

The Humanitarian Relief Chain

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Abstract:

Supply Chain Management is a concept that originated and flourished in the manufacturing industry and has been subsequently adapted to many different areas. At present Disaster Management is one of those areas to which it has been adapted. Disaster Management is the set of rules for the coordination of activities at the disaster area and the rational usage of resources. During a disaster several logistics decisions should be made. The unpredictability of global emergencies (e.g., volcanic eruptions, earthquakes, floods) and the stakes of the adequate and timely delivery of the goods/services and challenge of managing material flow in the relief operations, which hold as their ultimate objective the delivery of the appropriate level of resources to locations worldwide in order to minimize human suffering and loss of life.

Keywords: The Humanitarian Relief Chain, Disaster Management, Relief Operation, Supply Chain Management

JEL: M11, M14, L31, H84

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1. Introduction

A Supply Chain (SC) is a network of facilities and distribution options that performs the functions of the procurement of materials, transformation of these materials into intermediate and finished products and the distribution of these finished products to customers. SCs exist in both service and manufacturing organizations (Ganeshan and Harrison 1995).

Supply Chain Management (SCM) is a concept that has originated and flourished in the manufacturing industry and has been subsequently adapted to many different areas. Nowadays Disaster Management (DM) is one of those areas to which it has been adapted. DM is set of rules for the coordination of activities at the disaster area and the rational usage of resources. During a disaster several logistics decisions should be made. The unpredictability of global emergencies (e.g., volcanic eruptions, earthquakes, floods) and the stakes of the adequate and timely delivery of the goods/services and challenge of managing material flow in relief operations, which hold as their ultimate objective the delivery of the appropriate level of resources to locations worldwide in order to minimize human suffering and loss of life. While

international large-scale responses to global emergencies are not new, research on understanding and improving the relief supply process has received little attention in the literature.

2. Logistics and Supply Chain Management

The Council of Logistics Management defines logistics as the process of planning, implementing and controlling the efficient flow and storage of raw materials, in-process inventory, finished goods, services and related information from the point of origin to the point of consumption (including inbound, outbound, internal and external movements) for the purpose of conforming to customer requirements (Cooper, Lambert, and Pagh 1997). All of the logistics operations (procurement, transportation, distribution, warehousing etc.) are closely

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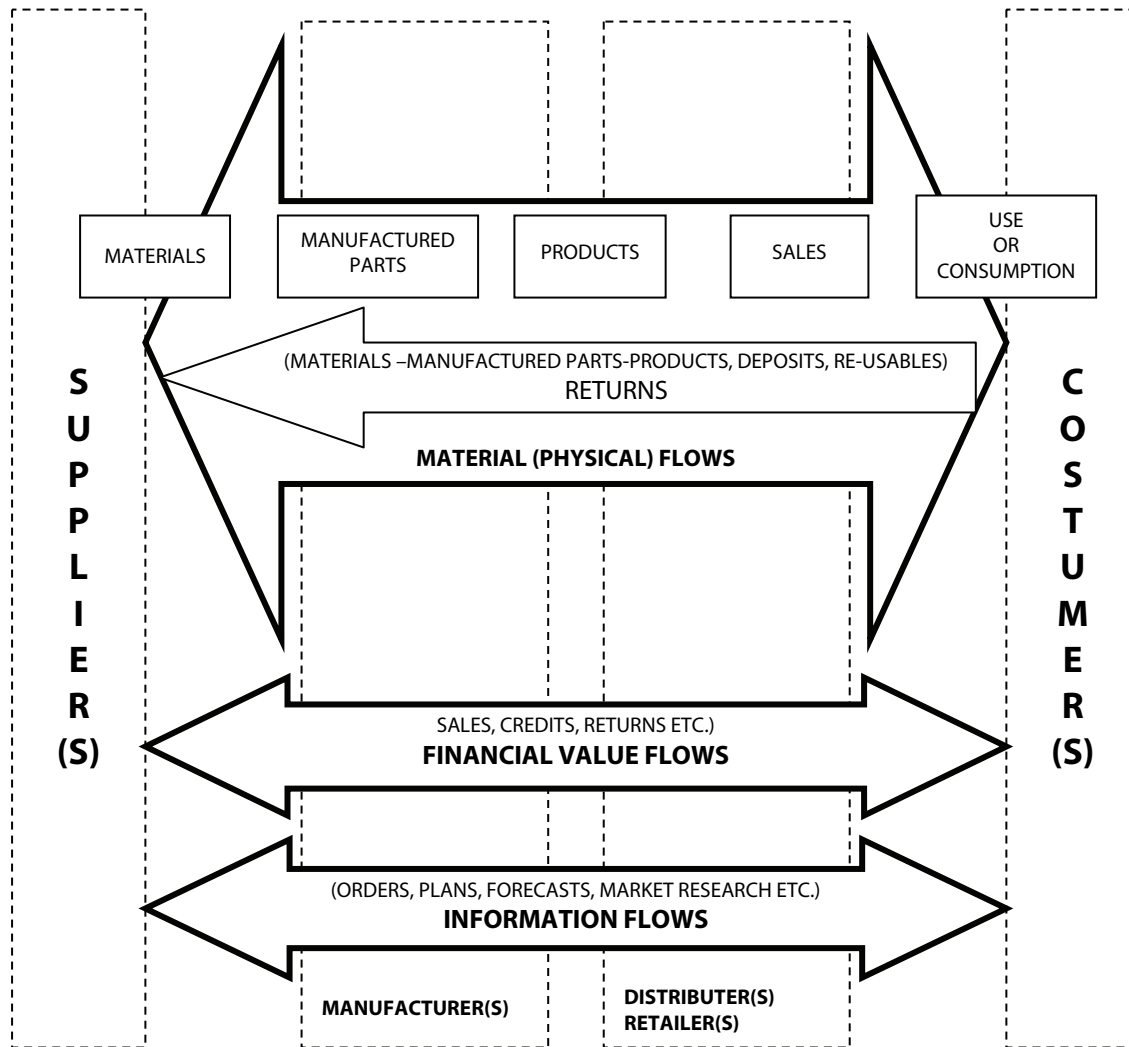


Figure 1: Generic Configuration of SCM in Manufacturing

linked to each other.

Supply Chain, a dynamic structure in both directions, has material (physical) financial value and information flows. Material flow circulates in its manufacturing processes from raw materials or components, through its use within the manufactured product. Material flow occurs between the following SC processes: resource mobilization, procurement, transportation, stock asset management and extended point of delivery. Railroads, motor vehicles, ocean shipping and aviation can represent physical logistics tools. Nevertheless, various modes of transportation can be considered. The sequence of the SC is usually determined by the natural sequence of activities inherent in the manufacturing and logistics processes. However, the structure can follow the previous history, habits and limitations of the

communication media and limitations of the coordination mechanisms. The flow of material is not always along an arborescent network (Ganeshan and Harrison 1995). The bill of materials for the end item may be both deep and large. These flows can be very long and complex or have a simple structure. The product on the basis of all the products may be separate or may be in for a single grain. Different types of organizations require different SC designs and strategies. An organization's SC strategy must be aligned with business strategy and goals and must be tailored to meet the needs of the customer (Beamon and Balcik 2008, p.8). More efficient information exchange affects directly better physical and financial flows. Figure 1 shows a simple and generic configuration of an SC in manufacturing with information flow such as orders, schedules, forecasts, circulations between

customers, retailers, assemblers, manufacturers and suppliers.

Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers and customers (Council on Supply Chain Management Professionals 2008). The goal of SCM is holistic, coordinated decision making across the firm's supply chain of these decisions regarding purchasing, production, distribution and therefore inventory, of the firm's products so as to minimize total cost (Shapiro 2006, p.1). The firm's products so as to minimize the total cost (Shapiro 2006, p.1). It can be difficult to grasp the concept of SCM from a definition alone. This is due to the fact that SCM is a methodology that can be applied at different extremes. Cooper and Ellram (1993) provide a useful description of characteristics that can be used to differentiate between SCM and traditional approaches. These characteristics can also be grouped into two main perspectives and are summarized below;

- From the Enterprise Perspective: Most of the time, firms using traditional approaches have independent efforts in their inventory managements and try to minimize only their own costs and risks. Information sharing, even in a firm, is not sufficient and efficient. Also there may be independent efforts between the departments (human resources, finance, marketing etc.) in a firm. However, in SCM, with the help of sharing information, joint planning about orders, procurement, manufacturing, sales, forecasting and market research, etc. between firms is possible. Firms within the same SC focus on reduction of channel inventories, and minimize channel risks and product costs offered to the last user. The time horizon of plans also can be extended.
- From the Channel Perspective: Firms using traditional approaches should create and manage their own channel(s) for procurements and sales. They focus only on their own performance. However in SCM, there is a channel leadership for coordinating all efforts and there are multiple contacts between firms and levels of channel. By sharing information, the speeds of flow (material, financial values, information) are relatively high and

uninterrupted. The transparency and visibility of the channel increases gradually.

Simchi-Levi et al. elaborate that SCM is a set of approaches utilized to integrate the suppliers, manufacturers, warehouses, and stores efficiently so that the product is produced and distributed at certain quantities to certain locations and at a certain time in order to minimize system-wide costs while satisfying service level requirements (Simchi-Levi et al. 2000). SCM looks across entire SC rather than just at the next entity or level and aims to increase the transparency and alignment of the SC's coordination and configuration, regardless of functional or corporate boundaries (Cutting-Decelle et al 2007, p.73). More precisely, the objective can be translated into more precise areas of concern which are: flexibility, delivery reliability, delivery time, lead time and inventory level. Delivery reliability and delivery time are both aspects of customer service, which is highly dependent on flexibility and inventory (Cutting-Decelle et al 2007, p. 73).

Supply Chain Management also aims for a real sense of customer satisfaction (e.g., high-quality service at a cost acceptable to enable the submission). Enterprises achieve this objective in itself before supplies and along the entire chain with the most efficient manner possible (low cost, creating a minimum of waste, through rapid response, high efficiency, with less stock, without damaging the material with the lowest possible error rate) required (Waters 2003, p.18).

One of the major benefits of the SCM is "To help to resolve the mismatch between demand and supply". Surge in demand may be taken control of by creating inventories along the chain (Waters 2003, p.12), yet failure in one area may result in the failure of the entire logistics operation (Iqbal et al 2005).

Supply Chain Management is a concept that has originated and flourished in the manufacturing industry and has been subsequently adapted to many different areas.

3. Disaster Management and the Humanitarian Relief Chain

3.1. Disaster Management

Disaster is a term that can be defined in different ways depending on whether the spectrum is broad or narrow, and can also be classified as either a rapid onset disaster, such as an earthquake or flood, which requires immediate

interventions of rescue and aid, or a slow onset disaster such as drought or famine that may allow more time to respond. But generally “disaster” means a progressive or sudden, widespread or localized, natural or human-caused occurrence which; (a) causes or threatens death, injury or disease, damage to property, infrastructure or the environment; or disruption of the life of a community; (b) is of a magnitude that the affected community cannot help themselves with their own resources. The disaster is not entirely the event itself, but the consequences born of it (Yilmaz 2003, p.112).

Regional or international non-profit organizations, UN bodies and donor organizations that provide humanitarian assistance to victims during the disaster or crisis situations are defined as Humanitarian Relief Organizations (HRO) (Sphere Project 2000, p.275). HROs execute the aid or humanitarian operations according to “The Standards of Human Aid Agreement” and various accepted international agreements. Relief operations, humanitarian operations, humanitarian assistance, humanitarian aid and humanitarian intervention are terms often used interchangeably in the literature. Here Relief Operations (R/O) is the preferred term. In addition to these bodies, one of the first groups to respond in disasters is generally the military of the country. Military humanitarian missions are often amongst the fastest in terms of response times. At the same time, a military humanitarian mission may consist of conventional military units and other peacekeeping forces may be dispatched to a crisis area to safeguard humanitarian workers, the aid itself and/or to assist in the deconfliction of a troubled area.

The companion of disasters is the deployment of aid: people, equipment, materials and funds-resources employed to relieve sufferings wherever disasters occur, and the cost-effective flow and storage of goods and materials, 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 (Thomas and Kopczak 2005). Disaster Management is the set of rules for the coordination of activities at the disaster area and the rational usage of resources (manpower, time, material, equipment, money, etc.). DM can be divided into two phases, which are proactive and reactive; (a) the Risk Management Process Phase, which includes pre-disaster risk reduction and disaster preparedness, rehabilitation and reconstruction, and (b) the Crisis Management Process Phase, which includes rescue and first aid during the disaster. These two main phases

include a continuous and integrated multi-sectoral, multidisciplinary process of planning and implementing measures aimed at:

- Preventing or reducing the risk of disasters (capacity building, reducing future damage: two years or longer)
- Mitigating the severity of the consequences of disasters
- Emergency preparedness (rapid and effective response to disasters: immediate assistance 1-3 months, food, clothing, shelter, medical, water and sanitation, daily necessities)
- Post-disaster recovery and rehabilitation (resumption of normal living: 3-12 months, temporary housing, schooling, community facilities, etc.)
- Reconstruction (rebuilding homes and communities - 1-5 years)

The boundaries between these different phases are sometimes blurred; phases can overlap and initiatives exist to integrate these phases in Linking Relief, Rehabilitation and Development programs.

The Humanitarian Relief Organization also engages in two broad types of activities:

- Relief Activities: Relief for victims of large-scale emergencies. These short-term activities focus on providing goods and services to minimize immediate risks to human health and survival.
- Development Activities: Longer-term aid, focusing on community self-sufficiency and sustainability. These activities include establishing permanent and reliable transportation, healthcare, housing, and food

In this study, the focus is the relief activities of the HRO about its R/O. The application of SC concepts to R/Os is relatively new. This new way of providing aid has to be related to the current trend in R/Os to move towards a more industrial way of working, particularly for global HROs. This is a challenging sub-field of SCM, where the disaster itself may prevent conventional distribution (Maspero and Ittman). Logistics in R/Os has much in common with commercial logistics. But the best practices from the commercial world or from other HROs have not crossed over yet.

3.2. Relief Operations and the Humanitarian Relief Chain

Relief Operations aim to preserve life and reduce the sufferings of members of communities in crises. R/Os comprise the provision of material and technical aid as well as the delivery of essential services in response to crisis situations when the community's ability to cope has been severely impeded. R/Os are launched in response to both natural and man-made crises and executed normally over a short to medium-term time horizon. As soon as the political and security situation permits, these operations are replaced by rehabilitation and reconstruction programs, which in turn are followed by development aid.

During a disaster several logistics decisions should be made. These must be structured according to the needs of the community. When a disaster hits, the distribution of supplies to victims at a certain time is vital. Any delay in procurement may complicate logistics operations and accelerate casualties. Effective operation of the procurement process requires financial resources to maintain procurement activities before and during the disaster. Priorities should be given to the most affected regions and coordination between the different agencies there. It is important to note that each crisis is unique and may require a tailor-made response.

Relief Operations are a time-limited process. R/Os start immediately after the occurrence of the disaster and continue 1-3 months depending on the size of the disaster (Can 2005, p.3-4). The simplest R/Os start with the procurement and dispatch of aid for transportation to the beneficiary region. These grants can be in the form of materials, services and cash. The aid may be stored in either a national or regional warehouse before transport to central warehouses and distribution points in the disaster area, and then to local warehouses where the aid is handed to the beneficiaries. The activities executed during this period are mainly vital activities and should be managed by appropriate methods within a very short time (Yilmaz 2003, p.56). For this reason, HROs create SC. The Humanitarian Relief Chain (HRC) is an SC that can create cost-effective material flows, financial value flows and information flows for the planning, implementing and controlling of R/Os.

In Relief Operations, the HRC is required to organize and implement the efforts of organizations responding to a crisis. This is not a simple matter. Often large amounts of people, food, shelter, clothing, heavy machinery, and

medical supplies must be moved into and around the disaster area using many different modes of transportation. Lives are at stake, so the procurement of disaster relief goods at a certain time should be made to meet the needs of the victims in a disaster. This must be done quickly, while holding costs low. The main problem areas of any R/O can be characterized by the following elements:

- Generally the demand pattern is unpredictable in terms of timing, location, type and size (Beamon 2004)
- The lead time is approximately zero and dramatically affects inventory availability, procurement and distribution.
- Inventory control is challenging due to the high variations in lead times, demands, and demand locations. Supply information is unreliable, incomplete or non-existent.
- Transportation and distribution network configuration are challenging due to the nature of the unknowns and occurrences away from major traffic lanes in less developed regions with inadequate infrastructure (Long and Wood 1995). Locations are frequently unknown until the demand occurs.
- The strategic goals are to minimize the loss of life and alleviate suffering (by increasing donor funding). The performance measurement system traditionally focuses on output performance metrics (e.g., response time, ability to meet the needs of the disaster). Many R/Os are naturally ad hoc, without effective performance measurement systems in place.
- Information systems are often unreliable, incomplete, or non-existent.
- Due to the high stakes nature of disasters and complex emergencies, there is a desire to rush aid to victims despite the lack of or poor structure of coordination among NGOs.
- The high stakes over lives (rescue/relief teams, beneficiaries) and donations.
- Having the same needs for coordination, collaboration, visibility and logistical information systems as the military and business sectors.

The characteristics mentioned above have a great impact on the HRC. However, the operational characteristics of the HRC also differ depending on the type of disaster and the types of relief actors involved.

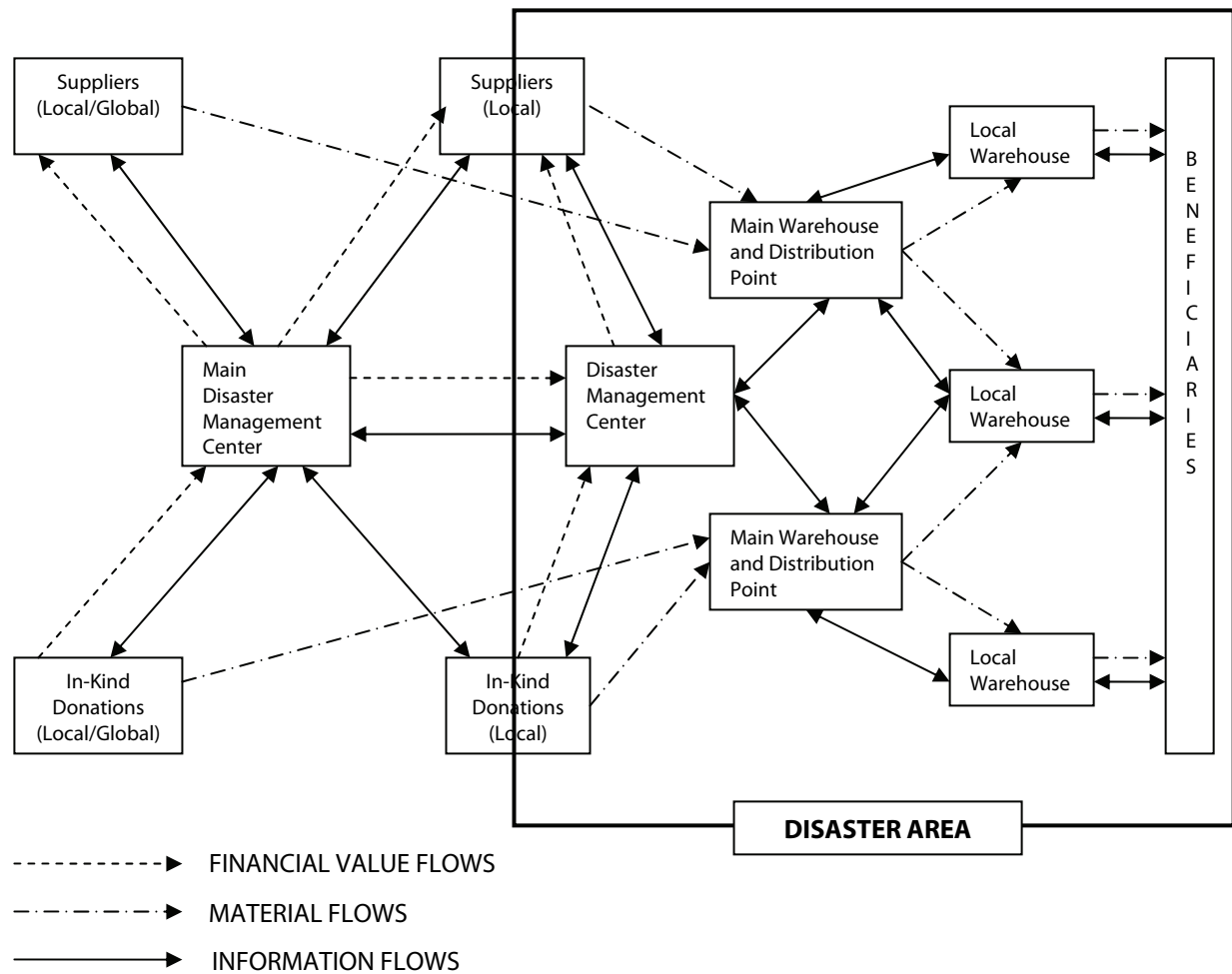


Figure 2: Generic Structure of Relief Chain

Like Supply Chain Management, the HRC also involves delivering certain supplies to certain people, at a certain place, at a certain time and in certain quantities. The HRC links all of the stakeholders (donors, humanitarian organizations, military, governments, beneficiaries, etc.) in the processes. The typical flows in the HRC driven by an international/local HRO are illustrated in Figure 2. Material flows of humanitarian aid activities and deliveries of goods and equipment to disasters follow routes from the suppliers to the warehouses. Delays or disruptions in the flow of material during a disaster may cause additional pain. Information flows connect the actors and the following HRC processes: preparedness; assessment and appeal; track and trace; monitoring, evaluation and reporting and communications. Financial flows take place during the subsequent processes: preparedness, assessment and appeal, procurement, monitoring, evaluation and reporting.

3.3. Comparison of the Humanitarian Relief Chain with the Commercial Supply Chain

Relief Operations crucially rely on logistics support and effective HRC, which enable the prompt delivery of the required goods and services. Applied to R/Os the fundamental aspects of SC remain the same; however some differences may appear due to the specificities of DM.

One of the primary differences between the nature of the “Demand Patterns” is that whereas commercial SC experiences relatively stable and predictable demand patterns, the demands in a humanitarian chain are irregular and occur suddenly in unpredictable locations. In most applications, the commercial SC product demand from the internal and external environment is relatively stable and predictable. In addition, many facilities, especially warehouses and residential demands, are needed for an appropriate structure. However, the chain

of humanitarian aid materials, the demand for services and the staff is composed of irregular amounts and irregular intervals. For this reason, many facilities are in place until the demands become unclear.

The other difference concerns "inventory management". In the commercial sector an inventory management system ensures the continuity of business profits and sales revenues to increase the competitiveness of the acquisition and the active management of stock due to a decision parameter (Üreten 1999, p.43-44). Strategic inventory planning is concerned with the optimal deployment of inventories, often by product family, across the redesigned SC network. Deployment refers to decisions regarding the location of inventories and the missions of the facilities where inventories are stored. For example, decisions about whether or not to have one or more distribution centers dedicated to slow moving items. Such inventory deployment decisions should be coordinated with other network redesign decisions such as the location of plants and distributions centers. Incorporating inventory deployment decisions in SC network optimization models to optimize coordination plans has been recently achieved. It requires innovative modeling methods because the one year planning periods typically used in these models are too long to accurately track inventories through material balance equations (Shapiro 2006, p.3).

But creating a systematically inventory management system for HRO can be more difficult than a commercial enterprise. HRC has very short lead time, challenging inventory policies, and unreliable information flow to minimize suffering in the affected areas. Excessive costs and unnecessary resource use in this situation is caused by the operations carried out. HROs in a wide variety of inventory management policies can be affected by the following factors:

- The organization's founding goals.
- Long-term management strategies, medium-term tactical and short-term daily operational decisions. For example, the goal of the strategy of the International Federation of Red Cross and Red Crescent Societies (IFRC) for inventory management services is "the national organizations of humanitarian aid, disaster preparedness and disaster activities and manpower services to offer in terms of material resources in order to be capable of adequately supporting the effective management of a stock". Such an operation is considered successful in the case of a disaster anywhere in the world

consisting of 48 hours for 5,000 families, and 15,000 families predicted for the delivery of relief supplies at a standard of 14 days.

- The needs of victims
- Disasters
 - Type
 - Size
 - Area
 - Number of victims
- Weather and terrain conditions
- Response priority and speed
- To-do type of assistance
- Use of required technology
- Transportation facilities
- Economic movements
- Ethnic structures

Another difference is "information flows". In SCM, information flows create efficient coordination through the channels. This enables the transparency and visibility of the SC. But as mentioned before, information flows are often unreliable, incomplete or non-existent at the disaster area. In addition, HRC does not have a stable environment, very well-defined, pre-committed or over-defined networks and no pre-planned customer demand. In addition, the system actually works in an environment where within a very short period of time it is required to meet demands for formations amid insufficient or missing information, or information overload, as well as within an uncertain environment and with unreliable information flow to minimize suffering in the affected areas. An important requirement for a collaborative system is the ability to capture knowledge from multiple domains and store it in a form that facilities reuse and sharing. It is clear that communication problems form an important part of the differences in the construction of HRC.

Another difference concerns "performance measurement". The ultimate goal of the performance management in SC systems is establishing relationships between decision variables and performance outputs, leading to the certainty and maintenance of high-performance systems. A performance measure describes the effectiveness and/or efficiency of a system. Effectiveness is the extent to which the system performs the required objectives, while efficiency is the amount or number of resources the system uses to meet the required objectives (Beamon 2004, p.79).

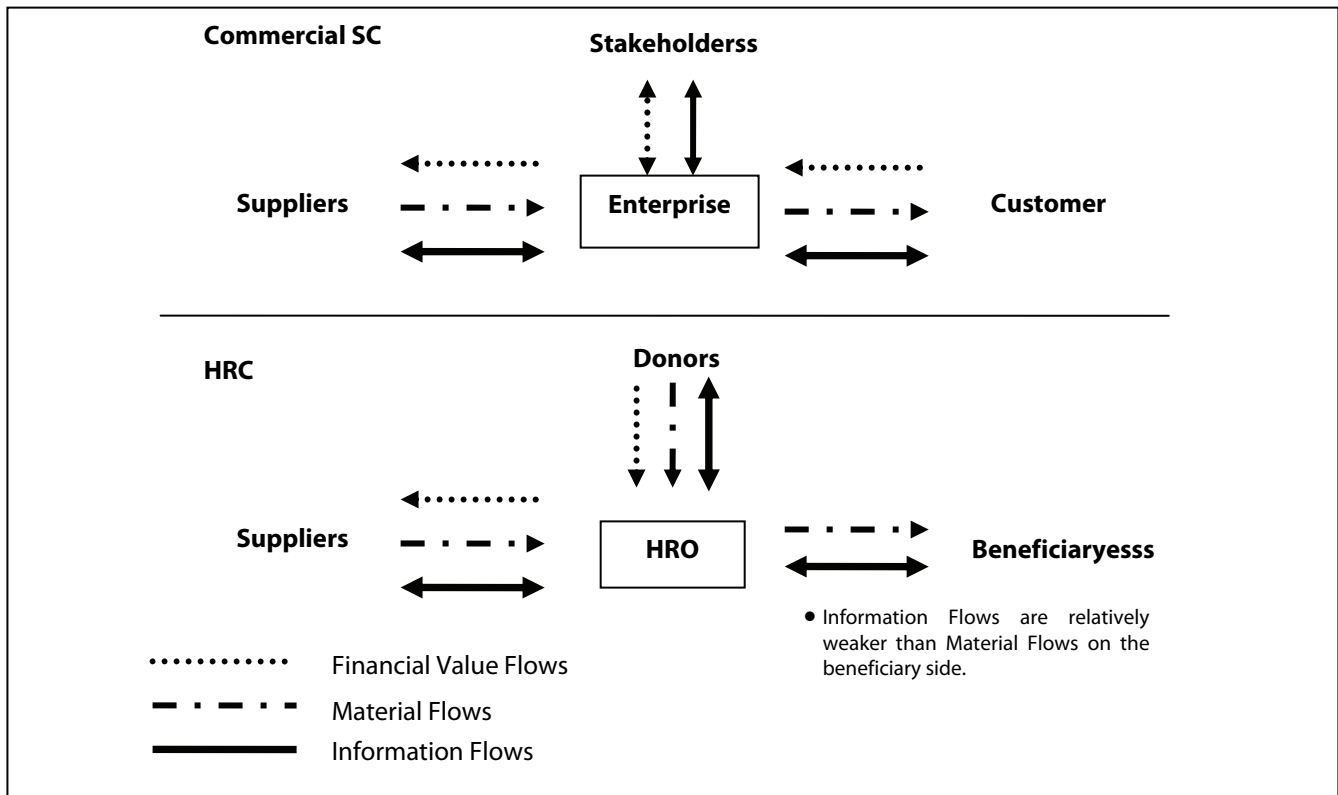


Figure 3: Comparing HRC and Commercial Supply Chain Flows

Performance measurement is vital to HRO as well. However, like other processes, performance management in HRC is not simple. Critical issues remain regarding which measures are the most appropriate indicators of performance and how these factors influence the flow of information for decision making and coordination. For example, lack of coordination among chain members has been shown to increase inventory costs, lengthen delivery times, and compromise customer service. Since logistics accounts for 80% of relief operations, relief chain coordination is the key to improving HRC performance (Balcik et al 2010, p.22). It may also be necessary to have more than one set of criteria for performance management: one for rapid onset disasters and another for slow onset disasters.

The Humanitarian Relief Chain, according to commercial SC, has among its most significant shortcomings its still immature performance measurement sets and undefined standard management processes. There are several reasons for this situation, including:

- The lack of structure for collecting the necessary information
- Insufficient IT infrastructure

- The unpredictable, chaotic and unknown environment after the disaster
- The lack of encouragement for HROs to measure performance
- The potential negative approach of the media
- Human resource issues
- Organizational culture
- Conflict between short-and long-term goals of the DM approach
- Other external factors

Another difference concerns the “structure of the chain”. Chain content must change according to the type of disaster: the weather and ground conditions, transportation opportunities and the degree of assistance vary priority. This activity is taken into account when at the disaster region unstable and changing conditions become more complex.

Another important difference is the “customer”. Commercial SC originates at the customer who is driven by his/her needs, wishes and desires and who is, or ought to be, the origin of all activities within the SC. This notion can partially be transferred to HRC, where the beneficiary is in need of certain services and goods. However, the beneficiaries cannot be considered the real driving forces

behind the SC, although an assessment of the beneficiaries' needs is often the origin of activities within the HRC, as shown in Figure 3. Rather, these are the donors who finance all activities within the SC. Donors provide (mainly financial) resources, which are sourced, channelled and managed by the funding process. Humanitarian organizations must sometimes be the first solution to their sponsor before they can serve the beneficiaries. Beneficiaries are the "customers" who hopefully do not seek to return. Therefore, the objectives are different: while the objective of commercial supply chains is the maximization of profits, the HRC is driven by alleviating the suffering of people in crisis (Kovács and Spens 2007, p. 107).

4. Conclusion


Disaster is a situation or event that overwhelms local capacity, necessitating a request to national or international levels of external assistance. It is an unforeseen and often sudden event that causes great damage, destruction and human suffering (İlhan 2009, p.248). The need to increase activity rates for humanitarian aid supply chains is emerging in all its clarity. To increase quick response capability and the effectiveness of relief operations, any HRO needs careful planning and strong relations with its suppliers and donors. In 2006 alone, 427 disasters occurred around the world. In those disasters, more than 23,000 people were killed, and 143 million people affected, and more than \$34.5 billion in economic damage was incurred. "Disaster relief is and will be a continuing growth market. Disasters are expected to increase another five-fold over the next fifty years due to environmental degradation, rapid urbanization, and the spread of HIV/AIDS in the developing world" (Thomas and Rock Kopczak 2005).

Most of the research work and real test case analyses (in fact, as can be seen in the literature, not enough research has been done in the domain of DM) have assessed that many relief operations are ineffective and many problems can be observed. Analysis of these problems has shown that a major part involve inventory, transportation, communication, and performance problems originating at the interfaces of different parties or functions.

The Humanitarian Relief Chain has the opportunity to increase its contribution to disaster relief, as well as to be recognized for this contribution by implementing initiatives in the areas of logistics, knowledge

management, performance measurements, community and positioning. While moving relief items to disaster sites will continue to be an important role for logistics, the strategic focus must be on providing timely information, analyzing information to garner insight as to how to improve operations and learning internally, among others. It is imperative for humanitarian logisticians to find ways to communicate to donors and the general public how logistics effectiveness is improving.

It is hoped that through a stronger focus on logistics and especially the professionalization of the humanitarian logistician this focus will indeed change. If this can be achieved, humanitarian logistics will have successfully made the transition to HRC management, where every partner in the chain is committed to the goal of creating and fostering value creation for the poorest, most marginalized and disaster-stricken populations on earth.

In this paper, the Humanitarian Relief Chain has been discussed as an approach of SC within the point of view of DM and its differences from commercial SC have been highlighted. It is clear that many activities should be done to bring HROs closer to the private sector in terms of accountability, transparency of operations, coordination and collaboration, improved logistics and streamlined operations. HRC has been recognized as being of crucial importance for the effectiveness and efficiency of humanitarian operations. However, many humanitarian actors have not yet acknowledged this importance and continue to mainly concentrate their efforts on fundraising, communications or public relations. HRC is commonly viewed as a necessary expense rather than having an interface and management function decisive for the success of relief operations. 

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