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Improving the efficiency of a non-profit supply chain for the food insecure

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ABSTRACT

This paper focuses on the operational planning issues in a non-profit supply chain that distributes food for the "food insecure". The study details how by partnering with a local University the organization was able to improve the efficiency and effectiveness of its operations that resulted in more food reaching the food insecure. A detailed simulation model of the warehouse operations where food is processed served as a framework for making changes that improved the efficiency of the operations in terms of handling extra volume without investing in additional warehouse space. In addition, proper demand planning, supply coordination and logistics integration were key drivers for improving the effectiveness of this food supply chain.

1. Introduction

Food insecurity is defined as the limited or uncertain availability of nutritionally adequate, safe foods, or a person's inability to acquire personally acceptable foods in socially acceptable ways. The recession of 2008–2009 has exacerbated the food insecurity problem. For example, in the United States of America close to 49 million people were found to be "food insecure" up from 36 million in 1997 (DeParle, 2009; Nord et al., 2009). In Arizona, where our study was conducted, nearly 900,000 people experienced food insecurity in 2009 up by 85% over previous study estimates in 2006 (Hildebrand and Simpson, 2010). A shortage of supply is not the problem as a surplus of food exists, even in countries poorer than the United States. However, the challenge is to get the available food reach the needy.

Various non-profit groups are working to provide the food to needy families. For example, in 2009, 37 million people obtained food through non-profit agencies in the United States (Wunderlich and Norwood, 2006; Hildebrand and Simpson, 2010). These organizations act as food intermediaries, managing the entire *food supply chain* for the "food insecure" by obtaining food from donor organizations and individuals, processing the food and distributing it to the hungry. The organizations are primarily run by volunteers to keep the cost low. However, their food supply chain is riddled with inefficiencies because of lack of knowledge in managing them. This study focuses on the operational issues in one such supply chain and describes how a simulation-based approach was used to improve the efficiency and productivity of a food reclamation center and also describes the strategies used to analyze the need and distribute food effectively. The goal of the supply chain is to minimize the operational costs and maximize the quantity of food reaching the food insecure.

The rest of the paper is organized as follows. In the next section we discuss the relevant literature on humanitarian logistics. We describe the case of the non-profit supply chain, the challenges that it was facing to fulfill its obligation with a growing demand and the tactical and operational strategies that it deployed to successfully manage its growth crisis in the following sections. We conclude with directions for future research in the last section.

2. Literature review

Humanitarian logistics represents adequate response to a disaster and/or humanitarian crisis. Managing food insecurity and making sure food reaches the needy is definitely a type of humanitarian logistics issue. Response includes, "preparedness, planning, assessment, appeal, mobilization, procurement, transportation, warehousing and distribution" (Ozbay and Ozguven, 2007). Humanitarian relief chains are generally, non-profit supply chains that coordinate assistance in the form of food, water, medicine, shelter and supplies to people affected by emergencies (Beamon and Balcik, 2008). Emergencies could vary from food insecurity caused primarily by economic conditions, to large-scale emergencies such as earthquakes or floods. Logistics is central to the coordination in humanitarian relief operations and also the most expensive part of the relief operation. Hence it needs to be managed in the most effective ("doing the right things") and

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efficient ("doing things right") manner (Van Wassenhove, 2006; Gatignon et al., 2010).

Oloruntoba and Gray (2006) state that coordination in humanitarian supply chains is also the ability to cope with uncertainties in the supply chain. One effective "coping" strategy is understanding the decoupling point in such supply chains where "downstream market-pull" (i.e., end customer demand) meets "upstream push" (forecast-based). The philosophy in humanitarian supply chains is that supplies are "pushed" to the crisis location in the immediate response phase, while the "pull" philosophy is applied in the reconstruction phase (Kovacs and Spens, 2007). Also, the upstream operations in the push phase would focus on improving the efficiencies of material (example food) flow and prepare "strategic inventory" that can be distributed through proper logistics to satisfy evolving needs of the end user (Oloruntoba and Gray, 2006). In our field work described later, a reclamation center becomes the "decoupling point" whose efficiency improvement is paramount to effective food distribution for the needy.

Key success factors in managing humanitarian supply chains fall into two broad categories, namely, (a) preparedness and readiness and (b) unity of direction and cohesive control of responding agencies (Oloruntoba, 2010). Proper planning is an essential driver for good performance and our work talks about a simulation framework as a tool for food reclamation center planning. Lastly, effective performance measures would assist relief chain practitioners in their decisions and help improve effectiveness and efficiency of relief operations. This is turn increases the transparency and accountability of crisis response (Beamon and Balcik, 2008; Balcik et al., 2010). The non-profit humanitarian supply chain that we studied faced many of the same issues. In the next section, we describe the operations of the non-profit organization and its supply chain.

3. St. Vincent de Paul's humanitarian supply chain

The Society of Saint Vincent de Paul (SVdP) is an international organization present in 130 countries spanning five continents and counting 900,000 members. Founded in 1833, in Paris, France, by six University students desirous of helping the Parisian poor, the Society is one of the oldest charitable organizations. Since its inception, the mission of the Society is to serve the needs of the poor and to provide to those more fortunate, an opportunity to serve others. The Society has served homeless and low-income families in Arizona, USA since 1946 through a variety of programs including a free medical and dental clinic, dining rooms, transitional housing and an opportunity program to help people build job skills through volunteer service. Services are provided without regard to race, origin, religion or gender (Society of St. Vincent de Paul, Phoenix website, 2011).

3.1. Food supply chain

The Society's food reclamation center (FRC) collects non-perishable food items donated by grocery stores and community food drives. Most of the food comes from grocery stores that provide not saleable food and non-food items with damaged packaging or nearing their expiration date. FRC cleans, accounts, inspects, sorts and stores the food using employees and volunteers. It then assembles the food on pallets primarily for pick up by the *Society's Conferences of Charity*. The conferences store the food in their pantries and distribute it free of charge to people seeking assistance. Normally, a conference serves people who live in the neighborhood and who have been referred to it. Conference volunteers also make home visits to establish need and deliver food. For example, in fiscal year 2009, roughly around 3000 volunteers in 73 conferences distributed around 400,000 food boxes to Arizona residents in need of food assistance. FRC also distributes food to the various dining rooms that use it for cooking and delivering meals to the people who visit them to dine on a daily basis (breakfast, lunch and dinner).

A typical non-profit food bank in the United States is provided food through donations by individuals, grocers and other organizations. The food must be inspected for usability following strict standards to eliminate food packages that are damaged or having expired use-by dates. The food is then assembled in bulk lots by the food bank and distributed to other organizations that prepare the food through free meals or provide it in packaged form to the food insecure families.

For the Society, the supply chain is more complex. The bulk of food is provided by a local grocery chain through regular deliveries. Additional food enters the system through food drives and other donations. All the food must be unloaded and then temporarily stored. The food from the grocer must be scanned to provide an accounting to the grocer to be used in their inventory management system and for tax benefit purposes. Once the food has been scanned, it can then be combined with other donated food and sorted in various food groups such as cereals, pastas, rice and so on. The food then goes through quality control before being assembled in pallets ("strategic inventory", Oloruntoba and Gray, 2006) for pick-up by the Society's conferences that then repackage the food for the food insecure families.

Food obtained through the FRC also supports SVdP's five dining rooms in the Phoenix metropolitan area. The Society provides hot meals to other non-profits in the area that do not have adequate kitchen facilities. Food not distributed through the conferences or used in the Society's dining rooms is transferred to other food banks or distributed to the needy during Mass distribution events. Fig. 1 illustrates this food supply chain.

3.2. Supply chain challenges

3.2.1. Supply

The supply is dependent on donations, food drives and delivery from grocery stores. Hence it is uncertain and constantly evolving. For example, the donation from the grocery chain has an organized process for collecting and reporting the donated food products (damaged, out-of-code and seasonal items—termed as shrinkage). However, the amount available for use varied from week to week. Furthermore, grocery chains continuously try to reduce their shrinkage rates (Grannis, 2010), which in turn affects the amount of food provided to the warehouse. Similarly, the donations from other sources are not predictable especially at times of economic uncertainty and have quite a variation in the quantity available for useful distribution and consumption.

On the other hand there was consolidation in the grocery chains in Arizona around 2004 and hence the general volume of food available at the warehouse was estimated to increase tenfold (from one million pound per year to one million pound per month). Hence, an immediate challenge was to accommodate this increase in food coming in. The Board at SVdP was trying to decide whether to invest in a new warehouse or use the storage space in the current warehouse more effectively. The latter idea translates to increasing efficiencies in receiving, processing, storing and distributing food.

3.2.2. Demand

The demand for food could be analyzed at two levels. At the macro level, the "need" was dependent on factors such as poverty, local economic conditions (unemployment rates), migration rates and cost of living. Hence, based on census data we could estimate