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SUPPLY CHAIN VISIBILITY, SUPPLY CHAIN VELOCITY, SUPPLY CHAIN ALIGNMENT AND HUMANITARIAN SUPPLY CHAIN RELIEF AGILITY

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ABSTRACT: *The research aimed at examining the relationships between supply chain visibility, supply chain velocity, supply chain alignment and supply chain relief agility using a case of humanitarian agencies in responding to Bududa Land Slide disasters in Eastern Uganda. The study was motivated by the fact that although several humanitarian agencies responded by delivering aid to those in need during the aftermath of Bududa landslides in 2010, their humanitarian supply chains were not fast and agile enough to respond to the sudden onset disaster. A cross sectional data was collected from a sample of sixteen (16) humanitarian agencies that were involved in responding to landslide disasters in Bududa district in Eastern Uganda region. A total of 135 usable questionnaires were collected which were used for data analysis. The results indicate significant positive relationships between supply chain visibility, supply chain velocity, supply chain alignment and supply chain relief agility. Findings also revealed that supply chain visibility and supply chain alignment are significant predictors of humanitarian supply chain relief agility. The study has both practical and theoretical implications which are discussed.*

KEYWORDS: Supply Chain Visibility, Supply Chain Velocity, Supply Chain Alignment, Supply Chain Relief Agility, Humanitarian Agencies

INTRODUCTION

Humanitarian supply chain relief management is the process of coordinating an efficient and effective flow and storage of goods and services as well as related information from the point of origin to the point of consumption for the purpose of alleviating the suffering of vulnerable people due to disaster (Bolsche, 2014). Agility refers to internal capabilities that meet dynamic needs with speed, flexibility and responsiveness (Gunasekaran & Dubey, 2014). In order for humanitarian supply chain relief to respond to disaster appropriately, agility is needed. However, globally this has not been achieved. Humanitarian supply chain relief agility is still poor. Most of the humanitarian relief assistance is not delivered on time; there is usually lack of baseline data, delays in information flows due to translation, lack of coordination from health sectors and lack of disaster preparedness (Disaster Relief Emergency Fund Operation Report, (2010). This could be attributed to poor supply chain visibility, lack of supply chain alignment and lack of supply chain velocity.

According to Barrat and Oke (2007) supply chain visibility is defined as the extent to which actors within a supply chain have accesses to or share information which they consider as key or useful to their operations and which they consider will be of mutual benefit. Supply chain velocity is the ability to complete an activity as quickly as possible (Carvalho & Azevedo, 2012), whereas, supply chain alignment is the property of supply chain network design that enables the supply chain network to flexibly adjust its configuration to align the objectives of all members (Dubey & Gunasekaran, 2014).

The world has witnessed numerous disasters over the centuries and although some are man-made due to wars and terrorism, Mother Nature certainly dishes out her fair share. In Uganda heavy rains that started late February 2010 resulted into floods, water logging and landslides affecting more than 50000 people across the country. The areas worst affected was Bududa district in eastern Uganda where the villages in Bukalasi Sub-county were almost completely buried by landslides. Other districts affected include Butaleja, Katakwi, Amuria, Pallisa, Mbale, Moroto, Nakapiripirit, Sironko, Manafwa, Bukwo and Budaka in the eastern while Bundibugyo, Kasese, Kisoro, Kabarole and Kabale were the areas most affected in the western part of the county (International Federation of the Red Cross Report, 2010).

In Bududa landslides and floods occurred in the areas around Mt. Elgon following five days of consecutive downpours resulting in death, displacement of people, destruction of property including burying a health center, destroying food crops, roads and sanitation systems. An estimated 400 people were killed in this area alone and only 105 bodies were recovered (Disaster Relief Emergency Fund Operations Report, 2010). Landslides caused extensive damage to property, environment and loss of lives. Nonetheless, landslides in the mountain Elgon areas and mostly in Bududa seem to have occurred in the past with little intervention and study. According to International Peace Support Training Center Report (2013) in the major soil survey done in the country, the soils of Bududa in the areas around mountain Elgon are under risk of soil slips. Bududa district has been affected by landslides some of which are reported and others not.

The rescue team comprised of humanitarian agencies i.e. World food programme, United Nations Development Partner, World Health Organization, United Nations Children Fund, United Nations High commissioner for Refugees, United Nations Population Fund, Uganda Red Cross, International Committee of the Red Cross, Save the Child, and World Vision among others.

UN agencies and Non-Government Organizations (NGO's) deployed staffs and provided relief services like emergency health kit, plastic bags for dead bodies, 600 tents and tarpaulins, water purifiers, 1000 five liter jerry cans, 910 blankets, 100 buckets, 10 shovels among others (WHO Report, 2010). Humanitarian actors faced a lot of challenges in Bududa which impacted heavily on their fast and agile response. These include inaccessibility due to its location; the area is difficult to reach using surface transport. Limited resources; the local administration lacked adequate resources to cope with the disaster, lack of updated maps, lack of skilled manpower, equipment and Finance. Poor weather also slowed down the operation and also induced fear of a possibility of another similar disaster occurring: False registration; many people who were not affected falsely registered to benefit from the relief aid. This put undue strain on the assistance offered. Misappropriation of aid; some of the aid provided did not reach the intended recipients but instead was diverted to other uses. Resistance by the local people to vacate the area despite the real danger of continued stay in such places. Many resisted government attempt to relocate them (International Peace Support Training Center Report, 2013). The purpose of the study is to establish the relationship between supply chain visibility, supply chain alignment, supply chain velocity and humanitarian supply chain relief agility. The research is guided by the following objectives: (i) to examine the relationship between supply chain visibility and supply chain velocity, (ii) to establish the relationship between supply chain alignment and supply chain velocity, (iii) to establish the relationship between supply chain velocity and humanitarian supply chain relief agility, (iv) to establish the relationship between

supply chain visibility and humanitarian supply chain relief agility and (v) to establish the relationship between supply chain alignment and humanitarian supply chain relief agility.

LITERATURE REVIEW

Supply chain Visibility and its dimensions

Supply chain visibility is defined as the extent to which actors within a supply chain have accesses to or share information which they consider as key or useful to their operations and which they consider will be of mutual benefit (Barrat et al., 2007). It also implies a clear view of the upstream and downstream inventories, demand and supply conditions, and production and purchasing schedules (Christopher & Peck 2004). For supply chain visibility to be effective, data must be readily available, timely, accurate and in a format that communicates necessary information (Pettit, 2008). In view of the resource based theory, an organization can achieve a sustainable competitive advantage through acquisition of and control over resources (Grant, 1991). Grant, (1991) further argues that these resources can include both tangible for example equipment's and intangible for example information or process knowledge assets that enable the production and delivery of goods and services. Therefore based on that theory, it's argued that supply chain visibility is a necessary resource for enabling organizations to develop greater responsiveness.

According to Pettit (2008) supply chain visibility includes information technology, information exchange, business intelligence gathering and knowledge of asset status. Pettit (2008) further argues that supply chain visibility can successfully come from many types of media not only electronic. A phone call or memo can suffice in the right circumstances. However, with vast amount of data being created in today's enterprises, electronic dissemination, filtering and monitoring can be extremely rapid and cost effective. Visibility also extends beyond the firms among the supply chain members. This knowledge contributes to supply chain confidence through sharing information such as current inventory position, procurement status, manufacturing schedules, distribution reliability, order status and demand forecasts (Christopher et al., 2004). Pettit (2008) argues that visibility is clearly an enabler of rapid, effective decision making to support normal operations and especially in turbulent times. Supply chain visibility can be improved through resilient upstream and downstream practices helping companies to anticipate, perceive and effectively manage the real consequences of supply chain disruptions (Carvalho et al 2012).

Humanitarian supply chain relief agile capability can be enabled through enhanced supply chain visibility. Ideally all parties in the network should share information in as close to real time as possible. This information will include the actual requirements from the field i.e. demand, current inventory, disruptions, the supply schedule and events management alerts.

Many traditional supply networks have poor upstream and downstream visibility with little shared information. Hence they are prone to mismatches of supply and demand of events interface. The most agile supply networks are typified by a mindset of collaborative working with other partners in the network based upon a spirit of trust and shared goals (Christopher & Tatham, 2011). According to Oloruntoba et al. (2006) humanitarian supply chain at the level of the international donors should be lean for upstream activities such as needs assessment i.e. remote demand forecasting, mobilization of sufficient financing, people, skills and goods, accessibility, terrain, weather and available facilities, procurement transportation sourcing,

disaster preparation and planning and related upstream supply chain activities. Upstream activities in the humanitarian supply chain are usually lauded for their agility. For example credit is given to the speed with which a particular appeal can be instituted and how generously and quickly donors can respond to a one off event (Oloruntoba et al., 2006). For an agile and effective supply downstream, Oloruntoba et al. (2006) argues that humanitarian supply chain should be lean for upstream activities such as supply chain donor funds, supply chain accessibility, supply chain mobilization, supply chain procurement and supply chain transport logistics. Nonetheless, this has not been achieved. According to Pettit (2008), the dimensions of supply chain visibility include information technology, information exchange, business intelligence gathering and knowledge of asset status.

Information technology

Information technology is the use of computerized systems to integrate supply chain operations and provide visibility of internal operations and processes (Pettit, 2008). Internal integration involves cross-functional collaborations that enable the overall organization to absorb and utilize information in ways that enhance flexibilities. Additionally, Pettit (2008) argues that in today's age of electronic data interchange, radio frequency identification and web-presence, visibility can successfully come from many types of media. With vast amount of data being created in today's enterprises, electronic dissemination, filtering and monitoring can be extremely rapid and cost effective.

Information exchange

Information exchange is defined as the extent to which information is communicated between the partners in the chain (Vilko, 2012). In facilitating dynamic actions and decision – making, the exchange of information of a sufficiently high quality is vital in the coordination of operations within supply chain. Research on supply chain management has given much attention to information sharing and more recently to supply chain visibility. According to Wiliam et al. (2013) greater information access increases organizations ability to respond quickly to changes in its business environment. Information sharing is the glue that holds all the activities and resources together along the supply chain from raw materials procurement to customer services (Holcomb, Ponomarov & Manrodt, 2011).The key to improving supply chain visibility is shared information among supply chain members. Sharing information significantly increases its power due to the fact that information reduces uncertainty and thus reduces the amount of buffer inventory that is needed. Barrat et al., (2007) argues that high level of visibility that is characterized by the quality of useful information within a supply chain linkage is what makes the visibility distinctive.

Business intelligence gathering

Business intelligence is both a process and a product that extends beyond the boundaries of even the supply chain. The goal is to provide leading indicators of future trends and to predict the behavior of competitors, suppliers, customers, technologies, acquisitions, market, product and services, and the general business environment with a degree of certainty (Pettit, 2008). Humanitarian relief agencies are expected to have a higher visibility of business intelligence since it's clearly an enabler of rapid, effective decision making to support normal operations and especially in turbulent times.

Knowledge of Asset status

Pettit (2008) posits that for general efficiency especially in times of disaster crisis, the status of assets including facilities, equipment, inventory and personnel is crucial to effective decision making. Converting this status data to knowledge requires dissemination to the right people, at the right time and in a form they can use. Humanitarian relief organizations are expected to have clear visibility of the asset status to effectively perform their duties of alleviating the suffering.

Supply chain velocity and its dimensions

The second hypothesized predictor of humanitarian supply chain relief agility is supply chain velocity. Velocity is defined as the ability to complete an activity as quickly as possible (Carvalho et al., 2012). Velocity can also be explained as distance over time thus to increase velocity, time must be reduced i.e. end to – end pipeline time or the total time it takes to move products and materials from one end of the supply chain to the other (Christopher & Lee 2004). Supply chain velocity focuses on the pace of flexible adaptation and thus determines the recovery speed of the supply chain from a risk event (Tukumuhabwa, Stevenson & Busby., 2015). Dubey, Ali and Venkatesh (2014) and Tukumuhabwa et al., (2015) identified dimensions of supply chain velocity as supply chain empowerment, supply chain adaptability, supply chain speed and supply chain innovations.

Supply chain empowerment

Empowerment of workforce plays a significant role in achieving the desired agility (Dubey et al, 2014). This can be achieved through selecting and training people who are capable of planning, coordinating, acting and intervening where necessary. According to Pettit, (2008) empowerment through trust building activities may even identify way to improve day-to-day operational efficiencies. Building trust with key partners will benefit the ability to transparently share data and then use the data in collaborative decision making. The basic principle of humanitarian aid is that people and countries are empowered and can help themselves to the maximum level possible. Therefore upgrading local skills is a primary task both between and during humanitarian interventions. It is always better to use a local humanitarian staff instead of foreigners who can speak both foreign languages and the local languages. With better training, local teams would be better prepared, empowered and able to respond to local disaster (Wassenhove, 2006).

Supply chain adaptability

Adaptation consists of the firm's ability to reconfigure its strategy to changes in its environment and to capitalize on emerging opportunities (Yao & Meurier, 2012). Adaptation is recognized as one of the most crucial factors for gaining and retaining competitive advantage in supply chains. Since firms do not compete in isolation against one another, but jointly with their suppliers, suppliers of suppliers, customers and customers of the customer i.e. the supply chains, the need for rapid change and adaptation must exceed firm boundaries to include the whole supply chain. Thus, firms should design adaptive supply chains to be successful (Giannoccaro, 2015).

From an organization perspective, adaptation problem could be viewed as a result of environmental dynamism. It is especially challenging in the case of abrupt and unexpected changes such as supply demand or operational disruptions. Under such circumstances, the

organizations need to adapt and re-organize quickly in order not only to survive but also efficiently and effectively respond to a wide variety of environmental challenges (Ponomarov, 2012). Humanitarian organizations are expected to modify operations in response to challenges in order to cope with and adequately respond to changes (Pettit, 2008).

Supply chain speed

Torng (2004) defines supply chain speed as the ability to complete an activity as quickly as possible. The importance of a timely response is much different in the humanitarian sector than in the commercial sector. While a delay in the commercial supply chain is costly in terms of productivity and customer satisfaction, a delay in the humanitarian supply chain could literally mean the difference between life and death for those most severely impacted by a disaster (Overstreet, Hall & Hanna, 2011). A successful humanitarian operation mitigates the urgent needs of a population with a sustainable reduction of their vulnerability in the shortest amount of time and with the least amount of resources.

Supply chain innovation

Supply chain innovation is defined as the generation, acceptance and implementation of new ideas, processes, products or services (Calantone, Cavusgil & Zhao, 2001). Innovation involves a constant search for new information that goes beyond the knowledge related with firm's current operational activities. In order to provide solutions to business challenges and problems, Vicente, Seabra & Abrantes (2015) posit that managers change routines and develop a culture of innovativeness that is shaped to accept high levels of internal change. Vicente et al. (2015) argue that firms with a higher culture of innovativeness develop a superior competitive advantage which enables them to reinforce outcomes from it. Calantone (2001) further argues that successful innovations are those that result in improvements in efficiency, effectiveness, quality or social outcomes.

Innovation processes have the potential to stimulate positive change. Successful innovations can capture the humanitarian imaginations and provide new ways of delivering assistance to those who need it most. Ramalingam et al. (2010) argues that consciously prioritizing and managing innovations can provide an important and as of yet under-utilized mechanism for improving humanitarian performance. In every sector of humanitarian relief including health, waste and sanitation, shelter and camp management, food and nutrition, agriculture, logistics, protection, early recovery and telecommunication, products have been introduced to improve the conditions of disaster affected people. For instance, famine biscuits that were developed by Oxfam in collaboration with a confectionary manufacturing company and the humanitarian drinking straw that uses filtration technology to enable any water however dirty to be drunk safely.

Supply chain alignment and its dimensions

Supply chain alignment is the property of supply chain network design that enables the supply chain network to flexibly adjust its configuration to align the objectives of all through collaboration and risk sharing (Dubey & Ali 2015). Great companies take care to align the interest of all the firms in their supply chain with their own. That is critical because every firm be it a supplier, an assembler, a distributor or a retailer tries to maximize only its own interests. If any company's interests differ from those of the other organizations in the supply chain, its actions will not maximize the chains performance. Misaligned interests can cause havoc even

if supply chain partners are divisions of the same company. Lack of alignment causes the failure of many supply chain practices (Lee, 2004).

One way companies align their partner's interests with their own is by redefining the terms of their relationships so that firms share risks, costs and rewards equitably. In commercial supply chains, clever companies create alignment in supply chains in several ways. They start with the alignment of information so that all the companies in a supply chain have equal access to forecasts, sales data and plans. Next they align identities. In other words the parties must define the roles and responsibilities of each partner so that there is no slope for conflict. Lee (2004) argues that companies must align incentives so that when companies try to maximize returns, they also maximize the supply chains performance. Wassenhove (2006) argues that humanitarian organizations often have to contend with many stakeholders, including large number of uncoordinated and disparate donors, the media, governments, the military and the final beneficiaries. At any one time, there can be as many as several hundred humanitarian organizations at the scene of a disaster not always acting in a coordinated fashion. All with different political agendas, ideologies and religious belief and all are competing and fighting for media and donor attention. The greatest challenge here lies in aligning them without comprising their mandates or beliefs. Dubey et al. (2015) identified collaboration and risk sharing as the key dimensions of supply chain alignment that have been consistently used.

Supply chain collaboration

Collaboration is the ability to work effectively with other entities for mutual benefit (Pettit, 2008). The vast degree of turbulence and complexity in supply chains require an enterprise view with collaboration among all business functions within the firm. Pettit (2008) posits that a high level of collaboration is required to identify and manage risks. A collaborative network is the most advanced and demanding form of collaboration. It involves a joint process where the entities share information, resources and responsibilities to plan, implement and evaluates activities to achieve a common goal. Collaboration implies mutual trust and it takes time, effort and dedication. It implies risk, resources and responsibility and it gives an outside observer an image of a joint identity (Christopher et al, 2011).

One way that organizations can enhance their supply chain agility is by making use of collaboration and resources of other entities within the network. Christopher et al. (2011) further argue that it could be financially crippling for one organization to have to carry enough capacity and inventory to cope with any demand eventuality. However, if close working relationship can be established with other organization that can provide access to their own resources, then a real opportunity exists for creating high level of flexibility in the supply network. Several benefits of collaboration have been documented over the years for manufacturers, suppliers and customers. These include impressive cost reduction, improved services, improved end customer satisfaction, shorter lead times, improved information visibility, increased competitiveness and clear division of responsibility among partners (Kohli & Jensen, 2010). Kohli et al. (2010) further identified that barrier to successful implementation of collaboration in the supply chain are: fear of failure, exposure to competition, concern about trust, increase of operation complexity and technological incompatibilities. In humanitarian logistics, collaboration enables access to a common inventory with the United Nations humanitarian response depot (UNHRD) network which is coordinated by the world food programme WFP in Italy. Wassenhove (2006) argued that a successful humanitarian response depends heavily on local capabilities as well as collaboration with the host government such as welcoming foreign help or even military resources on their territories.

Supply chain risk sharing

Supply chain risk sharing occurs when two contracting parties enter into an investment and agree to share the risk upon the occurrence of any loss or damage in the transaction, or to share the profit if any (Al-Badani, 2014). Regarding the growing level of risks faced by companies nowadays, Pereira, Da-Silva and Christopher (2014) assert that risks assessment and sharing among the members of the supply chain is an essential elements of supply chain risk mitigation. Monitoring supply chain risks have a positive impact on the supply chain alignment. Therefore risk management seems to be a prominent procurement activity which intends to closely monitor the contingencies from various risk resources normally focused on the upstream of the company.

Humanitarian supply chain relief agility and its dimensions

Humanitarian supply chains are meant to provide efficient and effective flow and storage of goods and services as well as related information from the point of origin to the point of consumption for the purpose of alleviating the vulnerable people due to disaster (Bolsche, 2014). The function encompasses a range of activities including preparedness, planning, procurement, transport, warehousing, tracking and tracing as well as customs clearance. Thomas et al. (2005) argue that an agile humanitarian supply chain is central to disaster relief for several reasons. First, it is crucial to the effectiveness and speed of response for major humanitarian programs such as health, food, shelter, water and sanitation. Secondly, since the logistics department handles tracking of goods through the supply chain, it is often the repository of data that can be analyzed to provide post-event learning. Logistics data reflects all aspects of execution from the effectiveness of supplies and transportation provided to the cost and timeliness of response, appropriateness of goods donated as well as management of information. This is critical to the performance of both current and future relief operations and programs.

Beamon and Balcik (2008) argued that performance measurement is critical to humanitarian supply chain relief organizations due to increased frequency and scale of disaster, scarce resources, funding competition and the need for accountability which require more transparent relief operations. Therefore performance measurement for the relief chain is critical in terms of securing donor funding and improving the relief organizations mission of saving lives and reducing human suffering. Applying the theoretical concept of agility to humanitarian supply chain suggest a need to integrate processes along the supply chain and achieve virtual integration from suppliers to their end consumers, the aid recipient. This would require timely and accurate exchange of information hence leading to reduced cost and reduction in bottlenecks (Scholten & Scott 2010). According to Gligor (2013) supply chain agility can be manifested through the organizations capabilities that enables the firm to quickly detect changes, opportunities and threats (alertness), access relevant data (accessibility), make resolute decisions on how to act (decisiveness), quickly implement decisions (swiftness), and modify its range of supply chain tactics and operations to the extent needed to implement the organizations strategy (flexibility). Despite previous research, no study addresses how these variables i.e. (supply chain visibility, supply chain alignment and supply chain velocity) affect performance of supply chain agility especially of humanitarian agencies in responding to landslide disasters in LDCs. According to Gligor (2013) the dimensions of humanitarian supply chain relief agility include

Alertness

Alertness is the ability to quickly detect changes, opportunities and threats (Gligor, 2013). An agile supply chain is described as being alert and capable of responding to changes. This dimension of agility according to Gligor (2013) manifests itself through sensing emerging market trends, listening to customers and monitoring real demand through daily point of operation. Humanitarian relief agencies must have alertness to meet their challenges.

Accessibility

Accessibility is defined as the ability to access data (Gligor, 2013). Once a change has been detected through the alertness capability, the organization must also be able to access relevant data to decide how to provide an agile response. Christopher et al. (2004) argues that key operational metrics and status reports such as inventory, demand forecasts, production and shipment plans, work in progress, yields, capacities, and backlogs should be readily accessible by key members of the supply chain. Such information should be accurate and timely rendering it useful for all parties for planning and re-planning purposes. Humanitarian relief agencies must have access to data needed in their effective operations.

Decisiveness

Gligor (2013) defines decisiveness as the ability to make decisions resolutely. In order to develop an agile supply chain, it is not enough to create the ability to quickly detect changes and access relevant information on how to deal with changes. Humanitarian relief agencies must have the ability to make resolute decisions on how to respond to changes.

Swiftness

Swiftness is the fourth dimension of supply chain agility according to Gligor. (2013) and it's defined as the ability to implement decisions quickly. Once a decision is made on how to respond to disasters, relief agencies must be able to quickly implement those decisions. Damien and Shams (2008) posits that the faster flow can be achieved throughout the supply chain, the quicker aid recipients can be satisfied.

Flexibility

Flexibility is the fifth dimension of supply chain agility according to Gligor (2013) and it's defined as the ability to modify the range of tactics and operations to the extent needed. Damien et al. (2012) argue that flexibility in supply chain is the possibility to respond to short term changes in demand or supply situations of other external disruptions together with the adjustment to strategic and structural shifts in the environment of the supply chain. Flexibility thus combines agility, adaptability and alignment. Research also indicates that supply chain flexibility directly and positively impacts supply chain agility. The inherent instability and unpredictability of humanitarian needs demands flexible supply chains which prompted Olorunfoba et al. (2006) to initially suggest that the concept of agility may apply to humanitarian supply chains.

High level of flexibility is required to set up distribution networks quickly (Scholten, 2010). Changes and unpredictable business environments require agile supply chains which attempts to reliably meet market demands while minimizing costs and reducing risks. This incorporates flexibility in terms of resources and coordination of activities. Scholten (2010) argues that

achieving resources and coordination flexibility allows organizations to cope with high levels of environmental and operating uncertainty. The need for flexibility in terms of both resources and coordination of operations is particularly applicable to those relief organizations which operate in a constantly changing unpredictable environment. Coordination flexibility in this context applies to reconfiguring the chains to deploy the required goods to the identified recipients as speedily as possible. The degree of velocity, responsiveness, competence, visibility and collaboration will influence the supply chain behavior supporting the quick response to changes in demand in terms of volume and variety i.e. agility (Carvalho et al., 2012).

Supply chain visibility and supply chain velocity

For supply chain velocity to be effective in humanitarian logistics, there must be proper supply chain visibility so that the flow of materials, donor funds and information can be effectively managed to meet the humanitarian requirements on time (Azevedo & Prata 2012). The organization information processing theory (Galbraith, 1974) emphasizes that an organizations information processing capabilities must be aligned with its information needs. That is, an organization must be able to gather, interpret, synthesize and coordinate information across the supply chain which increases supply chain speed, adaptability, innovation and empowerment.

Humanitarian agencies should primarily try to look further upstream into their supply chain to address those visibility blind spots which can increase supply chain response to disasters. Better upstream visibility then helps improve supply chain planning and ultimately optimizes on time delivery to aid recipients (Heaney, 2013). A well-managed enterprise continually examines its turbulent environment and realigns its resources faster than its rivals. Pettit (2008) further argues that visibility systems provide knowledge of where assets are and inventory management. This enables combination of planning data with demand projections and current orders to best compute cycle and safety stock as well as re-allocating inventories as fast as needed. Consequently, the management system requires efficient data exchange among various internal functional departments to create a more responsive customer driven process. *Thus, H1: There is a significant positive relationship between supply chain visibility and supply chain velocity.*

Supply chain alignment and supply chain velocity

Supply chain alignment and velocity are key to optimizing supply chains. Without these fundamentally basic ingredients, all the technology and process solutions and the donor funds spent in humanitarian crisis will amount to essentially naught (Wal-Mart report, 2014). Supply chains are about going horizontal and about velocity and about real time flow of products and information. Wal-Mart Report, (2014) indicates that supply chain alignment is one of the fundamental building blocks to getting supply chain velocity. To increase velocity, end-to-end pipeline time must be reduced i.e. the total time it takes to move products and materials from one end of the supply chain to the other. Supply chain velocity and indeed acceleration is dependent upon supply chain alignment of process improvements. *Thus, H2: There is a significant positive relationship between supply chain alignment and supply chain velocity.*

Supply chain velocity and humanitarian supply chain relief agility

Humanitarian organizations have come under increasing pressure to prove to donors pledging millions in aid and goods that they are reaching those in need. Since donors are becoming more aware when it comes to expenses, humanitarian organizations are under greater scrutiny to

monitor the impact of aid not just the input and output but the whole operation (Wassenhove, 2006). This means relief agencies must be more result oriented as they become even more accountable and therefore their operations must be more transparent. To achieve this, humanitarian supply chains must be slick, speedy, innovative and adaptive operations.

Wassenhove (2006) argues that humanitarian organizations need robust equipment's to be extremely adaptable and prepared for the unexpected as circumstances can change very quickly from one moment to the next. Adaptation provides relief agencies with the capacity to cope with and adequately respond to changes. For humanitarian agencies to respond quickly, they must allow for adaptive measures in the form of a decision making process that can transfer production or distribution in the event of a potential or actual disruption at the other point in the supply chain (Pettit, 2008). Pettit (2008) further suggests that relief operations should have the ability to quickly mobilize resources, manage the crisis and mitigate the consequences of a disaster. Quickly mobilizing resources is critical in relief operations and quick reaction can limit the overall severity of a disaster in terms of loss of life. *Thus it can be hypothesized that H3: Supply chain velocity is significantly and positively related to humanitarian supply chain relief agility.*

Supply chain visibility and humanitarian supply chain relief agility

Humanitarian and disaster relief assistance is a continuous effort spread around the world to support the distressed, displaced, insecure and needy population. The notable humanitarian relief community include unilateral agencies such as the United Nations high commission for refugees and the world food programme which are supported entirely by voluntary contributions mainly from governments both in cash and in kind as well as a wide range of non-government organizations (Olorunjoba et al., 2006). It is impossible to predict where and when an emergency will occur. In a disaster context, the humanitarian organization reach out to the victims of the emergency, prepare for appropriate commodities and ensure efficient and effective aid distribution to the victims (James & Martin 2002). However, optimizing humanitarian relief supply chain performance requires increased supply chain visibility. As supply chains mature across the globe, it is evident that there is increasing need to improve supply chain visibility which is one of the key drivers for humanitarian agencies looking to improve supply chain agility. Visibility is important for gaining insight into the supply and demand chain and it's a cornerstone for improving collaboration and responsiveness across the supply chain (Lee & Li 2011). Humanitarian organizations need to be flexible and better informed to deal with any unforeseen events that may have a negative impact on their performance. Visibility within the supply chain can help manufacturers eliminate or avoid problems and also provides a competitive advantage over their competitors. Lee et al., (2011) argued that having supply chain visibility translates into being able to meet customer needs. Humanitarian agencies should aim at getting more visibility into the entire supply chain since high visibility significantly contributes to lower lead-time variability, reduced inventory, shorter lead times, increased fill rates and other supply chain operational improvement. *Therefore based on this discussion, it can be hypothesized that H4: There is a significant positive relationship between supply chain visibility and humanitarian supply chain relief agility.*

Supply chain alignment and humanitarian supply chain relief agility

Successful humanitarian operations mitigate the urgent needs of a population with a sustainable reduction of their vulnerability in the shortest amount of time and with the results amount of

resources. A successful response depends heavily on local capabilities as well as collaboration with the host governments such as welcoming foreign help or even military resources on their territories (Wassenhove, 2006). Humanitarian organizations compete between themselves for media attention and for a shrinking base of common donors. In order for humanitarian supply chain relief organizations to effectively alleviate the suffering, there is need to align and coordinate the key players in relief operations whose origins, history, geographical, cultural, and political nature pose potential problems for humanitarian principles and space (Wassenhove, 2006). Once a disaster occurs, demand for large amount of a large variety of supplies occurs suddenly in massive amounts. However, the speed of relief operations during the first days of the disaster significantly affects the lives of many people threatened by the disaster. Therefore, the ability of relief organizations to align and mobilize its resources during the assessment and deployment phases is critical to the success of a disaster response (Balcik et al, 2008). *Therefore based on this discussion, it can be hypothesized that: H5: Supply chain alignment is significantly and positively related to humanitarian supply chain relief agility.*

In summary, despite previous studies, no study examines supply chain visibility, supply chain alignment, supply chain velocity and humanitarian supply chain relief agility. The relationship between these variables is necessary to draw logical conclusion to improve humanitarian supply chain relief agility considering the fact that disasters have increased. Such a study is likely to enhance our understanding of humanitarian supply chain relief agility which if improved can save lives of many who are struck by such disasters. Moreover, humanitarian supply chains are unique due to the urgency to save lives, short lead times and adhoc inventory management.

The conceptual model

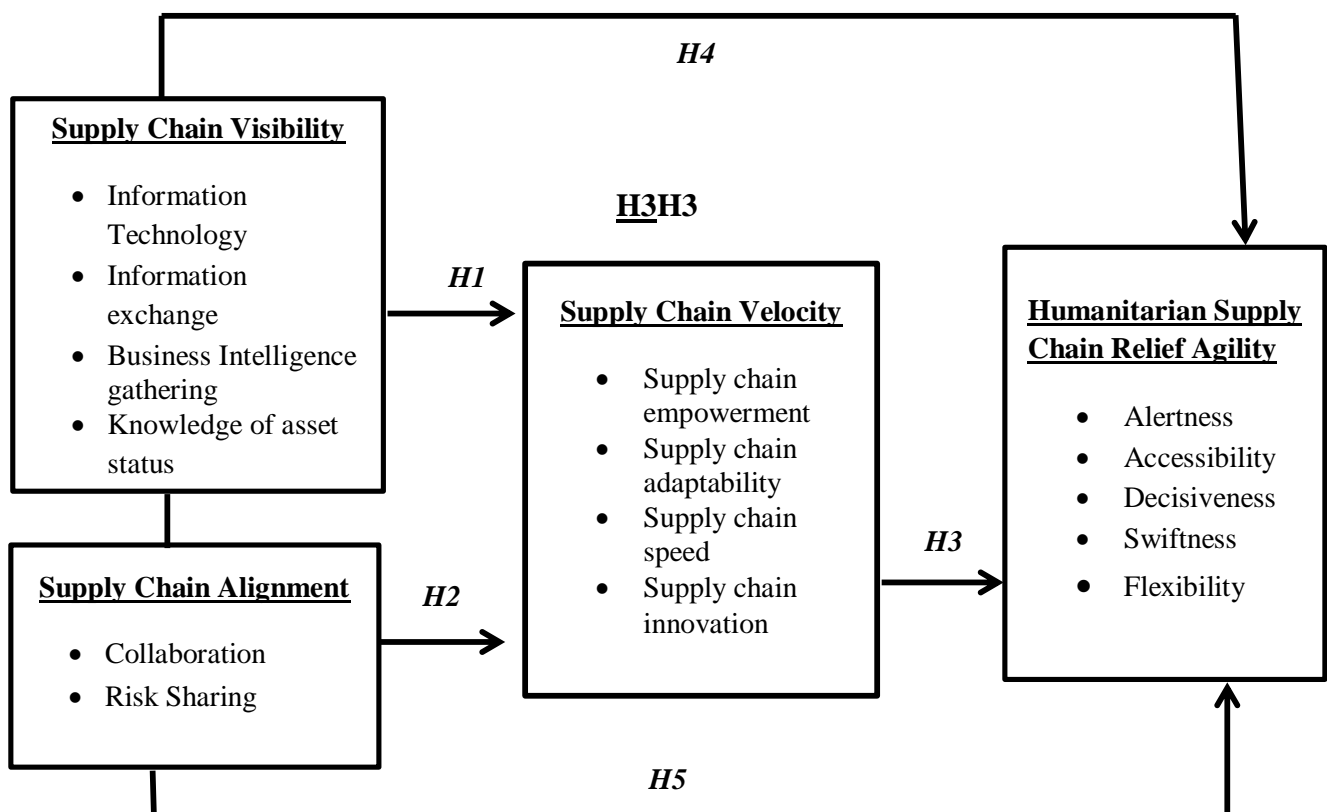


Figure 1: Conceptual Model (Source: Developed from literature)

Explanation of the Conceptual Model

The conceptual model above shows the hypothesized relationships between supply chain visibility, supply chain alignment, supply chain velocity and humanitarian supply chain relief agility. As shown in the model, it is theorized that supply chain velocity is influenced by supply chain visibility and supply chain alignment. Supply chain visibility, supply chain alignment and supply chain velocity are also theorized to influence humanitarian supply chain relief agility.

RESEARCH METHODOLOGY

Research design

The study used a quantitative and cross-sectional research design.

Survey population and sample size

The study population included all staffs from 150 humanitarian agencies operating in Eastern Uganda, which includes: UNDP, UNHCR, WHO, FAO, UNICEF, UNOCHA, UNFPA, WFP, IFRC, URC, and Care International among others (Office of the Coordinator of Humanitarian Affairs-OCHA Report, 2010). The study sample included staffs from sixteen (16) humanitarian agencies that were involved in responding to landslide disasters in Bududa district in Eastern Uganda region. All these sixteen humanitarian agencies are currently working in the country as resident organizations (UN report, 2015). A total of 135 usable questionnaires were collected and used for data analysis. Potential respondents were asked first if they were involved in delivering relief assistance in the aftermath of the landslides in eastern Uganda in 2010.

Sampling procedure

Due to lack of a clear list of the specific people who participated in delivering humanitarian aid to the victims of landslides, purposive and snowball sampling was used. Purposive sampling is a selective sampling which is aimed at getting the right respondents whereas snowball sampling involves using existing study subjects to recruit future subjects from among their acquaintances.

Data Sources and Collection methods

The main data type in the study was primary data which was collected from humanitarian agencies staff using a self-administered questionnaire. This was expected to foster confidentiality leading to more valid and reliable responses. The questionnaires are designed according to the objectives and study variables. Responses to the statements in the questionnaires were anchored on a five point Likert scale ranging from 1 – strongly disagree to 5 – strongly agree.

Reliability and validity of research instruments

Reliability is referred to as the consistency of measurement, or the degree to which an instrument measures the same way each time if is used under the same condition with the same subject. Reliability of the instruments was tested using Cronbach's Alpha coefficient which were all above 0.7 (Nannually, 1967). Validity refers to how accurately research instruments

capture data that gives meaningful inferences. Validity of the instruments was obtained through subjecting the data collection instruments to scrutiny from expert's i.e. academicians and practitioners to establish relevance of the questions / items in instruments as well as using the content validity index.

Table 3-1: Cronbach Alpha Values and Content Validity Indices

<i>Variable</i>	<i>Anchor</i>	<i>Cronbach Alpha Coefficient</i>	<i>Content Validity Index</i>
Supply Chain Visibility	5 Point	0.944	0.88
Supply Chain Velocity	5 Point	0.901	0.84
Supply Chain Alignment	5 Point	0.913	0.86
Supply Chain Relief Agility	5 Point	0.912	0.85

Source: Primary Data

Measurement of Variables

Supply visibility was measured based on its dimensions of Information technology, Information Exchange, Business Intelligence gathering, knowledge of asset status using the works of Pettit (2008), Holcomb et al., (2011) and Ponomarov (2012). *Supply chain Velocity* was measured using its dimension of adaptability, speed, empowerment and Innovation based on the works of Petti (2008), William et al., (2013), Dubey et al., (2014) and Vicente et al., (2015), Calantone et al, (2001) and Hurley et al., (1998). *Supply chain alignment* was measured based on its dimension of collaboration and risk sharing using the works of Pettit (2008), Kohli (2010) and KeiTse (2012). *Supply chain relief agility* was measured basing on its dimensions of alertness, accessibility, decisiveness, swiftness and flexibility using the measurements of Gligor (2013).

Data management and Analysis

Data was analyzed using statistical package for social scientists (SPSS) version 23. Descriptive statistics were used to describe respondent's characteristics. The relationship between supply chain visibility, supply chain alignment, supply chain velocity and humanitarian supply chain relief agility was analyzed using correlation coefficient to establish the strength of the relationships between variables. Multiple regression analyses were carried out to determine the extent to which the independent variables predict the dependent variables.

RESULTS AND FINDINGS OF THE STUDY

Sample characteristics

To present sample characteristics, frequency distributions were used to indicate variations of respondents based on Age, Education Level, Years worked in the organization (experience), Training in humanitarian logistics, Position held in the organization and the number of employees in the organization (size of the organization). The sample characteristics were presented basing on the responses from selected list of humanitarian agencies that were involved in responding to landslide disasters in Bududa district in Eastern Uganda region in 2010. These humanitarian agencies included the sixteen humanitarian agencies that are

working in the country as resident organizations, e.g., UNDP, UNHCR, WHO, FAO, UNICEF, UNOCHA, UNFPA and WFP etc. (UN report, 2015). The results are presented Table 4-1:

Table 4-1: Sample characteristics

Age of Respondents			Training Attained in Humanitarian Supply Chain Management		
	Frequency	Percent		Frequency	Percent
20-25	15	11.1	Yes	118	87.4
26-30	35	25.9	No	17	12.6
31-35	50	37.0	Total	135	100.0
36-40	20	14.8			
41and above	15	11.1			
Total	135	100.0			

Education Level			Number of employees in each humanitarian agency		
	Frequency	Percent		Frequency	Percent
Diploma	16	11.9	Less than 50	18	13.3
Bachelor's Degree	87	64.4	51-100	26	19.3
Master Degree	3	2.2	101-150	43	31.9
Professional Qualification	29	21.5	More than 150	48	35.5
Total	135	100.0	Total	135	100.0

Work Experience			Position held in the organization		
	Frequency	Percent		Frequency	Percent
1-5 years	83	61.5	Procurement Officer	22	16.3
6-10 years	49	36.3	Logistics Officer	36	26.7
11-15 years	3	2.2	CEO	5	3.7
Total	135	100.0	Procurement Manager	21	15.6
			Transport Officer	22	16.3
			Supply Chain Manager	9	6.7
			Others	20	14.8
			Total	135	100.0

The results in Table 4-1 show that the majority of the respondents (37%) were aged between 31-35 years. The least number of respondents (11.1%) were aged 20-25 and 41 and above years. The rest of the respondents who were 26-30 represented 25.9% whereas the respondents who were in the age bracket of 36-40 were 14.8%. This suggests that most humanitarian agencies employ more staffs who are between 31 to 35 years of age and the least employed age brackets are 20-25 and 41and above years. The results also show that the majority of the respondents (64.4%) have attained a bachelor's degree while the least have attained a master degree (2.2%). The rest of the respondents had professional qualifications (21.5%) and the rest were diploma holders (11.9%). The findings indicate that humanitarian agencies employ majority of the staff who have attained a Bachelor's degree of education and employ few master

qualified staff. The results possibly indicate that most of the humanitarian work requires a person who holds a degree because it involves a lot of lifting the relief items, cross checking the paper work, planning and sometimes critical thinking.

According to the results the majority of the staff (61.5%) had worked for 1-5 years while the least number of staff (2.2%) had worked for 11-15 years. The rest of the workers (36.3%) had worked for 6-10 years. The number of staff who had worked for the shortest time (1-5) for the humanitarian agencies was bigger possibly indicating that most of the staffs work on a short time basis as volunteers during the crisis whenever the catastrophe strikes. The majority of the humanitarian agencies staffs (87.4) had attained some training in humanitarian supply chain management whereas 12.6% had not attained some training in humanitarian supply chain management. This shows the majority of the respondents were knowledgeable and the data they provided is reliable. In terms of the number of people employed in each humanitarian agency, results in Table 4-5 show that the majority of the humanitarian agencies (35.5%) had more than 150 staffs as their employees while the least humanitarian agencies had less than 50 employees (13.3%). The rest of the humanitarian agencies had 51-100 employees (19.3%).

In terms of the positions held at the humanitarian agencies, results in Table 4-6 indicate that the majority of the respondents were logistics officers (26.7%) whereas the least of the respondents were CEOs (3.7%) and supply chain managers (6.7%) respectively. The rest of the respondents were procurement officers (16.3), procurement managers (15.6%), transport officers (16.3) and others (14.8%). The low responses results of top managers possibly reflect the busy schedules of CEOs as well as supply chain managers who were not easily accessible in most cases and in most cases where contacted they were always delegating the filling of the questionnaire to lower level logistics managers, transport officers and others.

Exploratory Factor Analysis

Since this research takes an exploratory rather than a confirmatory approach and there many measures that were amalgamated from numerous previous scholars, there was a need to methodically refine and reduce the measurement items into simpler components using exploratory factor analysis for further analysis. An exploratory factor analysis was conducted using the principal components analysis (PCA) approach with varimax rotation to establish the underlying pattern in the data. PCA was chosen because it is the simplest of the true eigenvector-based multivariate analyses that often reveals the internal structure of the data in a way that best explains the variance by providing the user with a lower-dimensional picture when viewed from its most informative viewpoint. Varimax rotation generally yields more stable results and is easier to interpret (Ahimbisibwe, 2014). A number of meaningful factors explaining a larger percentage of the common item variance emerged and all items loaded cleanly on the hypothesized constructs exceeding 0.50 as presented in the subsequent tables.

Exploratory factor analysis results of supply chain visibility yielded four components which were interpreted as Knowledge of Asset Status (variance=50.424%), Information Technology (variance=10.886%), Information Exchange (variance=8.010%) and Business Intelligence Gathering (variance=6.181%). The quadruple factors explained 75.501% of the total variance in supply chain visibility as shown in Table 4-2.

Table 4-2: Factor Analysis Results for Supply Chain Visibility

	Knowledge of Asset Status	Information Technology	Information exchange	Business Intelligence gathering
We have real-time data on location, and status of supplies, finished goods, equipment and employees	.798			
We have regular interchange of information among supplies, customers and other external sources	.870			
We have effective business intelligence gathering programs	.777			
We have detailed contingency plans and regularly conduct preparedness exercises and readiness inspections	.651			
Our organization have order status tracking	.763			
We have knowledge of distribution center stock levels	.781			
We have knowledge of product orders	.912			
We have inbound shipment from suppliers	.831			
Our organization have knowledge of suppliers finished goods inventory	.624			
Our firm has adequate ability to share information externally	.588			
Our firm has adequate ability to share customized information externally	.833			
We have information systems that accurately track all operations		.567		
We have knowledge of suppliers order status information		.724		
Our organization have knowledge of customer demand forecasts		.836		
The information available in our firm is accurate		.625		
Our firm has adequate ability to share information externally with key suppliers		.641		
Our firm effectively shares operational information between departments			.868	
Our firm effectively share operational information externally with selected suppliers			.833	
Logistics databases are integrated across applications within our firm			.736	
Logistics information systems in our firm are being extended to include more integrated applications				.877
Our firm's logistics information systems capture and maintain timely data				.763
Eigen value	10.589	2.286	1.682	1.298
Variance	50.424	10.886	8.010	6.181
Cumulative %	50.424	61.310	69.320	75.501
Extraction Method: Principal Component Analysis.				
Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 6 iterations.				

Source: Primary data

Exploratory factor analysis results of supply chain velocity yielded four components which were interpreted as Adaptability (variance=34.467%), Supply Chain Innovation (variance=13.872%), Supply Chain Empowerment (variance=9.142%) and Supply Chain Speed (variance=6.335%). The quadruple factors explained 63.815% of the total variance in supply chain velocity as shown in Table 4-3.

Table 4-3: Factor Analysis Results for Supply Chain Velocity

	Adaptability	Supply Chain Innovation	Supply Chain Empowerment	Supply Chain Speed
We can quickly reallocate orders to alternate supplies and reallocate jobs between different production facilities	.732			
we use strategic gaming and simulations to design more adaptable processes	.708			
We excel at seizing advantages from changes in the market	.794			
We develop innovative technology to improve operations	.769			
We continually strive to further reduce lead-times for our products	.877			
We effectively employ continuous improvement programs	.800			
We can quickly organize a formal response team of key personnel, both on site and at corporate level	.800			
Our organization empowers on-site experts to make key decisions regardless of level of authority	.818			
We train employees in a wide variety of skills	.723			
We rely on our own internal source of staff		.765		
We encourage mutual trust among members		.624		
Our organization frequently tries out new ideas		.573		
Our organization seeks out new ways to do things		.726		
Our organization is creative in its methods of operation		.719		
In our organization, cooperation is an important part of innovation strategy implementation		.749		
In our organization, formulating innovation strategy increases employee Skills		.746		
In our organization, improving employee commitment, morale or both is part of our innovation strategy monitoring		.775		
Our organization is creative in its method of operation		.533		
Our organization encourages every ones involvement			.695	

Our organization encourages delegation of authority					.743
Our organization encourages cooperation among members					.662
In our organization innovation is readily accepted in programs / Projects					.609
In our organization, people are penalized for new ideas that don't work					.745
In our organization, innovation is perceived as too risky and is resisted					.682
Our organization is often the first to market with new products and services					.500
Our new product introduction has increased over the last 5 years					.793
In our organization technical innovation based on research results is readily accepted					.587
We perform product/service modification quickly					.599
The time required to develop and introduce new product is extremely low					.719
Eigen Value	10.340	4.162	2.742	1.901	
Variance	34.467	13.872	9.142	6.335	
Cumulative	34.467	48.339	57.480	63.815	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Source: Primary data

Exploratory factor analysis results of supply chain alignment yielded two components which were interpreted as supply chain risk sharing (variance=43.770%) and supply chain collaboration (variance=13.013%). The dual factors explained 56.783% of the total variance in supply chain alignment as shown in Table 4-4.

Table 4-4: Factor Analysis Results for Supply Chain Alignment

	Supply Chain Risk Sharing	Supply Chain Collaborati
Our organization invests directly in our suppliers or customers operations as well as other actions to share risks	.664	
We exchange information frequently with our collaborative partners related to demand forecasts	.688	
We exchange information frequently with our collaborative partners related to lead time	.653	
We exchange information frequently with our collaborative partners related to price levels and pricing information	.580	
We exchange information frequently with our collaborative partners related to product / service quality	.678	

We regularly solve problems jointly with our key suppliers	.810	
We help our key suppliers to improve their product quality in the long run	.738	
We hold meetings with suppliers on a regular basis to solve quality problems	.763	
We invest in our key supplier's facility to improve product quality	.845	
We provide training for suppliers on quality requirements	.774	
We set up tasks and procedures for supplier's production with our key suppliers	.764	
We require our key suppliers to return the documents or statistical process control (SPC) data so we can keep track of the production quality	.670	
We effectively employ collaborative demand forecasting techniques using shared data	.813	
Our data flows transparently between supply chain members with full access by all firms to facilitate collaborative decision making	.738	
Our customers are willing to delay orders when our production capacity is hampered	.659	
We have proactive product lifecycle management programs that strive to reduce both costs and risks	.632	
Eigen value	7.441	2.212
Variance	43.770	13.013
		3
Cumulative %	13.013	56.783

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Source: Primary data

Exploratory factor analysis results of supply chain relief agility yielded five components which were interpreted as Flexibility (variance=43.609%), Decisiveness (variance=10.727%), Alertness (variance=9.870%), Swiftiness (variance=7.576%) and Accessibility (variance=5.015%). The five factors explained 76.797% of the total variance in supply chain relief agility as shown in Table 4-5.

Table 4-5: Factor Analysis Results for Supply Chain Relief Agility

	Flexibility	Decisiveness	Alertness	Swiftiness	Accessibility
We can easily change the volume of our processes	.581				
We can quickly change the quantities for products we handle	.699				
We can change over quickly from one product to another	.823				

We can vary product combination from one product to another	.779				
We can make definite decisions to address opportunities in our environment	.518				
My organization can make resolute decisions to deal with changes in its environment	.846				
We can rapidly address opportunities in our environment	.530				
When needed, we can adjust our supply chain operations to the extent necessary to execute our decisions	.759				
We can adjust the specification of orders as required by our customers	.661				
My organization can increase its short-term capacity as needed	.431				
Our firm can promptly identify opportunities in its environment	.881				
My organization can rapidly sense threats in its environment	.737				
My organization can quickly respond to changes in the business environment	.682				
We can quickly detect changes in our environment				.708	
We can swiftly deal with threats in our environment				.809	
We always receive the information we demand from our suppliers					.909
We always obtain the information we request from our customers					.930
Eigen value	7.850	1.931	1.777	1.364	1.000
Variance	43.60	10.72	9.870	7.576	5.015
	9	7			
Cumulative %	43.60	54.33	64.20	71.78	76.79
	9	6	6	2	7

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Source: Primary data

Findings on the Relationships among the study variables

The results in the Table 4-6 below indicate the relationships between the study variables using the Pearson correlation coefficient (r).

Table: 4-6: Zero Order Correlations

	1	2	3	4
Supply Chain Visibility(1)	1			
Supply Chain Velocity(2)	.165*	1		
Supply Chain Alignment(3)	.060	.390**	1	
Supply Chain Relief Agility(4)	.183*	.183*	.488**	1

** , * . Correlations are significant at the 0.01 and 0.05 level (2-tailed) respectively

The results in Table 4-6 reveal that there exists a significant positive relationship between supply chain visibility and supply chain velocity ($r=0.165^*$, $p<.05$), supporting *H1*. The results generally suggest that all the four components of supply chain visibility (i.e., knowledge of asset Status, information technology, information exchange and business intelligence gathering) are positively and significantly related to supply chain velocity (i.e. adaptability, supply chain innovation, supply chain empowerment and supply chain speed) of humanitarian agencies. These results imply that if there is increased supply chain visibility (i.e., knowledge of asset Status, information technology, information exchange and business intelligence gathering) in humanitarian agencies, it is likely to increase supply chain velocity (i.e. adaptability, supply chain innovation, supply chain empowerment and supply chain speed) of humanitarian agencies.

The results further indicate that there exists a significant positive relationship between supply chain alignment and supply chain velocity ($r=.390^{**}$, $p<.01$), supporting *H2*. The results generally suggest that all the two components of supply chain alignment (i.e., supply chain risk sharing and supply chain collaboration) are positively and significantly related to supply chain velocity (i.e., adaptability, supply chain innovation, supply chain empowerment and supply chain speed) of humanitarian agencies. The results imply that if there is increased supply chain alignment (i.e., supply chain risk sharing and supply chain collaboration), it is likely to increase supply chain velocity (i.e., adaptability, supply chain innovation, supply chain empowerment and supply chain speed) of humanitarian agencies.

The results also reveal that there exists a significant positive relationship between supply chain velocity and supply chain relief agility ($r=0.183^*$, $p<.05$), supporting *H3*. The results generally suggest that all the four components of supply chain velocity (i.e., adaptability, supply chain innovation, supply chain empowerment and supply chain speed) of humanitarian agencies are positively and significantly related to supply chain relief agility (i.e., flexibility, decisiveness, alertness, swiftness and accessibility). These results imply that if there is increased supply chain velocity (i.e., adaptability, supply chain innovation, supply chain empowerment and supply chain speed) it is likely to increase supply chain relief agility (i.e., flexibility, decisiveness, alertness, swiftness and accessibility) of humanitarian agencies.

The results indicate that there exists a significant positive relationship between supply chain visibility and supply chain relief agility ($r=0.183^*$, $p<.05$), providing support for *H4*. The results generally suggest that all the four components of supply chain visibility (i.e., knowledge of asset Status, information technology, information exchange and business intelligence gathering) of humanitarian agencies are positively and significantly related to supply chain relief agility (i.e., flexibility, decisiveness, alertness, swiftness and accessibility). These results imply that if there is increased supply chain visibility (i.e., knowledge of asset Status, information technology, information exchange and business intelligence gathering) in

humanitarian agencies, it is likely to increase supply chain relief agility (i.e., flexibility, decisiveness, alertness, swiftness and accessibility) of humanitarian agencies.

The results further reveal that there exists a significant positive relationship between supply chain alignment and supply chain relief agility of humanitarian agencies ($r=0.488^{**}$ $p<.01$), providing support for *H5*. The results suggest that all the two components of supply chain alignment (i.e., supply chain risk sharing and supply chain collaboration) are positively and significantly related to supply chain relief agility (i.e., flexibility, decisiveness, alertness, swiftness and accessibility) of humanitarian agencies. The results imply that if there is increased supply chain alignment (i.e., supply chain risk sharing and supply chain collaboration) in humanitarian agencies, it is likely to increase supply chain relief agility (i.e., flexibility, decisiveness, alertness, swiftness and accessibility) of humanitarian agencies.

Regression Analysis

The results in the Table 4-7 show the regression model that was used to examine the extent to which supply chain visibility, supply chain velocity and supply chain alignment predict the supply chain relief agility of humanitarian agencies.

Table: 4-7 Regression Model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	8.968	.167		.000	1.000		
Supply chain visibility	.174	.084	.156	2.062	.041	.990	1.010
Supply chain velocity	-.025	.091	-.022	-.271	.787	.842	1.187
Supply chain alignment	.771	.129	.488	5.979	.000	.847	1.181
Dependent Variable: Supply Chain Relief Agility							
R	0.512						
R Square	0.462						
Adjusted R Square	0.445						
F-statistic	15.532						
Sig.	.000						

Source: primary Data

Results in the table 4-7 reveal that supply chain visibility, supply chain velocity and supply chain alignment can predict up to 44.5% of the total variance in the supply chain relief agility of humanitarian agencies (Adjusted R Square =0.445). This means that the regression model can only explain 44.5% of the changes in the dependent variable while the remaining percentage can be attributed to other factors other than supply chain visibility, supply chain velocity and supply chain alignment of humanitarian agencies. The Variance Inflation Factor (VIF) was less than 4 and the Tolerance Ratio was above 0.1, indicating that multi-collinearity in this study was not a problem (Ahimbisibwe, 2014). As such, the interpretations of the *beta* weights and R^2 values were reliable. Thus, this regression model was significant (*sig.* $<.05$) with its results worth using for making predictions and being used as a basis to make decisions related to supply chain relief agility of humanitarian agencies.

Among the independent variables, supply chain alignment ($\beta=0.488$, $p<.001$) was the most significant predictor of the supply chain relief agility of humanitarian agencies then followed by supply chain visibility ($\beta=0.156$, $p<.05$). Surprisingly, supply chain velocity was not found to be a significant predictor of supply chain relief agility of humanitarian agencies. This implies that in order for the supply chain relief agility of humanitarian agencies to improve, there is a need to increase supply chain alignment and supply chain visibility. The non-significance supply chain velocity in predicting supply chain relief agility of humanitarian agencies could imply that supply chain visibility is a potential moderator under such humanitarian supply chain relief agility scenarios.

Discussion of research findings

The findings reveal a significant positive relationship between supply chain visibility and supply chain velocity. These results imply that as supply chain visibility increases in humanitarian agencies, supply chain velocity of humanitarian agencies also increases. The findings are consistent with Azevedo and Prata (2012) who assert that for supply chain velocity to be effective in humanitarian logistics, there must be proper supply chain visibility so that the flow of materials, donor funds and information can be effectively managed to meet the humanitarian requirements on time. More simply put, the presence of supply chain visibility enables a combination of planning data with demand projections and current orders to best compute cycle and safety stock as well as re-allocating inventories as fast as needed which increases supply chain velocity. This is further supported by Heaney (2013) who suggests that better supply chain visibility helps to improve supply chain planning and ultimately optimizes on time delivery to aid recipients. The findings are also in line with Galbraith (1974) who asserted that an organization must be able to gather, interpret, synthesize and coordinate information across the supply chain which increases supply chain speed, adaptability, innovation and empowerment. The findings also mirror Pettit (2008) who argues that visibility systems provide knowledge of where assets are and inventory management which increases supply chain velocity.

Findings indicate a significant positive relationship between supply chain alignment and supply chain velocity. This implies that if supply chain alignment increases, supply chain velocity of humanitarian agencies also increases. This means that a greater information access increases organizations ability to respond quickly to changes in its business environment. The findings are consistent with Barrat et al., (2007) who assert that high level of visibility that is characterized by the quality of useful information within a supply chain linkage is likely to increase supply chain velocity. Furthermore, the findings support Pettit (2008) who argues that the vast amount of data being created today using information technology improves supply chain visibility which also increases supply chain velocity. This implies that supply chain velocity and indeed acceleration is dependent upon supply chain alignment of process improvements. The findings also reflect the recent Wal-Mart report (2014) which found that supply chain alignment is one of the fundamental building blocks to getting supply chain velocity.

The findings reveal that there exists a significant positive relationship between supply chain velocity and supply chain relief agility. These results imply that if supply chain velocity increases, supply chain relief agility of humanitarian agencies also increases. The findings mirror Pettit (2008) that relief operations should have the ability to quickly mobilize resources, manage the crisis and mitigate the consequences of a disaster. This indicates how quickly mobilizing resources is critical in relief operations and how quick reaction can limit the overall

severity of a disaster in terms of loss of life. The findings are also consistent with Wassenhove (2006) who argues that humanitarian organizations need robust equipment's to be extremely adaptable and prepared for the unexpected as circumstances can change very quickly from one moment to the next. This means adaptation, innovation, empowerment and speed provide relief agencies with the capacity to cope with and adequately respond to changes which increase supply chain agility of humanitarian agencies.

Additionally, the results support Wassenhove (2006) that as humanitarian organizations come under increasing pressure to prove to donors pledging millions in aid and goods that they are reaching those in need, humanitarian organizations are under greater scrutiny to monitor the impact of aid not just the input and output but the whole supply chain operation. To achieve this, humanitarian agencies' have become more slick, speedy, innovative and adaptive in their supply chain operations. This means relief agencies have become more result oriented as they become even more accountable and therefore their operations are becoming more flexible, decisive, alert, swift and easily accessible. Consequently, this has greatly increased supply chain relief agility of humanitarian agencies.

The findings indicate that there exists a significant positive relationship between supply chain visibility and supply chain relief agility. These results imply that if supply chain visibility in humanitarian agencies increases, supply chain relief agility of humanitarian agencies also increases. This means optimizing humanitarian relief supply chain agility requires increased supply chain visibility. The findings suggest that there is an increasing need to improve supply chain visibility which is one of the key drivers to improve supply chain agility for humanitarian agencies. The findings are consistent with Lee and Li (2011) who assert that supply chain visibility is important for gaining insight into the supply and demand chain and is a cornerstone for improving flexibility, decisiveness, alertness, swiftness and accessibility across the supply chain. This indicates that humanitarian organizations need to be flexible and better informed to deal with any unforeseen events that may have a negative impact on their performance. In other words, having supply chain visibility translates into being able to meet customer needs. As humanitarian agencies gain more visibility into the entire supply chain, this contributes to lower lead-time variability, reduced inventory, shorter lead times, increased fill rates and other supply chain operational improvement. As a result, supply chain relief agility of humanitarian agencies improves.

The findings indicate that there exists a strong significant positive relationship between supply chain alignment and supply chain relief agility of humanitarian agencies. The results imply that if there is increased supply chain alignment (i.e., supply chain risk sharing and supply chain collaboration) in humanitarian agencies, it is likely to increase supply chain relief agility (i.e., flexibility, decisiveness, alertness, swiftness and accessibility) of humanitarian agencies. The findings are in line with Wassenhove (2006) who assert that a successful response depends heavily on supply chain risk sharing with the local capabilities as well as collaboration with the host governments such as welcoming foreign help or even military resources on their affected territories. This means that in order for humanitarian supply chain relief agencies to effectively alleviate the suffering, there is need to align and coordinate the key players in relief operations whose origins, history, geographical, cultural, and political nature pose potential problems for humanitarian principles and space. Furthermore, this shows that once a disaster occurs, demand for large amount of a large variety of supplies occurs suddenly in massive amounts which require supply chain risk sharing and high levels of supply chain collaboration by humanitarian agencies. Thus, the level of supply chain alignment of the relief operations

during the first days of the disaster significantly improves supply chain agility and affects the lives of many people threatened by the disaster.

CONCLUSIONS AND CONTRIBUTIONS

The study focused on establishing the relationships between supply chain visibility, supply chain alignment, supply chain velocity and supply chain relief agility using a case of humanitarian agencies in responding to Bududa Land Slide disasters in Eastern Uganda.

The results indicate significant positive relationships between supply chain visibility, supply chain alignment, supply chain velocity and supply chain relief agility of humanitarian agencies. Research findings also indicate that supply chain visibility and supply chain alignment directly influence supply chain relief agility of humanitarian agencies because according to the findings they are the only significant predictors. However, supply chain velocity was found not to be a significant predictor of supply chain relief agility of humanitarian agencies.

The research concludes that supply chain alignment and supply chain visibility are significant predictors of supply chain relief agility of humanitarian agencies whereas supply chain velocity is not a significant predictor of supply chain relief agility of humanitarian agencies. Supply chain alignment was found to be a better significant predictor of supply chain relief agility of humanitarian agencies than supply chain visibility. Therefore, humanitarian agencies need supply chain alignment and supply chain visibility in order to improve on their supply chain relief agility especially in terms of flexibility, decisiveness, alertness, swiftness and accessibility.

The current research contributes to both practice and theory as follows: The study will help humanitarian supply chain relief practitioners in setting up their goals, plans and making decisions, which is likely to improve the effectiveness and efficiency of relief operations.

The study is likely to help understand the relationships between supply chain visibility, supply chain alignment, supply chain velocity and humanitarian supply chain relief agility which is not clear at the moment. This is likely to help improve our current understanding of the humanitarian supply chain relief agility in responding to disasters.

The study will assist the humanitarian relief agencies to improve their performance in responding to disasters. The concept of humanitarian supply chain relief agility is likely to aid humanitarian agencies in learning to respond to disasters and reconfiguring supply chain quickly in difficulty conditions. This will potentially save many lives.

RECOMMENDATIONS

From the study findings, discussions and conclusions of the study the following recommendations are made: The researcher recommends that humanitarian agencies should aim at getting more visibility into the entire supply chain in terms of knowledge of asset status, information technology, information exchange and business intelligence gathering. This is because high supply chain visibility contributes to lower lead-time variability, reduced inventory, shorter lead times, increased fill rates and other supply chain operational

improvement which ultimately improves supply chain relief agility of humanitarian agencies in terms of flexibility, decisiveness, alertness, swiftness and accessibility.

Humanitarian agencies should improve information technology and the use of computerized systems to integrate supply chain operations and provide visibility of internal operations and processes. For supply chain visibility to be effective, data must be readily available, timely, accurate and in a format that communicates necessary information. Thus, it's key to improve supply chain visibility to achieve supply chain relief agility through shared information among supply chain members. Sharing information significantly increases supply chain visibility due to the fact that lack of information reduces uncertainty and thus reduces the amount of buffer inventory that is needed.

Supply chain relief agility can also be improved through supply chain visibility with resilient upstream and downstream practices by helping companies to anticipate, perceive and effectively manage the real consequences of supply chain disruptions. Ideally all parties in the network should share information in as close to real time as possible. This information includes the actual requirements from the field i.e. demand, current inventory, disruptions, the supply schedule and events management alerts.

Supply chain alignment must be improved to achieve supply chain relief agility. For instance, success of supply chain collaboration can be equated with the ability and readiness of humanitarian agencies to create trust and build relationships among stakeholders. At an operational level, the need for open and clear channels for information sharing must not only be recognized but emphasized. Supply chain alignment should also involve cross-functional collaborations that enable the humanitarian agencies to absorb and utilize information in ways that enhance flexibilities.

In facilitating dynamic actions and decision-making, the exchange of information of a sufficiently high quality is vital in the coordination of operations within humanitarian supply chains. There is a need for greater information access to increase humanitarian agencies' ability to respond quickly to changes in their operating environment. Information sharing must be observed since it is the glue that holds all the activities and resources together along the supply chain from raw materials procurement to customer services.

There is a need to improve preparedness and readiness in form of prior mudslides awareness and education. The humanitarian agencies also need to work with the local districts to gain support to a wider health facilities.

Limitations of the study and future research

Only humanitarian agencies which responded to Bududa Land Slide disasters in Eastern Uganda were sampled and studied hence the results of the study might be limited in being generalized. The sample size remains small. A self-administered questionnaire with close ended questions was used for data collection and this reduces the amount of data collected. The study adopted a cross sectional research design which generalized the data of the sample at a particular time hence limits the findings and conclusions of the study. The data collection instrument that was used by this study was a standard questionnaire which limits the information beyond the questions contained within the survey instrument. Measurement tools were adopted from previous studies and therefore any limitations that are embedded in them equally affected this study. Due to inadequate information on the specific humanitarian agencies staff that participated in delivering aid to the victims of Bududa landslides, purposive

and snowball sampling were used. However, both types are non-probability sampling techniques which can limit the findings. Common methods bias remains an eminent threat since data was collected from the same source. Other statistical weaknesses especially issues of endogeneity and multicollinearity due to use of regression analysis remain a potential threat to the results.

The researcher recommends future scholars to extend the study to other humanitarian agencies that were not included in this study. Supply chain velocity was not found to be a significant predictor of supply chain relief agility of humanitarian agencies despite the fact that literature appears to strongly suggest that supply chain velocity could be a significant predictor. Future studies should examine further the impact of supply chain velocity on supply chain relief agility of humanitarian agencies.

This study used a cross sectional research design approach, the behaviors of the variables over time were therefore not analyzed and this restricts the applicability of the findings. Future studies should conduct longitudinal studies to cross validate the findings.

Future research should employ a larger sample involving different types of humanitarian stakeholders like the government agencies, beneficiaries, and more humanitarian agencies. Data should also be obtained from various sources to minimize common methods bias.

Supply chain visibility, supply chain velocity and supply chain alignment can predict up to 44.5% of the total variance in the supply chain relief agility of humanitarian agencies. This means that the regression model can only explain 44.5% of the changes in the dependent variable while the remaining percentage can be attributed to other factors other than supply chain visibility, supply chain velocity and supply chain alignment of humanitarian agencies. Future studies should investigate what these remaining factors are.

Additional understanding of supply chain velocity which is the phenomenon of interest could be gained by using a qualitative approach. For example, supply chain velocity could be researched using grounded theory qualitative methodology. This approach is proven to be useful in generating depth of understanding when not much is known about a phenomenon of interest and when it concerns complex processes that cuts cross various contexts.

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