

1 Introduction

This thesis reflects a ten-year lasting action research journey in the area of humanitarian logistics (HumLog). Many iterations were undertaken, in which several logistics- and IS-problem-solving actions were investigated, planned, executed, and analyzed within and with the involved humanitarian organizations. The problem definitions, research approaches, and evaluations were presented and discussed at several dedicated scientific conferences as well as practitioners' meetings, workshops, and congresses. Therefore, a cumulative thesis reflecting all relevant iterations and the main developed artifacts seems to be an adequate way to report and reflect the research efforts.

The humanitarian domain is a very delicate application domain as it deals with saving lives and reducing human suffering. Humanitarians need to respond to unexpected events. They must adapt to communities in need under exceptional and partly unbearable circumstances. They often need to find as good as possible solutions to decision problems, with limited means and budgets, under psychologically demanding and high time pressure conditions. Investigating and assessing socio-technical solutions addressing relevant problems under such circumstances call for adequate research methods and setup. This is key not only to properly understand problems, actions, and their consequences in the practitioner communities but also because the researchers need to value and anticipate the much more critical work carried out by those humanitarians involved in the research. During the research process, several mega-disasters occurred, starting with the Haiti-Earthquake in the year 2010 up to the COVID-19 outbreak in 2020. In between, numerous ad-hoc and recurrent response operations were executed by the practitioner organizations involved in the research process. During those times, it was thus not only the practitioners who had to change and adjust plans. It was also the researcher who had to flexibly align with new time schedules. Being open to such flexible adjustments might be immanent to action research projects in general. But it is even more essential to carry out meaningful and rigorous research in the humanitarian domain. This flexibility might not fit the current "knowledge economy," as the philosopher of science ISABELLE STENGERS put it (Stengers 2018). However, it corresponds well with "(...) the requirement to be relevant" as politically relevant science being of interest to the broader public. (Muecke 2018)

The importance of logistics in the context of humanitarian operations has continuously increased within the practitioner communities within the last two decades. Humanitarian organizations increasingly value the impact of logistics and supply chain management for achieving their organization-specific objectives. These developments led to a professionalization of selected areas in logistics and supply chain management of humanitarian organizations in recent years. Several substantial improvements in disaster response operations have been reached, e.g., faster response times through the strategic prepositioning of emergency supplies. These practical improvements came along with an increased focus on HumLog in the scientific world. Meanwhile, several PhD projects have been executed, various special issues in journals have been edited, and even a Journal for Humanitarian Logistics and Supply Chain Management at Emerald has been launched. The settlement of HumLog in the academic world is epitomized by the launch of the world's first professorship for HumLog at the Hanken University in Finland. HumLog has been acknowledged as an important and interdisciplinary research topic in the scientific world.

As ongoing works show, logistics tasks still require more attention by both humanitarian organizations and the scientific community. On the practitioner side, there are several reasons why the potential improvement of logistics is still relatively high. One main challenge can be identified at the higher management of humanitarian organizations to communicate the value and contribution of logistics for operational success to their donors. While operational personnel are faced with logistical challenges daily, the management is still neglecting the importance of logistics and supply chain management. Instead, fundraising, program planning, and advertisement to provide enough (financial and in-kind) donations for relief operations receive more attention.

It took more than 30 years and lots of effort to reach today's commercial supply chain management and logistics businesses standards. They are still a work in progress in certain areas and generally in digitalizing supply chains. In contrast, in the humanitarian world, the logistical professionalization started later, around the year 2004, with the Indian Ocean earthquake and tsunami, which was often described as a logistical "nightmare." The logistics practices have been improved since then; however, the occurrences of "logistical nightmares" are still true for recent events like the Mozambique Cyclones Idai and Keneth in March/April 2019. The year 2004 was a turning point in the academic world that noticed the need for research. While many promising but partly "artificial" approaches have been developed, one ongoing challenge is meeting the practitioner's needs and

providing appropriate solutions which are grounded in the realities of humanitarian organizations and their practices (Walton et al. 2016). At the same time, theoretical contributions play an essential role. Thus, all research efforts require a well-balanced approach between relevance and rigor.

The present thesis covers the area of performance management in humanitarian logistics, which must be considered an enabler for logistics improvements in humanitarian operations. The development of an IT-supported performance management approach for humanitarian logistics follows the action research approach, which supports the above-described need for a well-balanced consideration of not only rigor but also relevant research endeavor. The major contribution of the present work to practice is the provision of a process-driven and sector-wide adjustable process analysis and performance management toolkit for humanitarian organizations. The main contribution to the body of knowledge is the proposed integrated design of a configurable process modeling tool (HumLog[em]), the construction of an adapted Balanced Scorecard (BSC) for Humanitarian Logistics (HumLogBSC), and a simulation-based performance management testbed (HumLogSIM).

The thesis starts with a motivation of the research approach by recapitulating the need for improved logistics performance of humanitarian organizations (HOs). Following the developments of humanitarian aid and the growing funding gap of the humanitarian community, the importance of logistics for the effectiveness and efficiency of humanitarian operations is derived from both the existing HumLog literature and a dedicated survey carried out among HumLog experts by the author of the thesis. The results are then contrasted with the state of the art in HumLog research, revealing a research gap of a missing integrated or process-driven and adjustable performance measurement system (PMS) for HumLog. The first chapter ends with the presentation of the main research objective, two specific sub-research objectives (SROs), and two related research questions (RQs).

Based on these foundations, the overall research methodology is presented in the second chapter. After presenting some preliminary remarks describing the rationale behind the selected research design, the philosophical assumptions, main research method, data collection, and analysis techniques are presented. The chapter closes with an integrated presentation of the research design.

The main results of the research process are presented in the publication overview in chapter 3. The presentation of the findings starts with an overview of the se-

lected papers and their relations to the research design. Before each paper is presented according to the goal, method, and key results, a brief description of the selected outlets is given. The presentation of the findings is structured in three categories: first, the findings related to the first SRO and RQ are described; second, the results of the application and evaluation cases are documented separately, although they refer to both SROs and RQs; third, the specific results for the second SRO and RQ are presented in the last category. To provide a structured overview of the submitted papers, their relations are discussed with reference to the research design. The presentation of results is finally complemented by a short recapitulation of four additional papers, which played an important role in the amended papers presented before.

Finally, the main lessons learned and reflections of the research process are discussed according to both RQs. On this basis, the identified research limitations are elaborated, and future research demand is derived. All amended papers and additional documents, such as the survey questionnaires or artifact-related documents, are added to the annex of the thesis.

1.1 The Rising Importance of Humanitarian Operations

Recent studies have shown that logistics processes are of high importance in order to enable effective and efficient humanitarian operations (see, i.a., Long and Wood 1995; Pan American Health Organization 1999, 2001; Gustavsson 2003; Thomas 2003; Thomas and Kopczak 2005; van Wassenhove 2006; McGuire 2006; Schulz 2008; Tomasini and van Wassenhove 2009; Kovács and Spens 2009; Majewski et al. 2010; Walton et al. 2011; Tatham 2011; Altay et al. 2021). Humanitarian operations aim at providing goods and services to help communities that were affected by disasters (Davies 2012). According to humanitarian principles (see also chapter 1.2), the main objective is to save lives and reduce human suffering. Thus, humanitarian operations cover a broad range from search-and-rescue activities, over setting up mobile hospitals, homes, and kitchens, up to the distribution of medical, food and non-food relief items (an overview of the different operational areas of humanitarian operations can be found in Blecken 2010a, pp. 54–56). Humanitarian operations are triggered by disasters, which may be caused by natural hazards, man-made disasters, or armed conflicts. The United Nations International Strategy for Disaster Reduction defines a disaster as an event which causes “(...) widespread human suffering and a serious disruption in

the normal functioning of a community by overwhelming its local response capabilities” (United Nations International Strategy for Disaster Reduction 2009, p. 9). Disasters can be caused by natural hazards (often referred to as “natural disasters”) or by humans (divided into man-made disasters or armed conflicts). In the literature, the term “natural disaster” is still used to describe natural hazards which lead to human losses and damaged or destroyed livelihoods (Centre for Research on the Epidemiology of Disasters and United Nations Office for Disaster Risk Reduction 2020, p. 8). In this context, natural hazards are differentiated by geophysical (e.g., earthquakes), hydrological (e.g., floods), meteorological (e.g., storms), climatological (e.g., droughts), biological (e.g., epidemic), and extra-terrestrial (e.g., space weather) types. Man-made disasters mainly encompass technological disasters, which can be further differentiated into industrial (e.g., chemical spill), transport (e.g., road), and miscellaneous (e.g., fire) accidents (EM-DAT 2021a). Finally, armed conflicts are often referred to as “organized violence” and can be divided into state-based armed conflicts, non-state conflicts, and one-sided violence (Pettersson et al. 2021, p. 1).¹

Before giving an overview of why logistics and supply chain management play a major role in humanitarian operations’ effectiveness, an outline of the need for its improvement must be provided in light of the development of disasters and their consequences. The importance of humanitarian operations is continuously growing. The current impact of natural hazards and man-made disasters can be described by (1) a rising number of events, (2) a growing humanitarian needs, and (3) an increase of direct and indirect financial losses for affected regions and the world economy.

(1) The estimations on the increase of the **number** of natural and man-made disasters vary between a tripling (Bevere and Weigel 2021) and quadruplication since the 1970ies (Centre for Research on the Epidemiology of Disasters and

¹ There is a vivid discussion ongoing in the practitioner and scientific communities with the tendency to avoid the term natural disasters because it is the vulnerability of a community deciding about the impact of natural hazards (see, e.g., Kelman 2020). To ensure consistent use of the terminology in this thesis, the term “natural disaster” is applied according to the aforementioned definition because most of the disaster-related databases referred to (especially EM-DAT or sigma) still apply the at least partly problematic term.