

Research and Management Insights

Introduction to the Special Issue on Humanitarian Operations and Crisis Management

Martin K. Starr, Luk N. Van Wassenhove

Humanitarian operations pose challenges for production and operations management researchers and practitioners that differ markedly from those of conventional supply chains associated with profitable enterprises. The overlap provides learning opportunities for those on both sides of the divide (which differ by objectives and consequent logistics). Further differentiation occurs in the role of policy makers, financial managers and socially responsible agencies. In an era of big data, one of the most vexing problems is the lack of robust data in the humanitarian domain which is as richly varied as the types of disasters that can occur. In addition to wanting to be cost effective, the issue of equity fairness is pervasive. Whose interests are foremost is a dilemma especially when considering the “last-mile logistics” of getting aid to those in most need. Efficiency-equity tension which characterizes the domain of humanistic operations and crisis management (who is the client, where do funds and supplies come from?) is not present in commercial situations. The complexity and unstructured nature of humanitarian systems demand systemization. How do theory and practice relate in this domain which desperately needs good scouts to map the territory? Study is required to use technology and training to eliminate and/or mitigate the impact of accidents, natural cataclysms and malevolent behavior.

Buttressing Supply Chains against Floods in Asia for Humanitarian Relief and Economic Recovery

ManMohan S. Sodhi, Christopher S. Tang

The use of alternative sales channels with social enterprises and micro-retailers can be a win for manufacturers and consumers alike even in humanitarian crises. Sodhi and Tang advocate the creation of social enterprises to enable the temporary distribution of essential goods from manufacturers to micro-retailers in flood-prone areas during medium-sized floods. The social enterprise would use a temporary supply chain network of makeshift warehouses on earmarked land for relief effort only during the flood. Everyone ‘wins’ although even a medium-sized flood

will take its toll: (a) the flood-affected people get essential goods; (b) the micro-retailers in these communities survive the flood economically by continuing to be replenished and by continuing to sell during the flood; (c) manufacturers continue selling essential goods through the proposed temporary channel, and (d) cash-strapped governments can focus on infrastructure instead of inefficient distribution of aid money or goods.

Vehicle Procurement Policy for Humanitarian Development Programs

Mahyar Eftekhari, Andrea Masini, Andreas Robotis, Luk N. Van Wassenhove

Mahyar Eftekhari, Andrea Masini, Andreas Robotis, and Luk Van Wassenhove study vehicle procurement for organizations engaged in humanitarian development programs and propose optimal policies to optimize fleet sizing decisions under different demand scenarios. The proposed model provides a relatively simple and robust tool for making fleet management decisions at the aggregate level when detailed data are not available. A thorough review of the fleet management operations of a large humanitarian organization shows that these organizations tend to modify their fleet sizes too abruptly over time. Conversely, the optimal policy recommends that, if organizations are constrained by the rate at which fleet sizes can be increased or decreased, then they should level fleet size by smoothing out demand requirements. It is only when humanitarian organizations can replace vehicles frequently, face substantial overstocking and understocking costs and are relatively unconstrained by procurement budgets, that they should follow a chase strategy. Because the humanitarian context seldom satisfies the latter conditions, the model implies that a level strategy would be optimal for most humanitarian missions.

Using Fairness Models to Improve Equity in Health Delivery Fleet Management

Jessica H. McCoy, Hau L. Lee

Production and operations management (POM) and especially humanistic operations and crisis management (HO&CM) research must be grounded in

realistic problems, both to motivate relevant work and to provide a framework for implementation. In the authors' experience, there is no substitute for on-the-ground interaction between researchers and partner organizations. Jessica McCoy and Hau Lee's partnership with Riders for Health was essential to a thorough understanding of problems faced in rural health delivery, and to the iteration of possible solutions. This partnership also underscored the importance of expanding the objective function to more accurately model decisions. Beyond the comprehensive study of efficiency in traditional POM, HO&CM requires a more formal treatment of equity, a dimension that cannot be ignored in future humanitarian research.

Further, the authors recognize that a key challenge of modeling non-traditional operations is the lack of data and historical solutions. The authors encourage researchers in HO&CM to carefully study the nuances of on-the-ground problems and how these problems differ from for-profit settings and to collect primary data and build robust models where possible. Finally, the authors also benefited from discussions within the growing HO&CM community. It is difficult for one researcher to have comprehensive on-the-ground experience, but the collective knowledge of this group is a tremendous resource.

Assessing Trade-offs Among Multiple Objectives for Humanitarian Aid Delivery using Expert Preferences

Erica Gralla, Jarrod Goentzel, Charles Fine

Humanitarian aid agencies deliver emergency supplies and services to people affected by disasters. When the available fleet of vehicles is insufficient to deliver all the needed cargo, they must decide how to prioritize the waiting deliveries. The humanitarian goal of alleviating human suffering is not an operational objective that can guide these aid prioritization decisions; for example, it is difficult to determine whether loading more food, more shelter, or more medicine on a truck will have a greater impact on human well-being. Erica Gralla, Jarrod Goentzel, and Charles Fine develop an operational objective to guide the prioritization of humanitarian aid deliveries, based on the preferences of expert humanitarian aid workers who make these decisions in practice. The resulting multi-attribute utility function assesses the relative importance of five key objectives: the amount of cargo delivered, the prioritization of aid by commodity type, the prioritization of aid by delivery location, the speed of delivery, and the operational cost. They find that the amount of cargo delivered is the most valued objective and cost the least important, and that experts prioritize more vulnerable

communities and more critical commodities, but not to the exclusion of others. The new objective function can guide decision support tools, score alternative aid delivery plans, and provide transparency and consistency in the aid prioritization process.

A School Feeding Supply Chain Framework: Critical Factors for Sustainable Program Design

Andreas Kretschmer, Stefan Spinler,
Luk N. Van Wassenhove

School feeding is an established development aid intervention that has been traditionally run by international organizations in low-income settings. Recently there has been a shift towards long-term, sustainable solutions that rely more upon local resources, local capacity, and community participation. Andreas Kretschmer, Stefan Spinler, and Luk Van Wassenhove contribute in the domain of development aid logistics with a focus on transitioning to sustainable program design. It describes how specific supply chain designs relate to program sustainability with the example of school feeding. The developed framework identifies the various levers within the supply chain, facilitates data collection in the field and the prioritization of actions by decision makers. For the OM/OR community, it provides a basis upon which to analyze school feeding and build quantitative models to investigate trade-offs in supply chain design. Practitioners can use the framework to evaluate design options contingent on the local context in order to improve performance and sustainability. The results are also relevant for other humanitarian supply chains (that are long term in nature and face similar issues) in their choice of supply chain to enhance program performance and sustainability.

Improving Humanitarian Operations through Technology-enabled Collaboration

Özlem Ergun, Luyi Gui, Jessica L. Heier Stamm,
Pinar Keskinocak, Julie Swann

An important challenge and opportunity for the field of humanitarian operations and crisis management is that of realizing the potential benefits of information technology (IT) tools, both within individual organizations and as a catalyst for inter-organizational coordination. In "Improving Humanitarian Operations through Technology-enabled Collaboration," Ergun, Gui, Heier Stamm, Keskinocak, and Swann summarize the current use of IT solutions in the management of camps for persons displaced by disasters. Benefits of these tools include increased data accuracy and improved operational efficiency; however, there are significant barriers to adoption and sustained use due to cost, system compatibility, and infrastructure capa-

bility. The authors provide insights about IT-enabled multi-agency coordination in settings where a significant initial investment is necessary to realize collaborative benefits. This work paves the way for future research to characterize situations in which collaboration is most beneficial and to identify practical cost allocation mechanisms that incentivize collaboration.

Information Diffusion among Agents: Implications for Humanitarian Operations

Nezih Altay, Raktim Pal

Many organizations struggle with coordinating individuals or independent units even though they share the same organizational objectives. Unfortunately, bad coordination leads to duplication of effort, raises costs, and lowers effectiveness of operations. A prerequisite for coordination is ensuring that relevant information is available for everyone and is shared. If good quality information is not made available to the relevant parties they would not know what their role is and how they are expected to take part in a coordinated operation. Altay and Pal look at this problem of information diffusion among independent units in the context of humanitarian relief operations. The organization they consider is a cluster of humanitarian agents with one agency taking the lead role of the cluster. The authors show that information sharing and the quality of the information exchanged makes a big difference in diffusion. Furthermore, organizational effectiveness increases if the cluster lead acts as an information filter and brokers this information to the parties in need.

Supplier Selection for Framework Agreements in Humanitarian Relief

Burcu Balcik, Deniz Ak

Burcu Balcik and Deniz Ak address supplier selection decisions of humanitarian organizations in establishing framework agreements. Through numerical experiments and a case study, several insights are developed about the effects of agreement terms on supplier selection decisions and procurement costs in different settings. Specifically, the authors explore how the changes in supplier reserve capacity, minimum total quantity commitment and pricing schedule in a quantity flexibility contract might affect supplier selection decisions and costs in settings with different disaster impact levels and supplier coverage. For instance, establishing agreements with suppliers that offer large reserve capacities and geographical coverage would be particularly beneficial for organizations that operate in areas prone to high impact disasters. Furthermore, negotiating for smaller minimum total quantity commitments would be more valuable in

areas where high and low impact disasters may occur and suppliers have limited geographical coverage. Moreover, it is important for relief organizations to consider disaster impact levels and the desired service levels while negotiating on the quantity- and/or lead time-based quantity discounts. Finally, practitioners and researchers must carefully examine the implications of alternative disaster scenarios in making supplier selection decisions; in particular, the effects of high impact disasters must be carefully analyzed in establishing framework agreements.

The Effect of Language Differences and national Culture on Operational Process Compliance

John V. Gray, Brett Massimino

Multinational firms continue to conduct operations in international locations, yet little is known about the relationship between an operation's location and its performance in non-financial dimensions. In this research, John Gray and Brett Massimino focus on how language differences and the national cultures of both the operation and headquarter (HQ) locations relate to the operation's process compliance. Studying pharmaceutical manufacturing plants, they find strong evidence that an HQ-plant national language difference relates to a lower level of operational process compliance. Analogously, they find that congruence along only one national culture dimension, power distance, consistently relates to higher levels of operational compliance. The authors also find little evidence of a direct effect of national culture on process compliance, implying that compliance can be achieved in any culture. The results collectively indicate that language has more of an effect on process compliance than culture, yet language has received little attention in the international operations literature. Most of the locations of the operations in this research are in high-cost countries, and the results hold when considering only plants located in the U.S. Thus, the results provide an explanation for challenges experienced in offshore production which does not place blame on deficiencies of the offshore location.

Distributed Development and Product Line Decisions

Ram Bala, V. Krishnan, Wenge Zhu

In a number of industries, the global distribution of product development work has become commonplace. The typical reason for the prevalence of this phenomenon is the cost advantage derived in locating design activities in emerging countries. However, companies that adopt this practice face several challenges. In particular, communication and coordina-

tion challenges in distributed product development lead to performance deterioration in the final product. Such deterioration may affect the willingness to pay of customers located in developed countries particularly premium customers who derive significant value from the product. Ram Bala, V. Krishnan, and Wenge Zhu provide a roadmap for managers in such industries that allows them to determine the level of product variety that they should offer as a function of the distributed development architecture they pursue. By marrying market outcomes with operational concerns, the authors uncover several optimal strategies that are counter-intuitive. For example, a greater degree of product variety is prescribed when the cost advantage from the remote location is at an intermediate level.

Monopoly Versioning of Information Goods When Consumers Have Group Tastes

Xueqi (David) We, Barrie R. Nault

Wei and Nault investigate conditions to determine when a monopolist should offer a single versus multi-

ple versions of its information good. The authors explore the situation where consumers differ in individual tastes for quality – features or functionality, and segments of individual consumers share the same group taste. The authors show that when the monopolist can generate versions that have some shared characteristics, and each version has special characteristics – a horizontal dimension, versioning is possible when the value of the shared characteristics is sufficiently low so that cannibalization from a lower priced version can be dissuaded. Consequently, any horizontal differentiation in product line design favors versioning. When group tastes are hierarchical such that higher taste groups value characteristics that are shared by lower taste groups but not vice versa – a vertical dimension, versioning is optimal as long as the valuation of the higher and adjacent lower taste group are sufficiently close. Thus, any hierarchical structure in product line design also favors versioning.