analysis further reveals that Collaboration Arrangements is a better predictor for Physical Distribution Service Quality in model 1, (Adjusted R Square = .114) as compared to Internet Technologies in model 3, (Adjusted R Square = .061).

4.4. Discussion of the Findings

The findings from this study are in agreement with similar studies undertaken by Friday, et al. (2011; 2012); Rabinovich and Bailey, (2003) and Simatupang and Sridharan's (2002; 2004; 2005) on the effect of collaboration arrangements in improving the physical distribution downstream. However, the findings also reveal the contribution of internet technologies and its effect on collaboration arrangements and PDSQ.

The analysis revealed a significant positive relationship between Collaboration Arrangements and Internet Technologies, thus supporting the need for a transition from traditional collaborations to E-collaborations that are logical and timely in response to the changes in supply chains. This further implied that manufacturers and distributors of soft drinks in Uganda should adopt Collaborative Agent System Architecture (CASA) and an Infrastructure for Collaborative Agent Systems (ICAS) as suggested by Weiming, et al. (2012) or any other internet enabled communication technologies such as EDIs and EPOS in their collaboration arrangements in order to improve the strength of their collaboration arrangements. Adoption of internet technologies would mean a high speed transmission of data coupled with low error rates and a quick response to information asymmetry, to improve the strength of the collaboration arrangements. According to Chwen, et al. (2006), Janjaap and Ghijsen, (2005) and Zhenxin, et al. (2001), increase in the level of information will improve communication and foster confidence in the continuity of the relationship and reduce the dysfunctional conflicts in the collaboration arrangements. Internet technologies also create a platform for manufacturers and distributors to optimize their collaborations by easing the decision synchronization process in the demand chain through collaborative demand planning and forecasting, creating inventory visibility and increasing the level of responsiveness to information provided by different members, (Soonhong. et al, 2005).

Given the low levels of trust in Uganda's Soft drinks industry, Friday, et al. (2012), businesses are skeptical or in preference of transactional as opposed to developing strong collaboration arrangements in their supply chain operations for fear of being cheated. By improving the visibility of the demand chains through providing accurate and timely information on sensitive aspects like costs of production, inventory levels, demand forecasts and financial data, internet technologies have made it easy for members to determine the likely incentives and risks associated with the different collaborations and therefore position themselves where they benefit most. This interpretation of the findings is in line with those of other scholars like Zineldin and Jonsson, (2000), that show that collaborative relationships among manufacturers and distributors relies on information exchange to build trust; a necessary component for stronger collaboration arrangements. As a result of the above discussion, hypothesizes I, II and III were accepted due to the positive significant contribution of internet technologies to information sharing, decision synchronization and incentive alignment to improve the relations in collaboration arrangements.

Furthermore, results from the correlation analysis in table 4.1 showed a positive significant relation between internet technologies and physical distribution service quality. While the regression model in table 4.2 was significant, it rather showed low prediction strength of internet technologies on PDSQ. This could be attributed to the low internet penetration rate in the country where over 80% of the distributors forming the end distribution points for soft drinks are Small and Medium Enterprises (SME) who have either no access or interest in applying internet technologies, (Eyaa, et al. 2010; Heloise, 2006) .

The results also showed a positive significant relationship between Collaboration Arrangements, Internet Technologies and Physical Distribution Service Quality as shown in table 4.1. Following suit, Table 4.2 indicates that collaboration arrangements and internet technologies can predict up to 13.1% change in PDSQ. Though low a percentage, the regression model was significant, implying the need for Internet Technologies. As a result, introducing internet technologies saw an increase in the prediction ability of collaboration arrangements on PDSQ from 11.4% to 13.1% (1.7% contribution). It was however discovered that internet technologies had more impact on collaboration arrangements 12.3% as compared to PDSQ 6.1%. A lower effect on PDSQ among the distributors and yet they comprise over 90% of the distribution channels, Eyaa, et al. (2010); calls for more emphasis in the integration of internet technologies in the distribution channels given the low internet penetration rate Heloise, (2006), if PDSQ is to be improved. However, supply chain members will benefit more from collaboration arrangements if they prioritise the application of internet technologies in enhancing their collaborations over PDSQ related processes. Therefore, from the above discussion of findings, hypothesizes IV, V and VI were accepted.

Finally, the rather low prediction strength of 13.1% can be explained by other variables like trust and commitment proposed by Friday, et al. (2011:2012) and Zineldin and Jonsson, (2000), to improve the influence collaboration arrangements on PDSQ, that were not included in the study. There is also need to note the influence of other factors like; inaccessibility of some areas due poor road infrastructure development in terms no paved roads, bridges, inadequate electricity supply, low or no information communication technology infrastructure, unreliable communication systems such as poor phone grids, poor storage facilities, ignorance and illiteracy of the distributors, that have limited the ability of the collaboration members to optimize their relationships and improve on the PDSQ downstream. It's from this discussion that hypothesis VI was accepted.

4.6 Managerial Implications and Recommendations

First and foremost, this study re-affirms the findings in Friday, et al, (2011; 2012), where it was established that managers and soft drinks' demand chain members will improve the PDSQ of their demand chains by embracing collaboration arrangements. Given that most stake holders responded to incentive alignment as the main component in collaborations in Uganda, Managers should ensure that stake holders are informed of the likely benefits arising from the collaboration and how they are to be shared. Incentive alignment mechanisms set up should ensure that "benefits, risks and losses incurred are re – aligned" according to Simatupang and Sridharan (2002). Demand chain members will endeavor to commit resources to see that collaboration arrangements work once they see how they will individually benefit. The incentives to be shared in the demand chain can include, proper packaging to allow smooth handling of products, provision of free marketing material, provision of delivery services like transportation of products to distribution points, lower prices that allow participants downstream to make profits from selling at slightly higher prices, shielding members from risk and uncertainty by carrying out research and accurate demand forecasts, among others.

This study contributes to managerial practice by identifying the contribution and worthiness of introducing internet technologies in collaboration arrangements to improve PDSQ. Much as table 4.2 indicates an increase in the prediction ability of the independent variable from 11.4% to 13.1% as a result of introducing internet technologies, it was however discovered that internet technologies had more impact on collaboration arrangements 12.3% as compared to PDSQ 6.1%. Therefore, managers need to start the transition from traditional collaborations by concentrating on building E-collaboration arrangements as first priority. Furthermore, managers should integrate internet technologies in collaboration arrangements before developing E – Distribution processes to improve their PDSQ downstream.

In addition, managers are advised to venture more in vertical and horizontal collaboration arrangements than diagonal arrangements in order to enhance each other and help each member achieve higher PDSQ levels. Adoption of internet technologies in vertical or horizontal collaboration arrangements would increase their performance further by widening their market to a global platform, increase their competitive position, reduce inventory cost, bridge communication and realisation of a general reduction in conflicts resulting from miscommunication. To achieve all the above, managers need to take note of the following Key Success Factors (KSF); Carefully choosing the right partner, determining the necessary information technology, managing the balance of power and dependence, monitoring the quality standards of the different partners and hiring intelligent and empowered employees as E-collaboration arrangements require higher skills than the traditional collaboration arrangements if the PDSQ objectives are to be achieved.

Though in agreement with Friday, et al. (2011; 2012) and propositions made by Yingli, (2012) on how collaboration arrangements can improve the physical distribution service quality in demand chains, Caiwei, (2008) cautions managers on the fact that collaborations of what never nature should not be considered as a silver bullet to all the PDSQ challenges. That without good understanding and preparation, E-collaboration arrangements can also damage the performance of the chains due to factors like unequal resource commitments and unbalanced management and power.

5. Study Limitations and Direction for Future Research

There were a number of identifiable research limitations like; limited literature addressing the subject content in Uganda that forced researchers to apply relevant literature from studies undertaken in other countries. Secondly, considering only registered manufacturers and distributors of soft drinks in Kampala region had a scope implication on the study. It should be noted that the

study focused on only Kampala because over 60% of the Manufacturers and Distributors forming the respondents were located there. With appropriate sampling techniques applied, the findings provide good inference for physical distribution processes in other regions. Lastly, failure to incorporate the perceptions of the consumers and carrying out a cross sectional instead of a longitudinal study were among the other research limitations that arose due to time constraints. These limitations should help other researchers identify research gaps and therefore create opportunities for further research.

Our model in figure 1, shows that introducing internet technologies between collaboration arrangements and PDSQ will increase the predictive strength of the independent variable from 11.4% to 13.1%, making a 1.7% contribution. Comparison of the regression results with those in Friday, et al. (2011) and Friday, et al. (2012), 12.3% and 13% respectively, provides an average of 12.8%, indicating a low prediction strength for all the variables; collaboration, trust, commitment and internet technologies on physical distribution service quality. The low prediction implies that researchers have the opportunity to identify other variables responsible for the up to 87% change in PDSQ.

In addition, though this study applied collaboration arrangements to improve PDSQ in a traditional supply chain, the continued increase in access to Information Communication Technology services in Uganda is likely to lead to E-collaborations. As a result, researchers can venture into establishing the viability of E-collaborations on PDSQ in the demand chains in Uganda.

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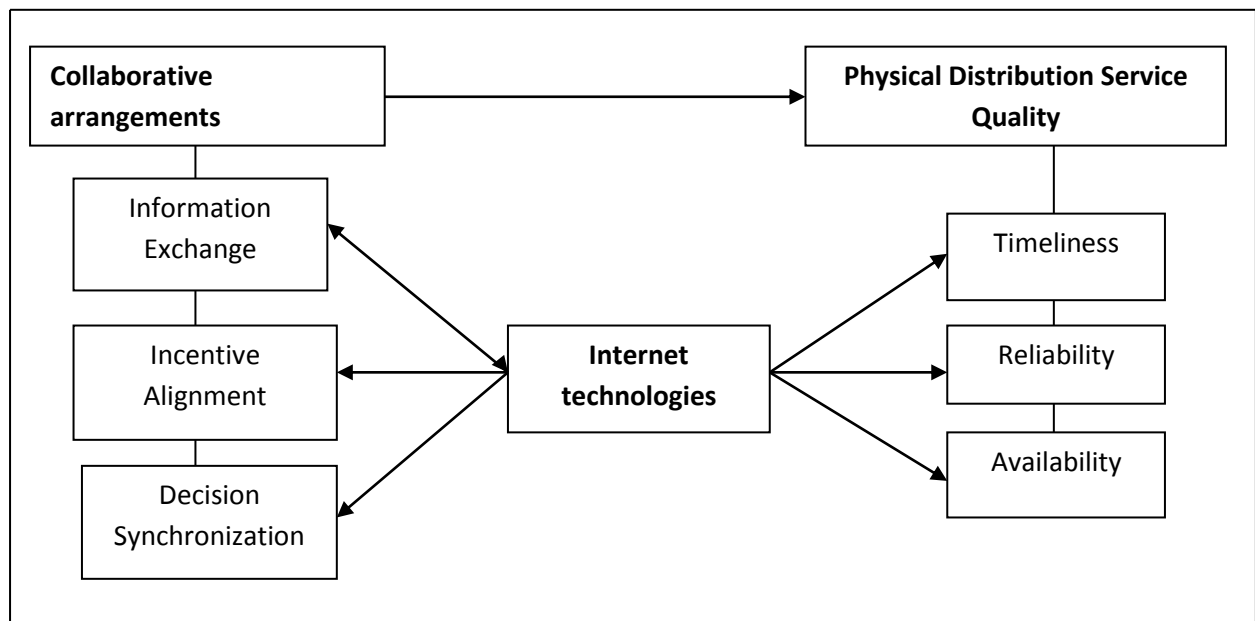
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Figure 1. Showing the conceptual frame work



Source: Rabinovich and Bailey, (2003); Simatupang and Sridharan, (2005); Sambasivan, et al (2009).

Table 3.1: Population and Sample Size

Category	Kampala	Sample Size
Manufacturers	31	28
Distributors	664	242
TOTAL	695	270

Source: Uganda Business Register of 2006/2007

Table 4.1 showing the relationships between the variables

		Collaborative arrangements	Internet technologies	Physical Distribution Service Quality
Collaborative arrangements	Pearson Correlation	1	.355**	.342**
	Sig. (2-tailed)		.000	.000
	N	281	281	280
Internet technologies	Pearson Correlation	.355**	1	.254**
	Sig. (2-tailed)	.000		.000
	N	281	283	282

Physical Distribution	Pearson Correlation	.342**	.254**	1
Service Quality	Sig. (2-tailed)	.000	.000	
	N	280	282	282

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

Table 4.2 Showing the Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	Sig. F Change
1	.342 ^a	.117	.114	.64298	.117	36.922	.000
2	.355 ^a	.126	.123	1.13464	.126	40.233	.000
3	.254 ^a	.064	.061	.65974	.064	19.299	.000
4	.371 ^a	.138	.131	.63668	.138	22.091	.000

Summary Model

Details	Model 1	Model 2	Model 3	Model 4
Sig. F Change	.000	.000	.000	.000
R Square	.117	.126	.064	.138
Adjusted R Square	.114	.123	.061	.131

Model 1: predictors – Collaboration arrangements and Physical Distribution Service Quality

Model 2: predictors – Internet Technologies and Collaboration Arrangements

Model 3: predictors – Internet Technologies and Physical Distribution Service Quality

Model 4: predictors – Collaboration Arrangements, Internet Technologies and Physical Distribution Service Quality .