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20th Anniversary Invited Article

Humanitarian Operations: A World of Opportunity for Relevant and Impactful Research

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Abstract. The number of people affected by disasters has increased over the past decades, whereas funding has declined. The need for effective humanitarian aid is, therefore, larger than ever. Humanitarian organizations have recognized the critical role of supply chain management in reaching beneficiaries, and they have introduced commercial routines and best practices. Academics realized that humanitarian operations constitute a fruitful new research area and adapted solution techniques developed for commercial operations to disaster situations with mitigated success. Meanwhile, the problems that humanitarian practitioners face quickly evolve. In this paper, we highlight challenges in matching practitioner needs with academic publications and outline the great opportunities for impactful and relevant research.

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Keywords: humanitarian operations • practical relevance • impactful research • innovation

1. Introduction

The last decade has been very busy for the humanitarian sector. Responding to large-scale emergencies in a timely and effective manner, like the 2010 Haiti earthquake, the man-made disasters in Syria and Yemen, or the Ebola pandemics, has drained available funds. Since 2011, appeals for funding by humanitarian organizations (HOs) have steadily increased, and more than 55% of requirements are unmet (<https://fts.unocha.org/appeals/overview/2018/plans>). HOs have come to realize that satisfying needs requires improved efficiency (i.e., low-cost operations owing to budget constraints) and greater effectiveness (i.e., reduced suffering for beneficiaries through smarter supply chain management [SCM]). The supply chain is indeed the backbone of humanitarian operations (Lewin et al. 2018). Approximately 75% of funding allocated to disaster response concerns supply chain expenditures (Van Wassenhove 2006, HELP Logistics AG, et al. 2018).

Humanitarian organizations have responded to crises for many decades. However, it was the response to the 2004 Asian tsunami that attracted massive media attention. Despite the huge support from donors, large

inefficiencies were observed, and the response was heavily criticized (Lewin et al. 2018). The humanitarian sector realized that changes were needed. Since then, HOs have successfully introduced commercial supply chain routines. Academics, with their tool kits of models and algorithms, have also been attracted by the challenging context and complexity of humanitarian operations.

Meanwhile, climate change started affecting the magnitude and frequency of natural disasters, like floods or epidemics. Man-made disasters (e.g., in the Central African Republic or South Sudan) have dragged on, increasing the complexity of humanitarian crises. Concurrently, technological innovations, like drones, big data, and artificial intelligence (AI), are slowly being introduced, hoping to make humanitarian operations more efficient and effective. These clear trends are only expected to grow faster, requiring humanitarians to once again adapt their operations and skill sets.

The intent of this paper is to reflect on the past and present of humanitarian operations and project them into the future. To do so, we conveniently distinguish three phases in the evolution of humanitarian operations based on their effectiveness and efficiency: past (Humanitarian Logistics (HUMLOG) 1.0), present

(HUMLOG 2.0), and future (HUMLOG 3.0). We define the response to the 2004 Asian tsunami as the transition between HUMLOG 1.0 and HUMLOG 2.0, because it was a wake-up call that gave humanitarian practitioners the resources to successfully introduce knowledge and practices from the commercial world (HUMLOG 2.0). In HUMLOG 1.0, the focus had largely been on the disaster response phase because of lack of recognition of the importance of supply chain management. HUMLOG 3.0 is driven by changes in the context and types of disasters along with technological advancements.

Over the past decade, academics have realized the attractiveness of humanitarian operations for operations research (OR), operations management (OM), and SCM work (Lee and Tang 2018). They discovered the many opportunities to apply existing tool kits for classical problems, like location, routing, or inventory control, to a very different and novel context that is both more dynamic and more uncertain. Since the first papers discussing the context of humanitarian operations (Altay and Green 2006, Van Wassenhove 2006), this research area has grown tremendously. A simple keyword search in well-known OR/OM/SCM journals readily yields 500+ papers over the last decade. There have been many special issues, and there is even a new journal focusing entirely on humanitarian operations. However, does this avalanche of papers accurately reflect the challenges that humanitarian practitioners face?

We chose to let practitioners speak by collecting information from the Logistics Cluster conferences. The cluster approach was adopted in 2005 by the United Nations (UN) to strengthen response capacity to humanitarian disasters, coordination, and accountability by enhancing partnerships in key sectors, like logistics, food, and education. The Logistics Cluster, a UN interagency group, aims to improve coordination, information management, and access to common logistics services between responders during emergencies (<https://logcluster.org/about-us>). This cluster has organized conferences since 2006, where logisticians of HOs discuss common issues of concern. We highlight potential mismatches between these practitioner challenges and academic publications.

Our paper is organized as follows. Section 2 discusses the characteristics of humanitarian operations. In Section 3, we identify the foci of OR/OM academic research on humanitarian operations. Section 4 presents the topics raised by humanitarian logisticians in the Logistics Cluster conferences and exposes a gap between these topics and current research. This gap provides great future research opportunities in helping practitioners reach HUMLOG 3.0 as discussed in Section 5. Finally, Section 6 presents the conclusions of our study.

2. Humanitarian Operations

In this section, we discuss the past (HUMLOG 1.0), present (HUMLOG 2.0), and future (HUMLOG 3.0) of humanitarian operations. We identify seven characteristics that capture the increasing dynamic nature and volatility of the humanitarian context, especially in going from HUMLOG 2.0 to HUMLOG 3.0, through changes in the number and role of *stakeholders* in humanitarian supply chains, *disaster lifecycle*, *disaster type*, *objectives*, *technology*, *type of aid* delivered to beneficiaries, and *business models*.

The humanitarian context is very dynamic. Actors affecting humanitarian operations can be local and international humanitarian organizations, beneficiaries, governments, donors, military, private sector companies, and media (increasingly social media) (Besiou et al. 2011). After the Asian tsunami, the number of stakeholders responding to highly mediatized so-called CNN disasters has substantially increased. For example, in Haiti, there were more than 1,000 new HOs in the field (Van Wassenhove and Besiou 2013). The role of these stakeholders in the humanitarian supply chain is also rapidly changing (Lewin et al. 2018). Given the scarcity of resources, the United Nations sustainable development goals (UNSDGs; <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>) call for a bigger role of the private sector and hence increased collaboration of HOs with private players. Donors are pushing for more localized responses (i.e., higher resilience through local capacity building and stronger engagement with local partners).

It is important to recognize the huge differences in disaster response between rich and developing countries and between conflict and nonconflict areas. It is the government's responsibility to protect and assist their people. Sovereign states have the right to refuse or welcome international help. Clearly, there are cases where governments do not have the power, resources, or willingness to care for their population in need. In 1863, after the battle of Solferino, Henry Dunant founded the Red Cross, the first humanitarian organization to protect and assist victims of armed conflict and other situations of violence (Tomasini and Van Wassenhove 2009). National Societies were created to support the local population, and, over time, their activities were extended from man-made crises to natural disasters and development programs. The United Nations international organization was founded in 1945 after World War II. It is currently made up of 193 member states (<http://www.un.org/en/sections/about-un/overview/index.html>) and consists of many organizations, some of which have humanitarian missions, like United Nations High Commissioner for Refugees (UNHCR), World Food Program (WFP),

United Nations Children's Fund, and World Health Organization (WHO).

The focus of HOs on different phases of the disaster lifecycle—that is, mitigation, preparedness, response, and rehabilitation (Tomasini and Van Wassenhove 2009)—is affected by availability of funding. When funding is scarce, HOs need to use it for their core programs. After the poor response to the Asian tsunami, funding suddenly became abundant and could be invested in strengthening supply chain capabilities and other preparedness activities, like geographical prepositioning of relief items. HOs implemented the basics of commercial SCM, including setting up departments/divisions, implementing training programs, hiring experts, and introducing software (HUMLOG 2.0). These experts often had a commercial or military background. Consulting firms were also eager to offer “pro bono” support in upgrading supply chain and logistics skills. However, the humanitarian context is very different from commercial operations (Van Wassenhove 2006, Van Wassenhove and Pedraza-Martinez 2012), and these experts (and donors) were not always fully aware of this when introducing, sometimes imposing, commercial best practices. Benchmarking commercial or military operations is useful, but the humanitarian sector needs to carefully adapt knowledge and best practices to its own specific characteristics, objectives, needs, and contexts. New domain knowledge and insights need to be developed (Van Wassenhove 2019).

HOs operate in a very volatile world. Complex global challenges, like climate change, urbanization, and political issues (<https://www.weforum.org/agenda/archive/humanitarian-response/>), affect the number and type of disasters. Pandemics, although rare a decade ago, are strongly on the rise (Marder 2018). The biggest concern of the WHO is that climate change can trigger pandemics, even out of diseases, like malaria, considered to be under control (Cahill 2018). Man-made conflicts, like the war in Syria, have created an unprecedented number of internally displaced persons and refugees: more than 68 million forcibly displaced people and more than 25 million refugees (<https://www.unhcr.org/figures-at-a-glance.html>). Especially in complex emergencies, like disasters resulting from several different hazards (e.g., natural and man-made origins [<https://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/complex-emergencies/>]), access to beneficiaries is difficult, and security is the number one concern.

HOs need to satisfy their objectives by reaching beneficiaries quickly to reduce their suffering (effectiveness) and at the lowest possible costs owing to budget constraints (efficiency). Assessing performance by targeting cost-effectiveness is not easy, because measuring reduction in deprivation or suffering per dollar spent is not straightforward (Holgúin-Veras et al. 2013).

Reduced funding calls for careful prioritization and cost-effectiveness, but it should be noted that this may conflict with equity and other ethical considerations.

HOs try to benefit from technological innovations in dealing with the changing environment. For example, using Facebook data on population movement after the Haiti hurricane yielded useful information on the status of infrastructure (Cahill 2018). Drones are used to carry blood to rural areas (<http://www.flyzipline.com/>). Satellite and unmanned aerial vehicle pictures provide real-time information on infrastructure damage after an earthquake. Big data and AI techniques are used for analysis. Global positioning system (GPS) equipment is used to track vehicles and help HOs locate staff members in regions with safety concerns. Social media accelerates information transmission on beneficiary needs and relief item distribution after disasters. However, unlike the commercial sector, limited and earmarked funding does not always allow humanitarian organizations to fully use modern technologies, which tend to be expensive. HOs often invested in traditional enterprise resource planning (ERP) enterprise systems to improve supply chain transparency, which field practitioners found inflexible, heavy to use, and unfit to their needs (Guerrero Pat 2016). Consequently, organizations, like Oxfam and MSF (Doctors without Borders), are developing and using their own custom-made supply chain management systems (Helios, Unifield, etc.).

Technology has also been used to make the humanitarian supply chain more flexible. Cash and vouchers (C&V) change the type of aid by providing beneficiaries with money or vouchers to buy what they need locally instead of distributing in-kind relief items (Besiou and Van Wassenhove 2015, Heaslip et al. 2018). The system empowers local markets as well as beneficiaries, but it requires excellent assessment of availability of local supplies and ability to quickly fall back on in-kind aid when necessary.

HOs are also increasingly questioning their “business” model. Donors ask whether all HOs should have a logistics department or own their vehicle fleet instead of outsourcing these activities. Some organizations develop services that can be shared or sold to others (Lewin et al. 2018).

In the future, HOs will be responding to complex disasters and pandemics, which are more expensive and subject their staff to higher safety risks (HUMLOG 3.0). To reach the UN sustainable development goals, humanitarian and development aid should be scaled up considerably but in a smart way. HOs can no longer simply adopt best practices from the military and commercial sector, because they do not fit their context. Intersectoral collaboration will have to be considerably intensified for humanitarian operations to be more efficient and effective, but this will not suffice. Technology

and innovative business models are necessary, but they do not provide the silver bullet either. Our claim is that research has a crucial role to play in helping practitioners find solutions to the tough challenges that they face.

3. OR/OM Research in Humanitarian Operations

The works by Altay and Green (2006) and Van Wassenhove (2006) are two early academic papers on humanitarian operations. Since then, the number of publications has grown exponentially. A meta-survey paper reviewed 43 survey papers on disaster management and humanitarian operations (Kovács and Moshtari 2019). The dedicated *Journal of Humanitarian Logistics and Supply Chain Management* has published 117 papers since its first number in 2011. Three special issues were published by highly ranked OM/OR journals. The *Production and Operations Management (POM)* issue on “humanitarian logistics” (Starr and Van Wassenhove 2014) contained 9 papers, whereas the *Journal of Operations Management (JOM)* issue on “humanitarian operations management” (Pedraza-Martinez and Van Wassenhove 2016) and the *European Journal of Operations Research (EJOR)* issue on “OR applied to humanitarian operations” (Besiou et al. 2018) contained 10 papers each. In their call, all three special issues emphasized their desire to publish papers focusing on real problems.

It is natural that academics have jumped on the new and promising topic of humanitarian operations. However, it is important to verify whether academic publications faithfully mirror the humanitarian context. Table 1 shows the number of special issue papers dealing explicitly with the seven characteristics of the dynamic and volatile humanitarian operations environment (Section 2). We added one more characteristic: does the paper discuss *traditional OM problems* (e.g., inventory management) without much adaptation to the humanitarian context?

First, Table 1 shows that the papers tend to deal with traditional OM problems without much consideration for the specific disaster context. These traditional OM problems are supplier selection, fleet management, network design, inventory location-allocation, forecasting and order planning, and transportation planning/routing. Second, in terms of including more stakeholders and looking at their changing role, only a few papers capture the local aspect of response. Third, the topic of shared services as a business model was discussed in only one paper. From the disaster-type perspective, one paper considers medical logistics but from a development angle. Regarding technology, information technology (IT) and social media are discussed in a few papers as enablers of information diffusion. Fourth, some papers try to better understand practitioner objectives, and others go beyond common goals, like efficiency and

Table 1. Frequency of Topics, Disaster Lifecycle Phases, Disaster Type, and Origin of the Data in the Special Issue Papers

Characteristics	POM (special issue) 2014	JOM (special issue) 2016	EJOR (special issue) 2018
Stakeholders	2	0	1
Disaster lifecycle	2	3	2
Business models	0	1	0
Technology	1	1	2
Type of aid	0	0	0
Disaster type	0	2	0
Objectives	3	1	0
Traditional OM problems	2	3	6
Disaster lifecycle phase			
Mitigation	0	0	1
Preparedness	1	1	1
Response	4	4	5
Development	3	2	2
All	0	2	0
Disaster type			
Sudden onset	2	1	4
Man-made conflicts	0	1	0
Hurricanes	0	1	0
Earthquakes	1	0	4
Slow onset	0	0	1
Data origin			
Abstraction from reality	3	0	0
Primary data	5	5	6
Secondary data	1	4	4

effectiveness, to consider sustainability, equity, and deprivation costs. One paper raises the issue of safety of humanitarian workers. There is not a single paper looking at C&V or other new types of aid.

Table 1 also classifies the papers according to the phases of the disaster lifecycle. A preponderance of entries deals with disaster relief followed by research on development. Two papers consider integration between relief and development programs.

Table 1 organizes the papers by disaster type as well. One paper deals with a man-made disaster, whereas most papers study natural sudden-onset disasters, with hurricanes and earthquakes being most popular. For example, the *POM* special issue (Starr and Van Wassenhove 2014) contains four papers on disaster response: two are sudden onset, one of which was an earthquake, whereas two do not specify the type of disaster. The other papers focus on development or preparedness. The numbers in Table 1 do not always add up to the number of papers in the special issues, because some may fit in more than one row. Specific disasters studied are the 2010 Haiti earthquake (three papers), 2012 Hurricane Sandy, 2010 Pakistan floods, and 2005 Niger famine. Countries/areas studied are the United States (five papers), Haiti (three papers), Colombia and Turkey (two papers), Pakistan, Niger, sub-Saharan Africa, Uganda, Sudan, Afghanistan, and Ethiopia. Attention is clearly on large so-called CNN disasters in more developed regions, perhaps because of easier access to data.

Finally, Table 1 shows a commendable trend of using real data, be it primary or secondary. Primary data come from expert interviews/surveys or directly from humanitarian organizations. Secondary data come from sources, like the Emergency Events (EM) database (<https://www.emdat.be/>), weather forecasts, World Bank, and social media (Twitter). The HOs studied are typically big players (UNHCR, WFP, MSF, Federal Emergency Management Agency [FEMA]), except for in one paper on Riders for Health, a smaller non-governmental organization (NGO).

The introductory papers of the three special issues emphasize that OM/OR can strongly support humanitarian practitioners provided that it deals with pressing real problems and translates research findings into easily implementable tools with effectiveness that can be verified. Optimizing constrained resources is the strength of OR. However, the introductions to the special issues also raise concerns about the practical relevance of current humanitarian operations research. We strongly subscribe to this and discuss how future research could be more impactful (i.e., support the work of humanitarian practitioners and/or help beneficiaries).

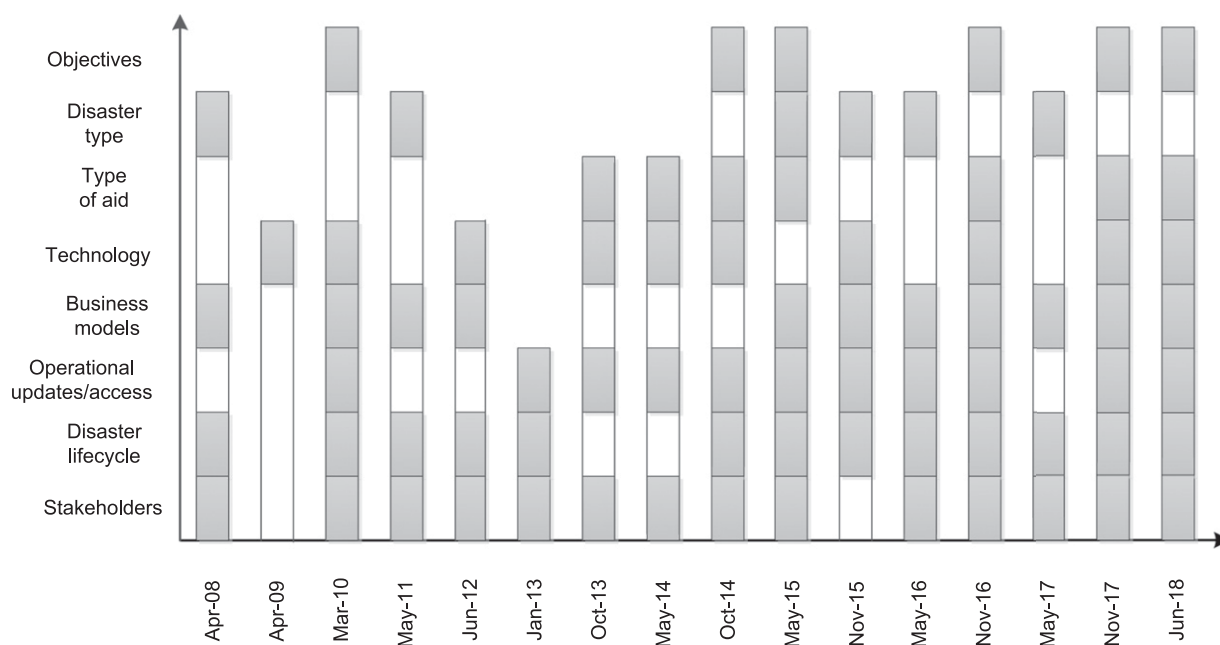
4. Matching Research with Practice

There are many opportunities for researchers to imagine problems by reading the news on disasters. Nice new algorithms and theorems can be developed for these made-up problems. Clearly, this can introduce a strong research bias on highly mediatized large disasters in developed countries as well as a focus on stylized problems that lack external validation. This is perfectly understandable (although not necessarily justifiable) given the messy dynamic and volatile context of disasters. It takes time and effort to get a grip on the real problems of humanitarian organizations. However, if our discipline aspires to have a positive impact, we need to reach out and listen to humanitarian practitioners.

In this paper, we let humanitarian practitioners speak by extracting information from the conferences organized by the Logistics Cluster, because this inter-agency group captures more characteristics of the humanitarian community than any single organization (Gralla et al. 2014). The Cluster is activated when there are response and coordination gaps in logistics and the country response or logistics capacity is unable to meet needs. All humanitarian organizations, international or local, can be members, and the Cluster currently has more than 50 regular partners. At field level, the Logistics Cluster organizes and chairs coordination meetings to streamline activities and ensure optimal use of resources. Its website provides a full overview of active operations and current activities (<https://logcluster.org/>). In 2018, the Logistics Cluster supported 606 organizations (including national and international NGOs, UN agencies, and governments) across 13 operations. At field level, they organized 307 coordination meetings; at global level, they organized two conferences joined by 79 organizations (<https://logcluster.org/annualreport/2018/>).

In our effort to identify some of the real needs of humanitarian practitioners and how they evolve over time, we identified the subjects discussed at the 16 conferences organized by the Logistics Cluster between 2008 and 2018. We attended several of these meetings, and our close contacts with the Cluster and many member organizations give us a good understanding of the discussion topics. Following the seven characteristics in Section 2, Figure 1 depicts the conferences in chronological order. Figure 1 also includes the *updates* of the Logistics Cluster operations and access to beneficiaries. The grey bars indicate when a specific characteristic was discussed.

Note that the meetings discussed civil, military, government, local, and intercluster partnerships and the challenge of persuading different stakeholders, especially donors, of the importance of logistics in disaster response (logistics advocacy). Preparedness

Figure 1. Frequency of Discussion Characteristics in Logistics Cluster Practitioner Conferences

was clearly the disaster lifecycle phase most frequently discussed. Updates on operations were given on Afghanistan, Bangladesh, Central African Republic, Ebola response, Ethiopia, Haiti earthquake, Iraq, Mozambique, Nepal earthquake, Philippines, Somalia, South Sudan, Syria, and Yemen. The business models discussed were shared services and leasing for fleet management. Technology discussions focused on relief items tracking, infosystems, data gathering, and interoperability. Challenges with C&V operations were brought up when discussing type of aid, whereas looking for the most appropriate key performance indicators (KPIs) was raised when the subject was objectives.

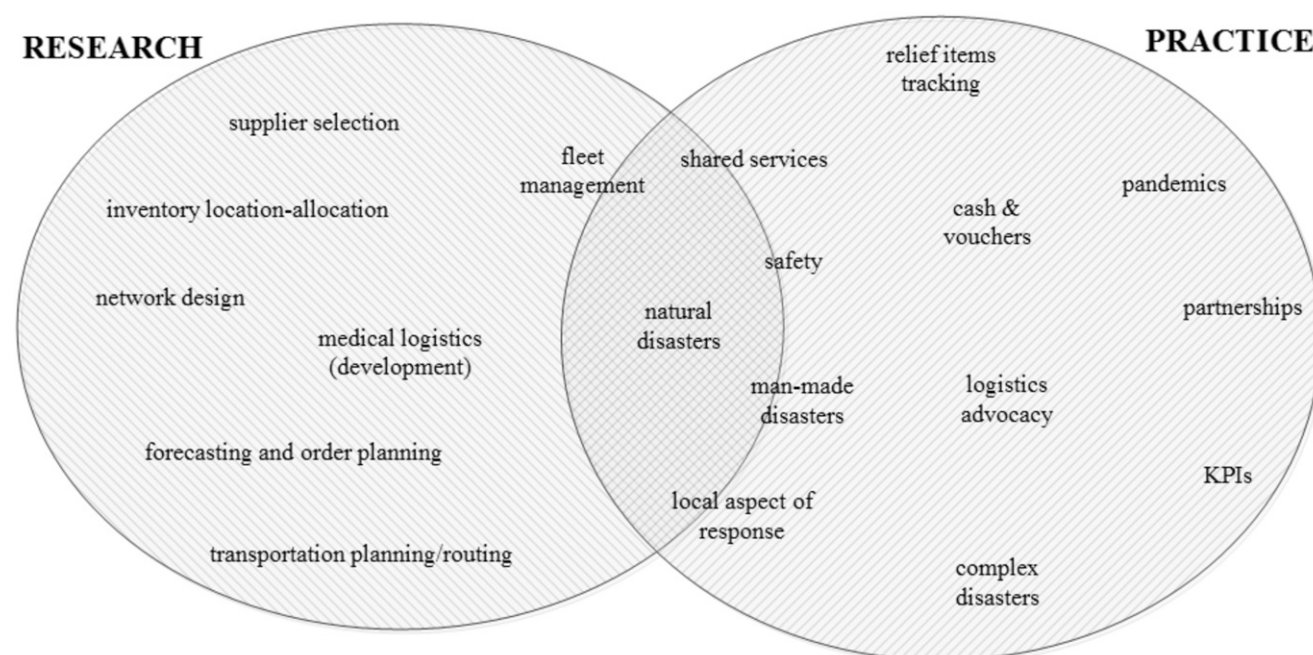
Figure 1 shows that the changing role and number of stakeholders, specifically partnerships and collaborations, have been recurring themes. Of course, the Logistics Cluster's role is to coordinate disaster response, and therefore, the conferences are clearly biased toward this, especially the earlier ones. For example, inter-cluster collaboration was only discussed at the first conferences. However, because participating organizations vote on the topics of the next conference, they clearly bring their own concerns to the table and not only those of the Logistics Cluster management team. Enhancing the logistics capacity of local organizations was raised in 6 of the 10 most recent conferences, and logistics advocacy was raised in the last 4. Preparedness (disaster lifecycle) was discussed in 10 of 16 conferences and in the last 7. Shared services (business models) and how to move them forward were raised in 10 of 16 conferences and in the last 6. As for technology, relief items tracking came up in 7 of the first 11

conferences, whereas innovation and data gathering as well as interoperability were discussed in the 4 most recent conferences. Cash and vouchers (type of aid) were raised in 7 of the last 10 conferences. As for disaster types, medical logistics was only discussed in six conferences but in five of seven recent meetings, showing the urgency to improve the response to pandemics, like Ebola.

The conferences mainly dealt with man-made conflicts and complex disasters. A typical complex disaster is the cholera outbreak after the 2010 Haiti earthquake. Complex disasters discussed were Afghanistan, Bangladesh, Somalia (twice), Central African Republic, Ethiopia, Iraq, Yemen (three times), South Sudan (four times), and Syria (five times). Natural disasters in Mozambique, Nepal, and the Philippines were discussed less frequently. Despite the biases that may be present, the topics discussed at the Logistics Cluster conferences during the 2008–2018 period should give a solid indication of the priorities and concerns of practitioners.

The next logical step is to compare Figure 1, listing the challenges of humanitarian practitioners, with Table 1, indicating the focus of academic research. First, this comparison shows a gap, which we tried to visualize in Figure 2. The evolution of academic research is not well aligned with current concerns of practitioners. Although the Logistics Cluster conferences focus strongly on man-made and complex crises, only one paper in the special issues deals with a *man-made* conflict, and none tackle *complex disasters*. Academic papers have mostly dealt with response to large natural sudden-onset disasters. This is also confirmed by the literature review on humanitarian

Figure 2. Matching Research with Practice



logistics and supply chain management by Jabbour et al. (2017). Second, although *access to beneficiaries* is the most popular objective in the special issues, it is handled from a road *infrastructure* angle (routing/transportation planning), whereas practitioners are mostly concerned with access to beneficiaries from a *safety* perspective. Security issues are hardly ever considered in academic research, even though they are the number one concern of humanitarian organizations today. Third, important practical problems, like cash and vouchers (type of aid) or pandemics (disaster type), have not received much attention from researchers. The same can be said for all characteristics in the “practice” area of Figure 2. Localization of response (linked to the role of stakeholders of the humanitarian supply chain) and shared services (business models) are but a few of the key practitioner concerns that have hardly been touched on in academic work. All of these obviously offer great opportunities for future research.

What are some of the reasons driving this mismatch between practice and research? We suggest three possible explanations. First, researchers may not have been close enough to practice to properly motivate their work. They sometimes make implicit familiar assumptions that turn out to be invalid in the humanitarian context. Second, some researchers may favor developing rigorous and complex mathematical models that they consider easier to publish in top tier journals over engaging in sometimes tedious but impactful research that closely matches practitioner needs. Some journals indeed focus more on methods and mathematics than on real problems (Sodhi and

Tang 2008). Reviewers may feel uncomfortable with how to appreciate/evaluate work on humanitarian operations. Consequently, researchers may select the easy way out, focusing on methods, and using the context of humanitarian operations to loosely motivate their work as opposed to a genuine effort to contribute to real problem solving. Third, the humanitarian world is constantly changing, and this is hard even for humanitarians. Now that they figured that they had finally cracked the complexities of supply chains by using knowledge from academic research and the commercial sector (HUMLOG 2.0), their whole world has changed again: pandemics, complex disasters, technology, big data, cash and vouchers, large numbers of moving refugees, security issues, strongly reduced funding, pressures to collaborate (including with the private sector), and building local capacity (HUMLOG 3.0). Research, if not properly informed by practice, may clearly lag instead of being timely and impactful.

It seems that many researchers have welcomed humanitarian operations as an interesting research topic, but the large output of academic papers did not necessarily impact practice much. This section has argued that there is a gap between research and practitioner needs and suggested some reasons. More effort is needed to produce research relevant to practice (Kunz et al. 2017). We claim that this gap is also a great opportunity for OR/OM researchers.

5. A World of Opportunity for OR/OM Researchers

Recent humanitarian operations literature discusses the complex nature of the sector (e.g., Van Wassenhove

and Besiou 2013, Starr and Van Wassenhove 2014, Besiou and Van Wassenhove 2015, Pedraza-Martinez and Van Wassenhove 2015, Besiou et al. 2018, Kovács and Moshtari 2019). At first, the academic world has simply adapted existing methodology developed for commercial operations to this context. This has resulted in a plethora of papers very valuable in upgrading practitioners' basic knowledge and skills on operations and supply chain management. However, there are obvious limits to this approach, especially if the complex nature of the humanitarian operations context is not fully incorporated. It seems that most of the OR/OM literature on humanitarian operations still focuses on HUMLOG 1.0 and HUMLOG 2.0 while the sector is rapidly transitioning to HUMLOG 3.0. The great opportunities for novel and impactful research on HUMLOG 3.0 should not be missed.

Academics need to step outside their comfort zone and face the real needs of practitioners if they want to make a lasting impact. Climate change; environmental deterioration; and general economic, social, and political unrest affect disaster types, leading to more pandemics and man-made and complex disasters. Models developed by academics need to accommodate interconnected disaster lifecycles with changing horizons. Consider a man-made disaster like the Syria crisis and refugee challenge. Clearly, this does not correspond to the traditional short-term disaster response phase followed by a longer-term rehabilitation phase. There may be successive waves of intense fighting pushing HOs in and out of crisis mode, combining response with rehabilitation epochs in different regions of the country over several years. Research also needs to move away from CNN sudden-onset disasters or FEMA response to areas with ample data availability and resources, like the United States, to regions where conditions are very different. We should not behave like the drunk searching for his house keys under the streetlamp but rather, focus more on smaller NGOs dealing with pressing problems, like draughts in Sudan. The needs and potential impact may be much larger there.

The potential mismatch exposed in Figure 2 shows that there are great opportunities for research to put more emphasis on dynamically changing conditions (volatility), the evolving role of different stakeholders in the humanitarian supply chain, and the use of new technology to support innovative business models. Empowering local communities can affect the mitigation of future disasters (Sodhi 2016) and the success of new types of aid, like C&V. Decreased funding and increased pressure to reach the UNSDGs offer opportunities for partnerships between different sectors and the development of new business models. Opportunities for research are abundant.

Specifically, HUMLOG 3.0 requires the humanitarian practitioners to go back to square one and start building new competencies all over again. Researchers can help with this transition but not by clinging to the approach and methods used so far. We need to push the boundaries of our discipline and develop new knowledge, methods, and insights (Van Wassenhove 2019). Indeed, humanitarian operations pose different types of problems, which require extension of our methods and the development of new methods/algorithms that can then, in return, fertilize mainstream OR/OM. Commercial companies also increasingly deal with disruptions, sometimes even in developed environments, like the aftermath of Hurricane Harvey in Houston or the Brexit in Europe. They can learn from how humanitarians deal with crisis situations. Academics should not be afraid to consider multiple stakeholders, use appropriate objectives (cost-effectiveness and security), put beneficiaries at the center (including deprivation costs or decision autonomy with C&V), and look for creative use of technology and innovative business models, with a realistic view on opportunities and limitations (e.g., of drones). It is no longer solely a matter of logistics or SCM but a much broader, multistakeholder, multidiscipline problem setting. We should be ready to take a holistic system view and include different methods, like field work, case research, simulation/system dynamics (SD), and econometric models in a complimentary way (Besiou and Van Wassenhove 2015). This has a large potential positive impact on the relevance of our work, especially if we are ready to extend our *modus operandi* and skillfully integrate knowledge from other disciplines. The opportunities for exciting and impactful research are quasinlimited.

Researchers could focus more on problems relevant to practitioners; collect field data with all its noise, dirt, and missing elements; and try to make sense of it using context knowledge as well as modern data analysis techniques. We may need to learn how to go through problem-solving loops with practitioners to guarantee that we tackle the real issue, come up with a practical solution, and prove the impact (i.e., close the loop by verifying, testing, or implementing the solutions that we propose). Unsurprisingly, practitioners quickly dismiss work that has not been verified to be of little use for their purposes. One can also note that researchers need to translate results and insights into practical recommendations that are relatively easy to implement or need to create theory from a single case by generalizing their findings for other organizations. By closing the loop in this way, the theory and its impact can and will be tested in the real world (Sodhi and Tang 2008). Our work should be driven by trends (Tang 2017). like the complex dynamic issues in

HUMLOG 3.0, rather than pursuing the trendy. OR/OM can really make a difference, especially in this era of increasing disasters and declining funds.

6. Conclusions

This paper discusses the evolution of humanitarian operations over the past two decades and identifies specific characteristics affected by the dynamic context of the humanitarian sector and the increasing volatility in the world. We distinguish three phases in the evolution of humanitarian operations: past (HUMLOG 1.0), present (HUMLOG 2.0), and future (HUMLOG 3.0). HOs have understood that operations/SCM is critical to reaching beneficiaries in a timely and cost-efficient way and have significantly augmented their capabilities/knowledge since the response to the 2004 Asian tsunami, the clear transition point between HUMLOG 1.0 and HUMLOG 2.0. This improvement mostly concerns the adoption of methods, tools, and software from the commercial sector for conventional problems, like planning and forecasting, and inventory management. Today, the practice of humanitarian operations is facing different challenges, like the impacts of climate change, global political conditions, and technological innovations, and it is quickly evolving to HUMLOG 3.0. Researchers in humanitarian operations have focused on HUMLOG 1.0 challenges, staying close to their comfort zone (e.g., solving location/allocation and vehicle routing problems by use of complex mathematical optimization algorithms in HUMLOG 2.0). This (implicit) research strategy did not always faithfully represent actual problems faced by practitioners, and more efforts could have been made to validate results and translate them into workable practical recommendations (de Vries and Van Wassenhove 2017). Although the work most certainly had academic value, its practical impact has been modest.

By matching OR/OM academic literature on humanitarian operations with challenges faced by practitioners, we identify gaps representing opportunities for researchers. These revolve mostly around (1) the changing number and role of stakeholders in humanitarian supply chains, (2) the interconnected phases in the disaster lifecycle of increasingly complex crises, (3) the changing nature of prevailing disaster types, (4) the complex objectives of HOs, (5) the opportunities presented by modern technology, (6) the changes in the type of aid delivered to beneficiaries geared at more self-determination, and (7) the power of innovative business models. These important changes offer great opportunities to develop new knowledge and provide real support to practitioners.

At this point, we would like to add a word of caution. Our observations are only based on a comparison between topics handled in three special issues (the *POM*, the *JOM*, and the *EJOR*) and those discussed at the

Logistics Cluster conferences over the past 10 years. This is clearly a choice of convenience inspired by the sharp deadline imposed on this paper. More work may be necessary to precisely outline the gaps between academic research and problems faced by practitioners. Nevertheless, the authors were involved in editing the special issues and attended Logistics Cluster conferences. They have participated in many research projects with a multitude of humanitarian organizations (i.e., the analysis also reflects personal experience). Therefore, our observations have some validity.

Taking the above words of caution into account and looking forward, how can practitioners and academics collaborate in productive problem-solving mode? As an academic community, we need to carefully consider the balance between solving messy real problems and publishing neatly purified analytical papers. Going the pure analytical paper route carries the risk of irrelevance and even obsolescence. Going the impactful problem-solving route requires considerable changes to our current academic ecosystem (Corbett and Van Wassenhove 1993, Guide and Van Wassenhove 2007, Singhal and Singhal 2012, Tang 2015, Gallien et al. 2016, Zinn and Goldsby 2017). We may want our work to have practical impact, but we do not necessarily have the time/resources/incentives to close the loop and help implement our findings. Also, developing practical tools and implementing them may not be considered publishable by our journals and societies. It may not even be considered part of academia (Corbett and Van Wassenhove 1993). There are issues to be resolved around what constitutes original and impactful academic work, what types of papers deserve publication, and how to assess the quality of currently less conventional nonalgorithmic or theorem-driven research work. Although this discussion is beyond the scope of this paper, it is an important and healthy one to have when celebrating the 20th anniversary of *Manufacturing & Service Operations Management (M&SOM)*.

Evidence-based research needs to work with whatever poor data are available as opposed to beating available databases to death, because the data are conveniently clean and close at hand, sometimes even at the expense of obtaining little of interest in terms of insights or impact (de Vries and Van Wassenhove 2017). Are we prepared to consider the design science literature, moving from learning about and improving operations of a single organization to developing more general theories that can be verified (Holmström et al. 2009, van Aken and Romme 2012, Kunz and Van Wassenhove 2019)? How far should availability of data and opting for complex methods offering optimal solutions to stylized subsystems drive problem choice (Besiou and Van Wassenhove 2015)? Perhaps, could potential impacts take more of the center stage?

M&SOM, like other OR/OM journals, clearly states an openness to publish relevant, rigorous, and innovative OM research articles (Dai et al. 2020) with impact (Tang 2015). To date, *M&SOM* has not published many humanitarian operations papers or works that relate to the UNSDGs, even though it has expanded its original focus on manufacturing and service operations to include innovative operations, environmentally sustainable operations, and socially responsible operations. Granted, these things take time, but the journal clearly welcomes innovative research on humanitarian operations (e.g., papers studying new business models for shared services, partnerships, or cash and vouchers). *M&SOM* can also excel by considering papers at the interface between environmentally sustainable and humanitarian operations: for example, by studying how climate change affects humanitarian operations by changing the nature and frequency of disasters. Technical papers clearly deserve a place when they study how the multiple objectives, changing time horizons, and overlapping phases of complex disasters affect efficiency and effectiveness of future humanitarian operations.

There are multiple avenues for doing good research that are, at the same time, relevant, impactful, and cost effective. So far, research in the field of humanitarian operations has been useful to practitioners largely because it introduced knowledge from commercial operations. However, humanitarian organizations face rapid and challenging changes, offering great opportunities for researchers to capture problems and collect relevant data. We should not shy away from this because it is challenging. Instead, it would be so much more productive to think about mechanisms to make work in this field more easily accessible (e.g., by showing organizations, like the Logistics Cluster, the potential impacts of our research; by sharing data on disasters, etc.). There is an ocean of interesting and challenging problems out there, and our field can make a substantial and impactful contribution. If OR/OM researchers are not ready to do more of that type of work, who will help humanitarian practitioners face the future and the challenges that it brings? We hope that this paper will motivate our OM research community to embark on this important and impactful research topic.

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