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Humanitarian Operations and the UN Sustainable Development Goals

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During emergencies humanitarian supply chains need to respond swiftly, very often without time for good planning that may end up in excessive waste and emissions. This short-term focus on saving people's lives during disaster responses may harm communities and the planet in the long-run. Even long-term (development) focus on improving the life conditions of the poor may be either unsustainable due to the lack of community involvement or inequitable due to lack of resources. At the same time, countries closer to fulfilling the United Nations sustainable development goals (SDGs) suffer less from disasters but still struggle with issues such as social equity. There appears to be an important link between humanitarian operations and SDGs. This special issue focuses on this interaction through a rich variety of contributions using different methodologies, data and lenses, while proposing ways to advance the SDGs. The special issue clearly shows the value operations management can bring to short-term and long-term problems society faces.

Key words: humanitarian operations; United Nations sustainable development goals; humanitarian logistics; disaster management cycle; sustainability

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1. Introduction

Back in 2015 the United Nations (UN) called for action to improve people's lives and protect the planet by adopting seventeen sustainable development goals (SDGs)¹ to be achieved by 2030. In 2020, the UN published a report (United Nations 2020) assessing the progress on achieving each individual SDG. While there is positive progress on some goals, for example, access to safely managed drinking water, for others like SDG16 related to peace, the trend is unfortunately negative, with 2019 being a record year for the number of people fleeing war, persecution, and conflict.² Often, conflict is at the core of complex humanitarian crises. For example, the greatest needs for humanitarian aid are in Yemen, Democratic Republic of Congo, Afghanistan, Sudan, and Syria.³ As to zero hunger

(SDG2), the forecast for 2021 was 40% higher than 2020, with 235 million people in need of urgent food aid worldwide.⁴ The COVID-19 pandemic has clearly increased the gap between the current status of progress on the SDGs and the 2030 goals. The global situation suggests the SDGs will most probably not be achieved (Sumner et al. 2020).

The 2016 World Humanitarian Summit—organized by the UN—links humanitarian aid and the SDGs. In particular, it proposes that “substantial reduction in humanitarian needs also requires increased investment in national, local and regional [disaster] preparedness and establishing predictable response arrangements, such as shock responsive social protection and safety nets.”⁵ Moreover, the Summit states the need to strengthen community resilience and women involvement as well as “investing in data, analysis and early warning, and developing evidence-based decision-making processes that result in early action.”⁶ In other words, the Summit asserts that the link between humanitarian operations and the SDGs requires a broad view of humanitarian

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operations including development activities and evidence-based decision making.

This special issue takes such a broad view of humanitarian operations and collects evidence-based papers at the intersection of humanitarian operations and SDGs, showing the urgency for more research in this area. In practice, many humanitarian stakeholders still approach development and relief programs in silos (Lewin et al. 2018). Research in operations management should not make the same mistake but study the intersection between shorter-term humanitarian operations and longer-term SDGs.

Humanitarian supply chains not only play a critical role in saving people's lives during emergencies, but also in improving quality of life during the recovery phase. Short-term, short-sighted relief interventions, however, can also harm communities in the long-term, increasing the number and impact of disasters even more. For example, sudden-onset disaster response requires quick action to save as many lives as possible, and this may happen without much consideration for how the impact area will be left after the intervention. Also, long-term development programs require cost-efficient procurement, and this may hamper sustainable interventions. Sometimes many unsolicited donations or too many items are brought to the field, due to poor planning and coordination (Holguin-Veras et al. 2012). Both may increase environmental degradation. Moreover, humanitarian organizations, for very good reasons, may compete for donations or be reluctant to building partnerships with other stakeholders, going against what the partnership for the goals (SDG17) tries to accomplish. Similarly, when SDGs focusing on higher level regional or global goals are not achieved, for example, reduced inequalities (SDG10), these inequalities can become humanitarian problems like increased poverty (SDG1) or reduced universal access to health (SDG3). Humanitarian operations and SDGs clearly interact both ways.

This introductory piece proposes an integrative view of humanitarian operations and the SDGs. We argue that this integration is possible if humanitarian operations take a broad perspective that encompasses all the phases of the disaster management cycle (preparedness, response, recovery, and mitigation) (section 2). In other words, we advocate for a perspective that examines short-term disaster response as well as long-term development operations. We explicitly connect the papers accepted for the special issue to the SDGs and identify the interactions between SDGs investigated in these papers (section 3). Moreover, we identify research areas that need further attention (section 4) and close with a discussion of how COVID-19 affects the findings of the papers in the special issue (section 5).

2. An Integrative View of Humanitarian Operations Management and the SDGs

This section elaborates on the interaction between humanitarian operations management and the SDGs. First, we explain our approach to humanitarian operations management in detail. Second, we present a systemic view of the SDGs. Third, we integrate humanitarian operations management and the SDGs.

2.1. Humanitarian Operations Management

Humanitarian operations management, humanitarian logistics, and humanitarian supply chain management often refer to the effective and efficient management of (logistics and supply chain) processes—within and between organizations—that are in place to deliver assistance to those in need, while respecting the humanitarian principles of humanity, impartiality, neutrality, and independence. The humanitarian principles aim to guarantee that assistance is delivered “without adverse distinction.”⁷ The scope of assistance delivery in humanitarian settings can be narrow, focusing exclusively on the response to humanitarian crises and disasters—or broad, focusing on relief through disaster preparedness, and response, as well as development through recovery, and mitigation, the so-called disaster management cycle (Tomasini and Van Wassenhove 2009). In low- and middle-income countries (LMICs), development aid often overlaps with the later phases of recovery and mitigation in the disaster management cycle.

This special issue takes a broad perspective on humanitarian operations management for several reasons. First, humanitarian organizations, in their effort to respond as quickly as possible, tend to underestimate the vicious cycle of natural disasters further increasing poverty and vulnerability (Sodhi 2016). People experiencing disasters get or stay poorer, and poverty makes them vulnerable to further natural hazards. As such, the number of people impacted grows over time (as in any such vicious cycle), desperately requiring intervention.

Second, disasters rarely happen without a warning, and warnings should trigger preparedness activities. For example, every year the US Federal Emergency Management Agency (FEMA), prepares for the hurricane season by pre-positioning inventory and signing contracts with local suppliers for aid delivery. If a hurricane strikes, FEMA deploys the pre-positioned aid, which contributes to an effective disaster response. So, it makes operational sense to study the interaction between disaster preparedness and disaster response.

Moreover, the level of preparedness of a community depends on long-term mitigation actions taken to

reduce the risk of disasters. For example, Aceh Province in Indonesia suffered catastrophic losses during the 2004 Asian tsunami. The tsunami hit Aceh only 30 minutes after the earthquake and it took 15 minutes for the early warning system to alert the population. Since then, Aceh Province invested in early warning systems reducing the time to alert to 5 minutes. This community also invested in shelter infrastructure. But these investments have not always backed up with evacuation training in local schools and neighborhoods, which would be vital for people to take advantage of mitigation investments (Rayawan et al. 2021). So, the link between mitigation and preparedness also needs attention.

Once the response that provides life-saving assistance ends, communities face the challenge of recovery, which often involves the same organizations that participate in the initial response. In doing so, these organizations leverage on the supply chains they employ for disaster response. However, it is not always easy to know when disaster response ends and recovery starts, which creates issues with the different donors funding either disaster response or development programs (Lewin et al. 2018). So, it makes operational sense to study recovery. Similar arguments can be made about the relation between recovery and mitigation, often referred to as “build back better,” that is, with more resilience. Building back better overlaps with capability building in development and focuses at breaking the vicious cycle of disasters creating even more disasters.

Development aid is defined as “aid expended in a manner that is anticipated to promote development, whether achieved through economic growth or other means.”⁸ Clearly, the level of development of a community affects the different phases of the relief effort in the disaster management cycle. For example, the 2010 Haiti earthquake affected the two countries—Haiti and Dominican Republic—located in the Hispaniola island (size comparable to Ireland). While the earthquake killed more than a quarter of a million people in Haiti, only four people were reported dead in the Dominican Republic, and this difference cannot be explained by distance to the epicenter alone. In 2010, Haiti’s GDP per capita was US \$1172 while the Dominican Republic’s was US \$5555.⁹ Typically, more developed communities suffer less and recover faster from disasters than less developed ones, by being better prepared and more resilient. The economic status of a nation is, however, only one for the factors determining the impact of disasters.

Of course, our integrative view does not suggest that every research article on humanitarian operations management should investigate the entire disaster management cycle. Instead, we propose that research should contextualize the problem within the broad

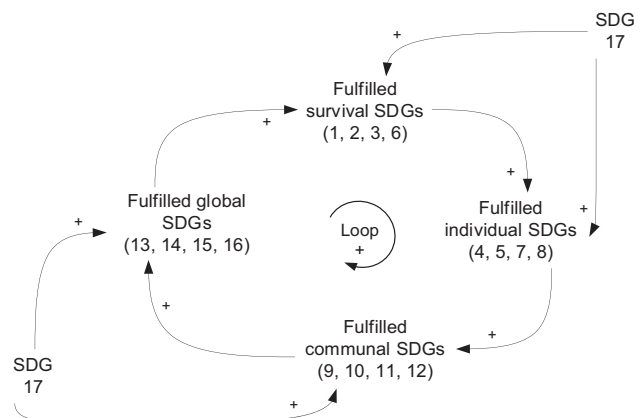
framework of humanitarian operations management. This framework supports the view of SDGs as a system.

2.2. SDGs as a System

Countries depend on their economic strength to reach the SDGs. In the poorest countries, a large percentage of the population faces difficulties satisfying critical survival needs and some suffer from extreme poverty (SDG1), hunger (SDG2), limited or zero access to health services (SDG3), and water and sanitation (SDG6). From now on we call SDGs 1, 2, 3, and 6 *survival SDGs*. Most deaths following disasters occur in LMICs.¹⁰ The closer countries are to achieving these four SDGs, the more they support their population to improve their quality of life by promoting gender equality (SDG5), decent work and economic growth (SDG8), access to quality education (SDG4), and affordable and clean energy (SDG7). From now on we call SDGs 4, 5, 7, and 8 *individual SDGs*. These individuals then want to give back to their societies and countries by investing in industry, innovation and infrastructure (SDG9), sustainable cities and communities (SDG11), responsible consumption and production (SDG12), and reducing inequalities (SDG10). From now on we call SDGs 9, 10, 11, and 12 *communal SDGs*. If national governments, the private sector and civil society do not coordinate and invest in these communal SDGs global challenges will arise regarding climate (SDG13), life below water (SDG14), life on land (SDG15), and peace and justice (SDG16). We therefore refer to SDGs 13, 14, 15, and 16 as *global SDGs*. The UN suggested building global partnerships (SDG17) between national governments, non-governmental organizations (NGOs), the private sector, and civil society to be the capstone objective to achieve the SDGs.

Figure 1 presents the interactions discussed. Each arrow represents an interaction, for example, an

Figure 1 Macro-Interactions of SDGs



increase in SDG17 can affect the fulfilment of survival SDGs (1, 2, 3, and 6). Traveling around the loop, we notice that an initial increase of a variable comes back to the same variable to further affect it. For example, we understand that fulfilling more survival SDGs (1, 2, 3, and 6) offers the opportunity to the individuals to focus on improving their quality of life by focusing more on individual SDGs (4, 5, 7, and 8), and afterwards to give something back to their communities (SDGs 9, 10, 11, and 12). By fulfilling more communal SDGs, global SDGs (13, 14, 15, and 16) will be supported and it will be easier for individuals to outgrow their survival SDGs. Since the initial increase of fulfilled survival SDGs (1, 2, 3, and 6) ultimately ends in an increasing effect on the same variables, the feedback loop is characterized as a positive feedback loop. Hence the seventeen SDGs intersect and influence one another, as depicted in Figure 1, which makes identification of root causes in case one of them fails to be realized very difficult.

2.3. Interaction Between Humanitarian Operations Management and the UN SDGs

How can humanitarian operations management support the SDGs? If the approach is about integrating shorter-term humanitarian operations and longer-term sustainable living conditions, then there is clear potential for contribution to SDGs. Consider Care International, which tackles “the underlying causes of poverty and social injustice to bring lasting change to the lives of poor and vulnerable people.”¹¹ Care International implements humanitarian programs that range from emergency response to women’s economic empowerment.

Humanitarian operations can contribute to the SDGs when they take a longer-term approach to disaster management. From a systemic perspective, humanitarian operations reduce the risk of future disasters and increase community resilience, which contributes to fulfilling SDGs 1–16. Strengthening the SDGs in turn improves the potential success of future humanitarian operations and the lower dependency on them, by ending poverty, ensuring prosperity, and protecting the planet (Figure 2). Perhaps the best way to illustrate the interaction between humanitarian operations and the SDGs is by discussing the papers included in this special issue. They provide very strong evidence-based research on this interaction.

3. The Papers in this Special Issue

The call for papers of this special issue encouraged submissions at the intersection of humanitarian operations and SDGs, clearly showing their connection to both topics. We asked the authors for rigorous research solidly anchored in practice, explicitly

Figure 2 Breaking the Vicious Cycle of Disasters through the Sustainable Development Goals [Color figure can be viewed at wileyonlinelibrary.com]



describing the problem context, justifying the data used, and clearly discussing how the findings were validated and how they could be applied in the field. We requested the authors to seek feedback from practitioners by asking them to confirm the papers tackle SDG-related issues grounded in reality, and results are useful in the field.

We were particularly interested in stimulating research that contributes to better understanding the complexity of the SDGs, that is, robust studies presenting relevant and original work, using different disciplines and methodologies. The papers could fit one or more of the following categories:

1. Analytical modeling: Papers well-grounded in frameworks that capture defining characteristics of SDG settings.
2. Empirical: Papers that use public data, proprietary data, or experiments to test new theories related to UNSDGs.
3. Multimethod: Papers that combine different methods, such as case studies, interviews, for triangulation purposes.
4. Multidisciplinary: Papers that build upon knowledge or methods from multiple disciplines.

Based on the interaction between humanitarian operations and SDGs, the call for this special issue was published in August 2019. The original deadline for submission was January 31, 2020. Due to multiple requests and the impact of COVID-19, we extended the deadline to May 31, 2020. In total, the authors

submitted 76 papers by the extended deadline. The regular POM journal system handled seven papers where all guest editors had a conflict of interest. Ten papers were finally accepted by June 2021.

Next, we summarize each paper emphasizing the importance of the topic being discussed, methods used, and fit with the special issue objectives.

3.1. Trying and Failing: Biases in Donor Aversion to Rejection, by Daniels, Kaitlin; Valdes, Leon

The UN recognizes the role donations play to achieve the SDGs: in its list of “170 daily actions to transform our world,” they suggest to “fill a box with non-perishable foods and donate it to a food bank”; and “[not to] keep clothes or other items you are not using. Donate them,” (United Nations Office at Geneva 2020). However, *unwanted donations* do not contribute to the SDGs and pose a unique challenge to nonprofit organizations (NPOs); rejected donors may be reluctant to give in the future. This study helps to address this challenge by improving our understanding of donors’ responses to rejected donations, shedding light on behaviors and biases that NPOs should be aware of and proposing interventions to mitigate them. The study uses a controlled experiment where subjects make a costly effort to donate but their donations can be rejected with some fixed probability. Rejection affects donors’ beliefs about the acceptance of future donations.

Daniels and Valdes (2021) mainly address SDGs 1 (no poverty) and 12 (responsible consumption and production). NPOs are on the front line of the fight to eradicate poverty and they rely on donations (including in-kind, the focus of this work) to further their missions. At the same time, donations give new life to a used good that may be destined for the landfill. Depending on the type of donation, this work also has implications for goals such as SDGs 2 (zero hunger, e.g., food donations to food banks and other charities), 3 (good health and well-being, e.g., blood donations), and 4 (quality education, e.g., donations to public libraries and public schools, which are also included in the UN’s list of 170 daily actions).

3.2. A Systems Framework for International Development: The Data-Layered Causal Loop Diagram, by Blair, Courtney; Gralla, Erica; Wetmore, Finley; Goentzel, Jarrod; Peters, Megan

It is essential that development scholars and practitioners have tools to understand the complex dynamics of global and local human systems and the key drivers of their behavior. System dynamics tools appear to be well-suited to address this challenge. However, they must be adapted to the typical data-poor and fragmented environment of development work in which it is simply quasi-impossible to gather all necessary

information for detailed simulations. This study’s key contribution is an adaptation of the system dynamics approach to fragmented and data-poor environments like the ones of developing countries, by enabling limited inference of behavioral drivers without simulation. Specifically, the causal loop diagram is augmented with a data layer: data are added to each variable in the diagram to describe its status, such as the extent to which behaviors are adopted or conditions are true, and its change over time. The data-layered CLD was developed through a four-year engagement with USAID/Uganda. The work strongly aligns with the objectives of this special issue by developing a tool adapted to the complex dynamic environment of many SDG situations, and working closely with practitioners to test and implement the methodology over an extended period of time. The complexity of SDG-related issues does indeed beg for engaged scholarship and closing the loop with the field and practitioners.

Given the research context of working directly with the USAID/Uganda Office of Economic Growth to support agricultural market development, Blair et al. (2021) work most directly applies to SDG2 (end hunger, achieve food security) and SDG8 (promote sustained, inclusive, and sustainable economic growth). The study of agricultural financing readily extends to other SDGs since much of the system structure—such as financial institutions, informal loans, and mobile money—is essential for increasing access to other vital resources like health (SDG3), water and sanitation (SDG6), and energy (SDG7).

3.3. A Multi-method Approach to Prioritize Locations of Labor Exploitation for Ground-based Interventions, by Kougkoulos, Ioannis; Cakir, M. Selim; Kunz, Nathan; Boyd, Doreen; Trautrimis, Alexander; Hatzinikolaou, Kornilia; Gold, Stefan

More than 40 million people suffer from modern slavery and other forms of labor exploitation worldwide. This study assesses labor exploitation risks of migrant workers in informal settlements. In particular, the paper identifies eight exploitation risk criteria: percentage of workers registered, hours of work per day on average, suitable work clothing provided by farmers, hygiene, safety measures, measures to protect against cold provided by farmers, percentage of workers speaking the host country’s language, and informal settlement visibility from village and main roads. Next, the paper applies the model to six settlements in Southern Greece. The authors use multi-criteria decision analysis (MCDA) to develop a decision-support system to help decision makers identify labor exploitation. This study “closes the loop” because the decision-support system is currently being used by the Greek Government as a decision-support tool in the strawberry production

area of Nea Manolada, Greece. This study is one of the first attempts to model labor exploitation in humanitarian operations management.

Koukoulou et al. (2021) mainly deals with SDG8 (decent work and economic growth) because it provides a framework to identify labor exploitation. In addition, the study also addresses SDG1 (no poverty), SDG3 (good health and well-being), and SDG10 (reduced inequalities) because populations in risk of labor exploitation often are poor and deprived of basic services such as healthcare and education.

3.4. Development-Aid Supply Chains for Economic Development and Post-Disaster Recovery, by Sodhi, ManMohan; Knuckles, James

Disasters do not only affect countries' infrastructure and economic situation but also lead many people to extreme poverty. Development-aid supply chains (DASC) focus on economic development in a region or its long-term recovery following a disaster. Very often the DASC are funded by large donors or governments. Literature on DASC is scarce and hence this study investigates what DASCs are, the role they play in economic recovery by reducing deprivation and in development by reducing dependence on humanitarian aid. Sodhi and Knuckles (2021) conducted a field study across five solar-lantern supply chains set up in Haiti. These DASCs were originally developed for recovery following the massive 2010 earthquake. So improving the operations of these five solar-lantern supply chains ensures access to affordable, reliable, and renewable energy for everyone. The study finds that funding, while crucial for reducing deprivation in the short term, may increase the dependence on humanitarian aid rather than reduce it. This finding is very important since it points to a big issue of why it is difficult for developing countries suffering from emergencies to stop being dependent on humanitarian aid.

The paper mainly deals with SDG1 and SDG8, and also touches upon SDG7. To quote from the opening paragraph: "The United Nations (UN) SDGs 1 seeks to end poverty in all its forms everywhere. SDG8 aims to promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. For regions such as post-2010-earthquake Haiti, with only 44 percent of the population having access to electricity, SDG7 – seeking to ensure access to affordable, reliable, sustainable, and modern energy for all – is also relevant."

3.5. Improving Outcomes in Child Care Subsidy Voucher Programs under Regional Asymmetries, by Arora, Priyank; Wei, Wei; Solak, Senay

An average family in the US spends as high as 60% of their annual income on child care. Therefore, families

that cannot afford child care receive subsidy vouchers. This study investigates the operational challenges of child care subsidies in communities in need. A government agency delivers child care subsidies to families in need, but sometimes these families decline the subsidies because they do not have access to voucher-accepting providers located close to the family's home. The government agency can allocate scarce resources to increase the pool of voucher-accepting providers (outreach), which ultimately reduces inequity in subsidy allocation. But the agency also strives to improve the delivery of child care services by participating providers. The analytical model in this study minimizes the inequity in voucher allocation to income-eligible families by the government agency subject to a budget constraint. The model finds cases in which inequity is reduced when more funds are allocated to regions with the lower proportion of income-eligible families. The authors apply the model to a service area in Massachusetts, United States, and find an equity improvement of 7%. While the setting is based in the United States, the modeling framework can be adapted to investigate equity in subsidy allocation in other countries.

Arora et al. (2021) directly relates to SDG4, which aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." Second, this study relates to SDG5 (gender equality). In particular, the proposed solution can help decrease gender inequalities by prioritizing outreach in regions with disproportionately lower maternal labor force participation. More often than not, due to an insufficient number of voucher-accepting providers, mothers who would otherwise be able to accept and use vouchers cannot re-enter the workforce. Furthermore, since increasing accessibility of high-quality child care helps parents in low-income families maintain employment or attend school, which in turn helps them break the cycle of poverty, this study also relates to SDG1 (no poverty) and SDG10 (reduced inequalities).

3.6. Aid Allocation for Camp-Based and Urban Refugees with Uncertain Demand and Replenishments, by Azizi, Shima; Bozkir, Cem Deniz Caglar; Trapp, Andrew C.; Kundakcioglu, O. Erhun; Kurbanzade, Ali Kaan

As of June 2019, the United Nations High Commissioner for Refugees (UNHCR) estimated that well over one-third of the 70.8 million forcibly displaced people worldwide, nearly 26 million, are refugees, that is, have both crossed an international border in search of safety, and have been granted corresponding status. When compared with just ten years earlier this figure represents a staggering 70.4% increase. How should humanitarian aid be distributed from a

central decision-maker to a refugee camp system, for example, in Turkey? And, at what point should a camp reserve aid for camp-based refugees, rather than sharing with nearby urban refugee populations? In light of uncertainties in medical aid distribution, namely camp-based demand, urban demand, and replenishment cycle duration, the authors present a stylized inventory management system and derive a sharing decision rule for each refugee camp, below which satisfying a demand occurrence from urban refugees should be rejected. The approach is then used to study aid allocation for a Syrian refugee camp system in southern Turkey motivated by real data, as well as for synthetic datasets. Results are validated by an extensive simulation study that shows broad support for the optimal thresholds and allocations to generalize across varied key parameters and distributions.

Azizi et al. (2021) deal mainly with two UN SDGs. The first is SDG16 (peace, justice, and strong institutions), which as recently noted by the UN High Commissioner for Refugees, includes “finding durable solutions for those already displaced.” The paper also relates to SDG10 (reduce inequality within and among countries), as better aid allocation policy contributes to the “planned and well-managed migration policies” target by helping facilitate orderly, safe, regular, and responsible migration and mobility of people. Moreover, the paper develops optimal ways to allocate aid to vulnerable refugees (SDGs 1, 2, and 3).

3.7. Elicitation of Preference among Multiple Criteria in Food Distribution by Food Banks by Hasnain, Tanzid, Sengul Orgut, Irem; Ivy, Julie

More than 800 million people globally are estimated to suffer from food insecurity both in developing countries, mainly due to famines, and in developed countries, mainly due to income inequality. Food banks collect usable food from donors (e.g., grocery stores) and distribute it to food-insecure households. In doing so, food banks need to balance three objectives: equity, efficiency, and effectiveness. The food bank achieves equity when each demand point (county) receives their fair share of food. Efficiency refers to cost. Effectiveness refers to the amount of food distributed. For example, perfect effectiveness is equivalent to zero waste. Based on a decade long collaboration with a food bank in the United States, Hasnain et al. (2021) build a multi-criteria optimization model to help food banks manage the trade-offs between three objectives. They use data from their partner food bank to feed the model and share their findings with the food bank. Their findings illustrate the cost of equitable and effective distribution.

Hasnain et al. (2021) directly address two of the UN SDGs: SDG2 (zero hunger) and SDG10 (reduced

inequalities). In seeking to identify solutions to support food banks in achieving these goals, this study also indirectly addresses two other UN SDGs such as SDG1 (no poverty) and SDG3 (good health and well-being).

3.8. Inventory Policies for Pharmaceutical Distribution in Zambia: Improving Availability and Access Equity, by Gallien, Jérémie; Leung, Zachary; Yadav, Prashant

Low-income countries attain less than 25% average service level of essential medicines at public health facilities. This study models the reduction of stock-outs of medicines, such as malaria drugs, specifically aiming to reduce inequality within and among countries in Sub-Saharan Africa. Using inventory management concepts, the paper proposes a simulation model that captures very specific setting characteristics (e.g., demand seasonality, uncertainty in both demand and lead-times, lost sale and equity) that would make an analytical model intractable. Through simulation, the authors compare the effectiveness of different inventory policies and find that an optimization-based policy outperforms the current base-stock inventory policy for malaria drugs in Zambia. They remark that the optimization-based policy is easy to implement at a low cost. The authors also describe an attempt to “close the loop,” that is, implement the optimization-based policy, led by Zambia’s Ministry of Health. Unfortunately, the implementation came to an end because of lack of funding. The authors highlight the implementation challenges of optimization models in humanitarian operations even when the cost-effectiveness of these models is high. This study models distribution equity using a standard deviation approach that can be easily extended to analyze inventory management of medicines in other Sub-Saharan countries.

Gallien et al. (2021) relate directly to SDG3 (Ensure healthy lives and promote well-being for all at all ages), which explicitly highlights the equitable access to essential medicines and vaccines for all human beings. It also relates to SDG10 (reduce inequality within and across countries) because it aims to reduce the gap in access to essential medicines that exist between developed countries and developing countries.

3.9. Site Visit Frequency Policies for Mobile Family Planning Services, by De Vries, Harwin; Swinkels, Lisa E.; Van Wassenhove, Luk N.

The UN Population Division (2009) assesses that for “every dollar spent in family planning, between two and six dollars can be saved in interventions aimed at achieving other development goals.” So enhancing access to family planning services is recognized as a

key strategy to accelerate progress. Mobile family planning teams play a major role in bringing these services to rural areas and urban slums in LMICs. Such teams operate a limited number of days per year, and need to consciously choose how they allocate these days across sites in the catchment area—that is, how frequently to visit each site. While the consensus is that high-volume sites are to be visited more frequently, current guidelines are loosely specified and weakly adhered to. Based on four years of close collaboration with NGO Marie Stopes International, de Vries et al. (2021) develop and study simple, flexible guidelines which can easily be incorporated into a decision tree or dashboard. In line with current practice, they assign visit frequencies to sites based on a simple metric and data from previous visits. They also prove mathematically that the worst-case optimality gap is very small and show numerically that performance is robust. The findings were discussed with HQ and the Uganda team and the authors address several practical implementation concerns. The study exemplifies how OM can aid progress toward many of the UN SDGs without additional investments but by more effective allocation of resources.

De Vries et al. (2021) relate to SDGs 3 (health) and 5 (gender equality) because they investigate access to family planning services. The implications of enhancing access, however, reach way beyond health and gender equality. Investing one extra dollar in family planning is argued to save many in interventions aimed at meeting other SDGs, including those on poverty (SDG1), hunger (SDG2), and education (SDG4).

3.10. A Cost-Sharing Mechanism for Multi-Country Partnerships in Disaster Preparedness by Rodriguez-Pereira, Jessica; Balcik, Burcu; Rancourt, Marie-Eve; Laporte, Gilbert

Every year, hurricanes hit Caribbean countries during the Atlantic hurricane season. This study focuses on developing partnerships among countries to strengthen multilateral coordination for disaster preparedness. In particular, the inter-governmental Caribbean Disaster and Emergency Management Agency (CDEMA) is responsible for coordinating the disaster management activities of the 18 participating states. To ensure fast and effective regional response, CDEMA operates a collaborative prepositioning network in the region, where emergency relief supplies are stored in strategically located warehouses in four sub-focal countries. Once a disaster hits the region, the prepositioned supplies are immediately dispatched to help the affected countries. The study focuses on this collaborative prepositioning network and develops a multi-objective insurance-based model to equitably (fairly) allocate the costs of this

multi-country partnership among its members, where fairness is formulated by enforcing horizontal and vertical equity as a convex linear combination with user-defined weights.

Rodriguez-Pereira et al. (2021) support the SDG17 (partnerships for the goals) because they investigate strengthening cooperation between nation states in disaster preparedness and supporting capacity building in developing countries. Moreover, since the Caribbean region includes several small island states, which are under significant threat by climate change effects, the paper also supports SDG13 and SDG11, which strives to make cities and human settlements inclusive, safe, resilient, and sustainable, and includes targets that stress the need to protect the poor people in vulnerable situations.

4. The Contributions of the Special Issue

We believe that the papers in this special issue encourage the development of more research at the intersection between shorter-term humanitarian operations and longer-term SDGs. First and foremost, all articles build on real problems and the authors take the reader to different locations worldwide. The work is relevant since most papers were written in close collaboration with practitioners and in some cases, for example Blair et al. (2021), a practitioner is co-author. The work is rigorous since all papers build upon realistic assumptions and use methods correctly. Several papers try to close the loop, which could potentially challenge their generalizability since they were built on a specific case. However, we do not believe this is the case because context and relevance are crucial in this field of study. We hope that this special issue indeed helps close the gap between research and practice. In section 4.1, we discuss how the special issue contributes to the interlink between humanitarian operations and SDGs, while in section 4.2 we raise a few important topics that are missing in the special issue.

4.1. This Special Issue and the Intersection between Humanitarian Operations and SDGs

Back in 2014, Starr and Van Wassenhove (2014) edited a POM special issue on Humanitarian Operations and Crisis Management. The current special issue on Humanitarian Operations and the UN sustainable development goals is the second in the POM journal dealing with humanitarian operations in a time period of seven years. Its emphasis is less on short-term crisis management but rather more on the longer-term developmental side. The introduction of Starr and Van Wassenhove (2014) to the special issue identified the following problems as particularly relevant

for research in humanitarian operations: the lack of real-world data, the centrality of the context, the right objective function, the misalignment of objectives across the different stakeholders of the humanitarian supply chains, information and collaboration and the criticality of the last-mile delivery and the supplier selection. It also raised other important topics requiring more research. For example, that stakeholders like donors often take a decision without knowing the benefit it may entail for society, or that cash and voucher systems needed more attention. Other important issues raised in Starr and Van Wassenhove (2014) were shifts in funding, disaster regions, types and frequency of disasters, importance of humanitarian space, new models of aid and the use of big data.

The papers in the current special issue shed light on some of these topics; for example, Arora et al. (2021) study the implementation of a voucher system, Sodhi and Knuckles (2021) investigate the role of donors in development aid supply chains, Blair et al. (2021) refer to methodological ways of dealing with lack of data, Azizi et al. (2021) focus on refugees who left their homes after a complex disaster, and Kougkoulos et al. (2021) on slavery. At the same time, the broader perspective of the current special issue offered the opportunity to specifically link humanitarian operations to the SDGs and encourage the development of a new field of research.

We asked all authors to explain which SDGs they focus on, both the direct and indirect ones. Since the special issue is at the interface of humanitarian operations and the UN SDGs we were expecting that the survival, the individual, the reduced inequalities and the global partnerships SDGs would feature most frequently. Indeed, except for two papers that could be said to deal with almost all SDGs (Blair et al. 2021, Daniels and Valdes 2021), no paper deals either directly or indirectly with the more communal SDG9 (industry, innovation, and infrastructure), or the global SDGs 14 (life below water), and 15 (life on land). Table 1 presents the SDGs covered either directly or indirectly by the papers in the special issue.

The current special issue also highlights the importance of interconnectedness. OM research often searches for closed-form solutions which are easier to derive from studying problems linearly, but reality is far from linear. The SDGs form a strongly interconnected system. They influence one another and are sometimes closely related, as shown in Figure 1, making a system perspective/ approach critical and prominent in this special issue. For example, de Vries et al. (2021) identify SDGs 3 and 5 as the primary goals their study tries to capture, while SDGs 1, 2, and 4 are then affected indirectly. However, SDG2 affects back SDGs 1 and 3 (Hasnain et al. 2021).

Table 1 Coverage of SDGs in the Special Issue

SDGs	Good health		Quality education	Gender equality	Clean water and sanitation	Affordable and clean energy	Decent work and economic growth	Industry, innovation, and infrastructure	Reduced inequalities	Sustainable cities and communities	Responsible consumption and production	Life below water	Life on land	Peace, justice and strong institutions	Partnerships for the goals
	No poverty	Zero hunger													
Daniels and Valdes	x	x	x												
Blair et al.	x	x		x		x									
Kougkoulos et al.	x	x			x				x						
Sodhi and Knuckles	x					x									
Arora et al.	x														
Hasnain et al.	x	x							x						
Azizi et al.	x	x							x					x	
Gallien et al.	x	x							x						
De Vries et al.	x	x													
Rodriguez-Pereira et al.										x					x

Correctly understanding the problem context is important to capture SDG interactions. Consequently, field work may be necessary along with the use of different methodologies that focus more on the context like case studies, intervention research, design science, interviews, and the like. These methodologies are not very common in papers published in top tier OM journals, but they can facilitate more exploratory research necessary to help “mapping” and “structuring” the territory (Besiou and Van Wassenhove 2015). This special issue includes some examples of papers using such methods like Sodhi and Knuckles (2021) and Kougkoulos et al. (2021) who develop case studies, Blair et al. (2021) who use system dynamics, and Gallien et al. (2021) using simulation, but more work is necessary.

The humanitarian supply chain involves many stakeholders who do not always share the same opinions, rendering evidence-based decision making very important. There could also be a need for using controlled experimentation, as in the case of Daniels and Valdes (2021), instead of developing more analytical models. At the same time, the SDGs also connect a larger ecosystem: different disciplines (e.g., climate science) but also multiple stakeholders and the need for partnerships (SDG17). Operations management research will need to be more open to interdisciplinary topics as exemplified by Kougkoulos et al. (2021) who focus on slavery, a particularly complex issue.

Tracking the progress on the SDGs, monitoring and analysis requires data, data analytics and AI. Data sharing and fact-based decision making becomes more important (de Vries et al. 2021). Data often require preparation for analysis, as shown in Blair et al. (2021). Contextual knowledge and understanding are necessary to make that important step between a huge multitude of raw data from different stakeholders and clean data that can be analyzed.

The plethora of SDGs presented in Table 1 also shows the variety of topics raised in the special issue. Blair et al. (2021) suggest using a data layer on a system dynamics model as a tool to be used in environments where data are lacking, typical for disaster response but also for development work. They also show how the tool was used in a project with USAID in Uganda. Daniels and Valdes (2021) focus on donations; using experiments they try to understand how donors respond when organizations turn down their donations. Sodhi and Knuckles (2021) analyze the role of donors in development-aid supply chains. Their case study focuses on Haiti. Gallien et al. (2021) use simulation to study how different inventory policies for malaria drugs in Zambia affect stockouts. They discuss their efforts in closing the loop between

practice and research by engaging with the Zambian Ministry of Health on how to implement their policies. This study is also a good example of the type of empirical work we were looking for in the special issue. The authors collected all the necessary data through “extensive field work in Zambia (about 4–5 trips between 1- and 2-week long between 2009 and 2016) and continuous relationships/exchanges with employees from MSL, the World Bank, IBM, and Crown agents throughout that period.” This problem is at the interlink between humanitarian operations and SDGs: effective antimalaria drugs distribution is critical in order to prevent outbreaks and achieve the SDGs 3 and 10.

De Vries et al. (2021), Azizi et al. (2021), Kougkoulos et al. (2021), Arora et al. (2021), Hasnain et al. (2021), and Rodriguez-Pereira et al. (2021) study resource allocation. For example, de Vries et al. (2021), together with Marie Stopes International Reproductive Choices, study the allocation of mobile health teams to different locations in Uganda by developing an analytical model. In an effort to close the loop, they show the lack of data does not significantly affect the findings. Azizi et al. (2021) develop an analytical model that studies how to best allocate aid between refugee camps and refugees who live in cities in Turkey. Refugees are also a key stakeholder in the work of Kougkoulos et al. (2021). The authors apply multi-criteria decision analysis to assess exploitation risks on migrant workers in informal settlements in Greece. Their decision-support tool is used by the Greek government, showing this study clearly closes the loop. Arora et al. (2021) and Hasnain et al. (2021) focus on the United States. Specifically, Arora et al. (2021) develop an analytical model to study whether resources should be allocated to provide more vouchers for child care or to increase the pool of voucher-accepting providers. Hasnain et al. (2021) study the operations of food banks, having worked with an organization for many years in an effort to best close the loop. Finally, Rodriguez-Pereira et al. (2021) develop a multi-objective analytical model that can serve as a cost-sharing mechanism among countries that coordinate and jointly invest in disaster preparedness. The Caribbean Disaster and Emergency Management Agency is used as a case study.

4.2. Topics that Need more Research

We are pleased with the richness of topics that the papers in this special issue are bringing, some being relatively new to our field like labor exploitation and refugee camps, raising awareness for these important problems. Nevertheless, a few important topics are not tackled in this special issue. We briefly mention some of these below:

1. **Localization:** For almost a decade now donors are pushing for localization—that is investing locally in order to reduce dependency on external humanitarian aid. There are many examples of activities that can strengthen local infrastructure or markets and suppliers like cash and voucher programs (Heaslip et al. 2018, Sahinyazan et al. 2021), innovative models like retail-in-a-box¹² or training local staff and partners. These activities support the resilience of the countries to future disasters, by improving their preparedness. We would expect that efforts for localization also support the achievement of SDGs. However, local regulations may put constraints on the operations of specific international humanitarian organizations. Building partnerships with local private companies or humanitarian organizations may then be more appropriate.
2. **Sustainability:** The humanitarian supply chain often contributes to waste and CO₂ emissions, affecting climate in a negative way. Donors are now pushing humanitarian organizations to reduce their environmental impact while are also asking for more effective and efficient disaster response operations. But is it possible to achieve these three objectives at the same time or is prioritization acceptable? How can humanitarian organizations change their operations in order to protect the environment rather than harm it? Or as Starr and Van Wassenhove (2014) highlighted “Researchers should also look at more strategic longer term problems humanitarians will have to face.”
3. **Interconnected Supply Networks:** Coordination and partnerships have a key role to play in achieving SDGs. Most research in humanitarian operations has looked at collaboration with the private sector or sharing information with other actors in the chain, for example during disaster response. Recent efforts of humanitarian organizations like pooling of supply chain resources (e.g., joint procurement, transport, storage, and distribution) deserve more attention.

5. COVID-19: How Does it Relate to this Special Issue?

The original deadline for submission to the special issue was January 31, 2020 and, unsurprisingly, nothing was mentioned about COVID-19. Even back then, it was clear that managing to deliver the SDGs by 2030 would be hard (United Nations 2020). Now, some 18 months later, the gap is even larger. Millions of women cannot access family planning services anymore, leading to unexpected pregnancies, more than

350 million children have missed school meals, crucial to their development, and these are just two examples. These changes make this special issue more timely than ever. Researchers have definitely an important role to play in helping to close this widening gap, for example, by doing more with less.

We therefore wonder what our discipline can offer to make things faster and more effective and whether we learned something during COVID-19. The papers included in the special issue were written before the tremendous impact of COVID-19 on the SDGs. We went back to the authors trying to get a better understanding of the impact of COVID-19 on their research topic, on the relevance of their findings and, if they would start their research from scratch post-COVID, what they would do differently. The responses showed that COVID-19, if anything, has increased the urgency of their research. For example, de Vries et al. (2021) note that COVID-19 has strongly affected family planning outreach programs. Need for family planning has evidently remained more or less constant, but women have faced significant access constraints (e.g., due to lockdowns and even scarcer health resources). Marie Stopes International estimates that 1.9 million fewer women have been served by their programs between January and June 2020.

At the same time, Hasnain et al. (2021) observe that the COVID-19 pandemic had significant health and socio-economic impacts on the most vulnerable population groups and it is forecasted that compared to pre-pandemic levels over 130 million more people could suffer from hunger due to the pandemic (United Nations 2021). In the United States, Feeding America COVID-19 impact assessment report shows a 46% increase in need, which translates to an additional 17 million people (Feeding America 2020).

COVID-19 has been met with generosity from donors—despite the increased economic strain, donations in the United States increased by 2% in 2020 relative to the previous year.¹³ However, nonprofits report that, as donations have increased, so has the volume of unusable, “trash” donations they receive and the beneficiaries’ needs (United Nations 2020). The confluence of these events has increased the urgency for nonprofits to develop guidelines to address unwanted donations while continuing to ensure the collection of much-needed goods, making the work of Daniels and Valdes (2021) the more relevant.

COVID-19 has not only created huge inequalities in access to healthcare but also in affordable child care. Given that a disproportionate number of essential workers belong to underserved and marginalized communities, ensuring equitable access to affordable child care is critical to facilitate a safe and robust reopening of the economy. Moreover, a disproportionate number

of mothers have decided to opt out of the workforce to bear responsibilities of child care and they cannot rely any more on grandparents (due to medical concerns). Arora et al. (2021) tool can help split limited funds between offering cleaning and sanitation and other safety-related services to private child care providers, and conducting outreach, especially in rural and remote regions, to expand the pool of voucher-accepting child care providers.

COVID-19 has also affected developments on decent work and economic growth. First, lockdowns have disproportionately affected migrant workers, estimating that 1.6 billion people in the informal sector risk losing their livelihood.¹⁴ To replace their lost income, these workers tend to accept jobs with higher risks of labor exploitation. Second, governments had to redirect some of their funding away from issues such as fighting labor exploitation to address the consequences of the pandemic, that is, labor exploitation and modern slavery issues are being under-funded. So, the urgency for work like Kougkoulos et al. (2021) has increased.

Rodriguez-Pereira et al. (2021) argue that COVID-19 has clearly demonstrated the importance of improving regional and global cooperation in order to prepare and respond to pandemics, and to improve solidarity to support the most vulnerable communities and countries, given the pandemic cannot be controlled before all countries become COVID-free. The approach of the paper can be adapted to the collaborative repositioning of essential medical supplies (such as ventilators and personal protection equipment), which are immediately needed in large amounts to save lives, like relief supplies after a disaster.

During COVID-19, Haiti has had among the lowest levels of per capita testing in the world and only 124 ICU beds for its entire population of 11.5 million. This small response capacity indicates that simply reducing deprivation after big disasters like the 2010 earthquake, leaves the country vulnerable to future disasters. As Sodhi and Knuckles (2021) remarked “If we were to do the research again, we would still do our research on seeking to understand development-aid supply chains as a first step. However, we would aim to follow it up by studying the donors themselves as to (1) their efforts on reduction of dependence on their aid in the long run as distinct from reduction of near-term deprivation, and (2) how they measure the efficacy of their efforts toward development.” This clearly illustrates the systemic nature of these complex problems again.

Azizi et al. (2021) also feel that the relevance of their work of informing aid distribution among refugee camps is only more accentuated in the post-COVID era. Independent of the effects of the pandemic, allocating medical aid supplies to both camp-based and urban refugees is important. This includes not only routine medicine such as painkillers and first aid kits,

but also preventative medical supplies that are critical to reduce the transmission of COVID, such as breathable face masks for air filtration and alcohol-based hand sanitizer.

Gallien et al. (2021) point out that the findings of this study have many implications for post-COVID health-care supply chain design. Supply disruptions for essential medicines during COVID-19 have reminded national decision makers, in high income countries and in developing countries alike, about the need for careful planning of how much inventory should be kept in the health system and at what locations (federal government level, sub-national level, and health facility level), and how should allocation decisions be made when total inventory in the system is scarce.

Other authors have already adapted their work to the urgent context of COVID-19. For example, Blair et al. (2021) noted that in the spring of 2020, USAID/Uganda asked for a rapid assessment of the surging pandemic’s impact on agricultural markets and food security in Uganda. The agricultural market system map developed during previous engagements was modified to include potential COVID-19 shocks to system elements and to catalog emerging data from more than 250 sources, including public data, articles, reports, and targeted key informant interviews. The data-layered causal loop diagram organized information was constantly updated and produced insights by considering how pandemic shocks propagated through the system.

Kougkoulos et al. (2021) work has also been adopted to improve response against COVID-19. The pandemic revealed the need to promptly tackle hygiene issues in the Nea Manolada informal settlements since lack of appropriate water supply increases transmission of potential diseases, including COVID-19, particularly given that up to 20 migrant workers live together in makeshift huts.¹⁵

When we called for papers, we were not sure how easy it would be to find papers that link humanitarian operations and SDGs. Looking now at the variety of topics, locations, methodologies, and the efforts to close the loop of the papers included in this special issue, we believe it is a success. It is even more of a success, if we consider the challenging situation of COVID-19 the authors, reviewers and editors of the special issue had to cope with. We are pleased to see that COVID-19 has not reduced the value of the special issue; on the contrary COVID-19 has increased even more the urgency for conducting research on these important and potentially impactful research areas.

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Notes

¹(1) No poverty; (2) zero hunger; (3) good health and well-being; (4) quality education; (5) gender equality; (6) clean water and sanitation; (7) affordable and clean energy; (8) decent work and economic growth; (9) industry, innovation, and infrastructure; (10) reduced inequalities; (11) sustainable cities and communities; (12) responsible consumption and production; (13) climate action; (14) life below water; (15) life on land; (16) peace, justice, and strong institutions; (17) partnerships for the goals. <https://sdgs.un.org/goals>

²<https://www.unhcr.org/figures-at-a-glance.html>

³<https://hum-insight.info/>

⁴https://www.unocha.org/sites/unocha/files/GHO2021_Press%20Release_EN.pdf

⁵World Humanitarian Summit, 2016. Natural Disasters and Climate Change: Managing Risks & Crises Differently. Available at http://agendaforhumanity.org/sites/default/files/resources/2017/Jul/NATURAL_DISASTERS_AND_CLIMATE_CHANGE-_MANAGING_RISKS_&_CRISES_DIFFERENTLY.pdf

⁶World Humanitarian Summit, 2016.

⁷https://ec.europa.eu/echo/who/humanitarian-aid-and-civil-protection/humanitarian-principles_en

⁸<https://www.imf.org/external/pubs/ft/wp/2009/wp09118.pdf>

⁹<https://data.worldbank.org/indicator/NY.GDP.PCAP.KD?locations=DO>

¹⁰<https://unstats.un.org/sdgs/report/2019/The-Sustainable-Development-Goals-Report-2019.pdf>

¹¹<https://www.care-international.org/what-we-do/cares-approach>

¹²<https://innovation.wfp.org/project/retail-box>

¹³<https://www.marketwatch.com/story/charitable-giving-rose-in-2020-despite-financial-turmoil-from-covid-19-why-did-americans-show-such-generosity-11613662427>

¹⁴<https://sdgs.un.org/goals/goal8>

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