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Invited research paper

On the unique features of post-disaster humanitarian logistics

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ABSTRACT

Logistic activity can be thought of as a socio-technical process whereby a social network of individuals orchestrates a series of technical activities using supporting systems such as transportation and communications. To understand the functioning of the entire system requires proper consideration of all its components. We identify seven key components: the objectives being pursued, the origin of the commodity flows to be transported, knowledge of demand, the decision-making structure, periodicity and volume of logistic activities, and the state of the social networks and supporting systems. Based on our analysis of the differences between commercial and humanitarian logistics, we pinpoint research gaps that need to be filled to enhance both the efficiency of humanitarian logistics and the realism of the mathematical models designed to support it.

We argue that humanitarian logistics is too broad a field to fit neatly into a single definition of operational conditions. At one end of the spectrum we find humanitarian logistic efforts of the kind conducted in long-term disaster recovery and humanitarian assistance, where operational efficiency – akin to commercial logistics – is a prime consideration. At the other, post-disaster humanitarian logistic operations involved in disaster response and short-term recovery activities represent a vastly different operational environment, often in chaotic settings where urgent needs, life-or-death decisions and scarce resources are the norm. The huge contrast between these operational environments requires that they be treated separately.

1. Introduction

Improving the state of the art and practice of humanitarian logistics (HL) has huge economic and social implications as there is ample evidence that the human and economic impacts of natural disasters are increasing (Centre of Research for the Epidemiology of Disasters, 2009). According to the Office of U.S. Foreign Disaster Assistance and the Center for Research on the Epidemiology of Disasters, in 2010 more than 297,000 people were killed and over 217 million were affected by natural disasters, and the economic damage has been estimated at over US$123.9 billion (Guha-Sapir et al., 2011). However, research on HL is simply not commensurate with its crucial role, particularly those aspects concerning characterization. The number of empirical studies of real life HL efforts is pitifully small. Part of the problem is that the HL practitioner community is very small – no more than a few thousand individuals in the entire world could claim HL as their full-time occupation. Given the minuscule size of the community, as well as its reluctance to produce publicly available accounts of actual HL efforts, only those individuals directly involved are familiar with the intricate details of the operations. In our view this represents a major obstacle to the development of relevant analytical models, since it is not possible to develop accurate models of a system that is poorly understood.

In contrast, the functioning, features and dynamics of commercial logistics are well known, hence researchers have been able to develop highly sophisticated analytical models to optimize the various components of modern supply chains. Together with the development of advanced distribution systems, this has dramatically enhanced performance. To give one illustration of this, transportation's share of total production costs fell by 52.3% between 1970 and 2002 (Chopra and Meindl, 2007).

The disparity between commercial and humanitarian logistics has prompted attempts to adapt analytical formulations originally developed for the commercial sector to the humanitarian context.

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While undoubtedly pragmatic, such adaptations have major limitations since commercial and humanitarian logistics are recognized as being radically different (Beamon, 2004; Beamon and Kotleba, 2006; Van Wassenhove, 2006; Holguín-Veras et al., 2007) and most analytical formulations fail to fully capture the complexity of HL.

This paper identifies differences between commercial logistics and the key variants of HL. The term 'humanitarian logistics' encompasses a wide range of operations including the distribution of medical supplies for routine disease prevention, food supplies to fight hunger, and critical supplies in the aftermath of a disaster. While these share humanitarian goals, they are profoundly different on account of the level of urgency of the operations, the state of the social networks that orchestrate the effort, the state of the supporting systems, and the dynamic nature of the needs, among others. Treating HL as a homogeneous block glosses over the complexity and distinctness of the various operational environments, making it difficult for outsiders to understand the unique features of the different types of HL and to develop suitable analytical formulations. While previous comparisons between commercial logistics and HL have been made (Beamon, 2004; Holguín-Veras et al., 2007), the role of social networks and the differences between the various modalities of HL have been largely overlooked. In analyzing the key forms of HL, our main emphasis is on post-disaster operations, where the contrast with commercial logistics is most extreme. For this reason we discuss cases from the literature and from our fieldwork on post-disaster humanitarian logistics (PD-HL).

The remainder of the paper is organized as follows. Section 2 focuses on the analysis of the differences between disasters and catastrophes from the standpoint of their respective impacts on the HL response. Section 3 discusses the differences between commercial and HL based on the disaster research literature, fieldwork by the authors, direct observation of prominent cases (e.g., World Trade Center, Hurricane Katrina, Haiti, Japan), and comprehensive analyses of the HL process. Section 4 presents an outline of research needs aimed at addressing the most pressing knowledge gaps related to PD-HL. We conclude with a summary of our key findings.

2. Disasters vs catastrophes

One of the most important factors impacting HL is the nature of the event itself. In particular, it is important to distinguish between a disaster and a catastrophe. There is no general agreement among researchers on how to define the term "disaster" (see Perry (2006) and Federal Emergency Management Agency (2004) for a comprehensive discussion), and the issues involved are complex, as articulated by Quarantelli (1998, 225): ". . .to be concerned about what is meant by the term disaster is not to engage in some useless or pointless academic exercise. It is instead to focus in a fundamental way on what should be considered important and significant. . ."

The term disaster is used here to refer to ". . .a non-routine event that exceeds the capacity of the affected area to respond to it in such a way as to save lives; to preserve property; and to maintain the social, ecological, economic, and political stability of the affected region. . ." (Pearce, 2000). While this definition is grounded in a conception of a disaster as external to the system, others such as Wisner et al. (2004) hold the view that a disaster is internal to the system itself. The distinction between catastrophic and non-catastrophic disasters is important, but the need to consider how they impact the socio-technical process of PD-HL has only been recognized relatively recently. We build on our previous work by providing a more comprehensive analysis of the impacts on PD-HL (Wachtendorf et al., 2012).

Catastrophes can be defined as high-consequence events that generate widespread and crippling impacts, where the ability of the impacted society to respond is severely compromised. They range in scale from cases where the impacted country can cope, to those where the country has to invite outside assistance, either regional or global. How the country copes will very much depend on the strength of the government and society, and the vulnerability of the population. In Haiti and Somalia, even a relatively minor disaster can have huge consequences, whereas Japan has well-developed disaster-response mechanisms.

Technically, a catastrophic event is one in which "most or all of the community-built structure is heavily impacted. . . [and] facilities and operational bases of most emergency organizations are themselves usually hit"; "local officials are unable to undertake their usual work role"; "help from nearby communities cannot be provided"; "most, if not all, of the everyday community functions are sharply and concurrently interrupted"; "the mass media system especially in recent times socially constructs catastrophes even more than they do disasters"; there are "mass out-migrations for protracted periods of time"; and, "because of the previous six impacts, the political arena becomes even more important" (Quarantelli, 2006; Wachtendorf et al., 2012). A catastrophe does not have to exhibit all seven characteristics, but the prevalence of multiple characteristics is an indication of how catastrophic an event is. The Tohoku (Japan) tsunami's impact on the town of Minani Sanriku, and the Port-au-Prince earthquake (Haiti) exemplify catastrophic events.

A non-catastrophic disaster is one in which the local population, authorities and humanitarian organizations can cope with the consequences despite significant casualties and destruction of infrastructure. The response involves fewer converging entities, less of an interface between the public and private sectors, and allows more autonomy and freedom of action (Quarantelli, 2006). The tornado that devastated a narrow strip of Joplin, Missouri, leaving surrounding areas untouched is an example. In terms of the HL effort, in the event of a catastrophe the majority of supplies have to be brought from (well) outside the impacted area, while in a non-catastrophic scenario some resources remain (e.g., trucks, leadership structures, inventory stocks at households and businesses) that could become the first wave of aid to the needy (Wachtendorf et al., 2012).

Table 1 summarizes the most salient impacts. As shown, there are major qualitative and quantitative differences between the HL efforts required after disasters and after catastrophes. The first concerns the impact of the event on local inventory held by both households and businesses. After a disaster these are likely to survive in significant amounts, particularly outside the directly impacted areas, whereas a catastrophe – by definition – will destroy or damage the vast majority of local supplies. Thus local supplies play a key role in the response to a disaster but almost no role in the response to a catastrophe.

The second difference concerns the demand for critical supplies to satisfy the needs of both the surviving population and the response process, respectively referred to as "disaster agent-generated" and "disaster response-generated" (Dynes et al., 1972). The demand for supplies, though significant in the case of a disaster, is much larger after a catastrophic event. Adding to the problem is the tendency of individuals and businesses to stock up on essential supplies in anticipation of shortages, such as before a hurricane or a snow storm, or after the sudden onset of a disaster, either for personal consumption or when they see an opportunity to profit from shortages. The magnitude of the demand increase may be significant. For example, the head of a major retailer and food distributor located in Tohoku reported that orders from businesses in the areas surrounding the towns destroyed by the tsunami doubled in the days after the March 2011 disaster (Holguín-Veras et al., 2011b). Such behavior strengthens the case for public-sector requisition of supplies