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Humanitarian Logistics Operations: A Review

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Abstract

Humanitarian logistics is a critical element of a successful relief operation, as it focuses on effective management of flows of persons, goods and information during and after a disaster. This field has been extensively studied so far, especially during the last three years. Although four literature reviews have been published on this topic up to now, they all focused on papers written between 1980 and 2008. Over 20 papers on this topic have been published since then; therefore our literature review gives an up-to-date insight on most recent publications. By using qualitative content analysis, we try to determine the main managerial problems studied until now, the major findings as well as proposed further research. We categorize the existing literature according to several attributes, such as topic, type and stage of disaster, methodology of the research, etc. We present the major findings from the existing literature, as well as the recommended steps for further research. Finally, we identify gaps between further research mentioned in the literature and the results of our content analysis. We find, for example that more attention should be given to slow onset, man-made disasters, as well as to the reconstruction phase following disasters. We also find that case studies and surveys should be used more in order to increase the empirical knowledge in the field.

1 Introduction

In recent years, an increasing number of natural and man-made disasters hit various regions in the world, killing thousands of people and causing millions of indirect victims. Recent examples such as the earthquake in Haiti in 2010 or the earthquake/Tsunami and resulting nuclear disaster in Japan in 2011, show how vulnerable developed, as well as emerging countries, are to disasters. Most of the time, such disasters require external (international) assistance in order to be solved. This assistance may come from the Government (military, civil defense, etc), but also from International Non-Governmental Organizations (INGOs) which have the knowledge and resources to help the populations in these crises. Following the Asian Tsunami in 2004, humanitarian logistics was publicly recognized as playing a central role in the disaster relief effort¹, and as a consequence a new field of research emerged.

Humanitarian logistics is a critical element of a successful relief operation as it focuses on effective management of flows of persons, goods and information during and after a natural or man-made disaster². In particular, effective and efficient supply chain management enables humanitarian organizations to make the best use of resources, by matching available supplies with highest priority needs in the shortest possible time, under constraint of limited funding³. Thomas and Kopczak define humanitarian logistics as “*the process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials, as well as related information, from the point of origin to the point of consumption for the purpose of alleviating the suffering of vulnerable people*”⁴.

The field of humanitarian logistics has been extensively studied so far, especially during the last three years. Although four literature reviews have been published on this topic, they all focused on papers written between 1980 and 2008. In 2006, Altay and Green published a review of research conducted on disaster operations management in the field of Operational Research⁵. Therefore, they limit their analysis to papers published in OR journal. Also, they do not focus specifically on humanitarian logistics, but more generally on disaster operations management. In their paper published in 2007, Kovács and Spens conduct a literature review on the field of humanitarian logistics, with the aim of creating a classification framework for disaster relief logistics⁶. In opposition to the other reviews, this paper is the only one which is focusing only on humanitarian logistics. Kovács and Spens provide interesting definitions and attributes of humanitarian logistics, which will be used in our review. Natarajarathinam et al. provide the most up to date review of literature, including articles published until

¹Kovács/Spens (2007), S. 110.

²Sheu (2007), S. 655.

³Van Wassenhove (2006), S. 477.

⁴Thomas/Kopczak (2005), S. 1.

⁵Altay/Green (2006), S. 477.

⁶Kovács/Spens (2007), S. 99.

2008⁷. They concentrate mainly on the field of supply chain management in times of crisis, which is a broader scope than humanitarian logistics, but which has many similarities with humanitarian logistics. Natarajarathinam et al. provide an interesting classification framework, which will be partially used in our review. As the management of supply chains in times of crisis has many similarities with the topic of humanitarian logistics, we decided to include also articles about this topic in our review, if they corresponded to the selection criteria. Pettit and Beresford performed a literature review on critical success factors in commercial supply chains, and considered their applicability to humanitarian aid⁸. Although this review covers our research topic, it is not analyzing literature from humanitarian logistics.

Given the fact that more than half of the papers we found in our selection process have been published since the period covered by these four literature reviews, our research provides an up-to-date and focused insight on most recent publications in the field of humanitarian logistics. In particular, our study tries to answer the following research questions: (i) What are the main managerial problems studied so far in academic literature? (ii) What are the major findings of existing research? (iii) What are the proposed steps for further research? Finally, by comparing these results with the outcome of a structured qualitative content analysis, this work tries to generate possible tracks for relevant future research which have not been addressed by previous authors.

In the next section, we will present the qualitative content analysis methodology used to categorize the papers. Section 3 presents the main results of our analysis, then in section 4 we interpret these findings, and finally we conclude the paper in section 5.

2 Methodology

As mentioned by Seuring⁹, a literature review fulfills two functions. First, it summarizes the existing state of research on a topic by identifying main themes and issues, and thus provides a starting point for new research¹⁰. Second, any scientific contribution has to be enfolded against existing scientific knowledge and theories, and in this regard a literature review is a useful tool¹¹. According to Seuring¹² and other authors¹³, qualitative content analysis is particularly adapted for conducting a literature review, as it helps to identify conceptual content of a field. In particular, Brewerton and Millward distinguish qualitative, quantitative and structural content analysis, and according to them a “*structural content analysis involves the development of a representation of the relationships between elements in the target material. In order to do this, both*

⁷Natarajarathinam/Capar/Narayanan (2009), S. 535.

⁸Pettit/Beresford (2009), S. 450.

⁹Seuring/Müller/Westhaus/Morana (2005), S. 92.

¹⁰Easterby-Smith/Thorpe/Lowe (2002), S. 159.

¹¹Saunders/Lewis/Thornhill (2003), S. 46.

¹²Seuring/Müller/Westhaus/Morana (2005), S. 93.

¹³Ryan/Bernard (2000), Mayring (2003).

*qualitative and quantitative aspects of the data have to be considered*¹⁴. For Seuring, quantitative and qualitative methods are not contradictory methods, but can well support each other¹⁵. Mayring also supports this approach, when he states that *“the classification of text sections to qualitatively generated categories can be quantitatively evaluated. It can be assessed what kind of category is most encoded”*¹⁶.

Mayring defines content analysis as a method for analyzing communication (e.g. documents) by applying a clear and systematic procedure. Based on this, and following Seuring’s advice, for our literature review we will use the process model for content analysis developed by Mayring¹⁷. The four steps of the model are shown in Fig.1 and described in the next sections.

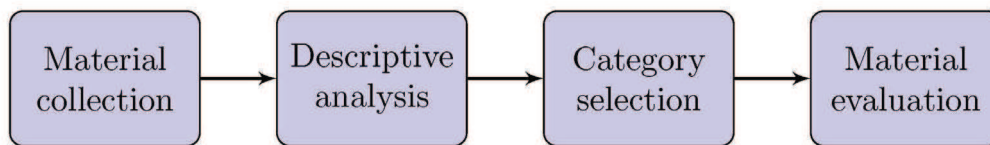


Fig.1: Process model for content analysis (Mayring 2003)

2.1 Material Collection

In this first step, the unit of analysis was determined. For our review, we analyzed single academic papers. Then, the articles to be collected were defined and delimited, by following the process described in Fig.2. We used a hybrid identification method for the papers, first through keyword searches in four databases, then through an existing bibliography list¹⁸. First, the following keywords and Boolean operators were searched for: *“Logistic* AND (Humanitarian OR Relief)”* in the fields *“Title”* OR *“Abstract”* OR *“Keywords”*. Additionally, the search was limited to *“Peer-reviewed publications only”*. This search was performed in the following databases: Business Source Complete, Science Direct, ABI/INFORM Global and Web of Science.

Additionally to these searches, we also collected articles through the extensive bibliography published by the HumLog Institute, a research network on humanitarian logistics regrouping the most known academic institutions in this field¹⁹. We included the papers we found in this reference list in our selection.

After this hybrid selection mechanism, we filtered the articles of the selection according to a quality criterion. We limited our selection to papers published in journals with VHB rankings of A+, A and B in order to focus our in-depth analysis on highest quality publications only²⁰. Finally, in order to assess the relevance of the articles to the top-

¹⁴Brewerton/Millward (2001), S. 153.

¹⁵Seuring/Müller/Westhaus/Morana (2005), S. 94.

¹⁶Mayring (2002), S. 117.

¹⁷Mayring (2003), S. 54.

¹⁸HUMLOG (2010).

¹⁹HUMLOG (2010).

²⁰VHB (2010).

ic based on academic judgment, the last step of the selection process was a reading of abstracts, as proposed by Jahangirian et al.,²¹ and irrelevant papers were discarded from the selection.

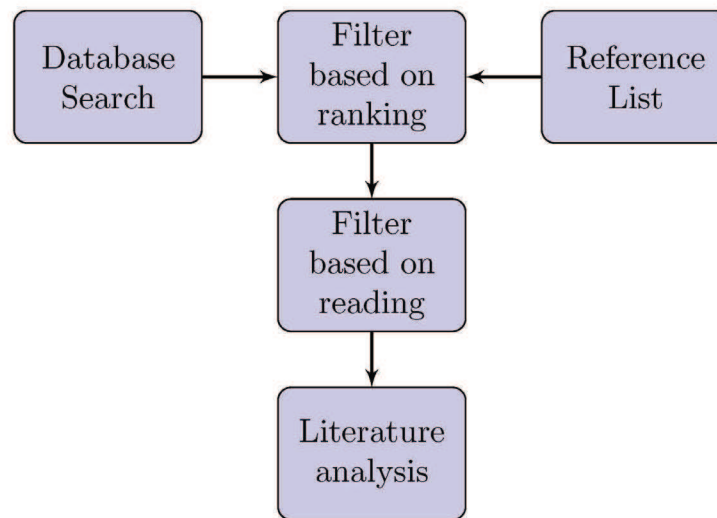


Fig.2: Material collection process

2.2 Descriptive Analysis

In this step, the formal aspects of the selection of literature were assessed. We decided to focus on the number of publications per year, as well as the number of papers per journal, in order to give an idea on publication trends. The repartition of papers between OR and management journals was also analyzed in this part. The aim of these analyses was to position our work in the context of the existing body of literature.

2.3 Category Selection

In this step, we selected the structural dimensions of our literature review and their related analytic categories. Our inspiration for the choice of categories came from existing literature as well as our own analysis.

First, we categorized the articles based on the *context of operation*, which can be either disaster relief or continuous aid work, as presented by Kovács and Spens²². In their description, disaster relief is used for sudden catastrophes, mainly natural disasters (earthquakes, hurricanes, tsunamis, floods, etc) and some rare man-made disasters such as terrorist acts. Disaster relief is usually mobilized very quickly, and ends relatively rapidly (i.e., less than five years after the disaster). On the other hand, continuous aid is generally a long term response to a disaster, and can last up to several decades. It usually focuses more on development aid, and is rarely characterized by emergency. In general, continuous aid starts in the last phase (i.e., reconstruction) of disaster relief.

²¹Jahangirian, et al. (2010), S. 2.

²²Kovács/Spens (2007), S. 101.

Second, we used one of the criteria developed by Van Wassenhove, which characterizes the *speed of start* of the disaster,²³ by distinguishing between sudden onset disasters, such as tsunami or earthquakes, and slow onset disasters such as famine or droughts. Depending on this distinction, the emergency level of the crisis is different, as is the type of logistical response needed.

Third, we used another criteria developed by Van Wassenhove, which is the *cause of disaster*²⁴. He differentiates between man-made and natural disasters. Man-made disasters can be terrorist attacks, political crisis and consequences of war. Typical INGOs focus mainly on such types of disasters, which more often occur in developing countries, where the government has limited resources to respond to the crisis. Van Wassenhove cites the former Director of Médecins Sans Frontières (MSF) France who stated that between 1982 and 1994, as much as 97% of MSF's operations were dealing with relief of man-made disasters²⁵. On the other hand, natural disasters occur in all parts of the world, as for example in Japan in March 2011. In developed countries, governmental agencies usually respond to the crisis and perform the emergency relief activities, with limited participation of local NGOs. Of course the types of logistical response to these two types of crisis are different, with incomparable levels of resources involved.

As fourth classification criteria, we used the *stage* in which the disaster relief process is. All previous literature reviews use this criterion, however with slightly different terminology. We applied the model presented by Kovács and Spens²⁶, which differentiates between the preparation (i.e., evacuation plans, training, prepositioning of supplies, etc.), immediate response (i.e., rescue, evacuation, coordinating and delivering supplies, etc) and reconstruction (i.e., reconstruction of houses and infrastructure, economic development, etc). Some authors also mention the mitigation phase, which deals with the avoidance of the disaster. This category will not be used in our research as it can only be applied to some types of disasters (i.e., those which can be mitigated).

The fifth classification we used was the *research methodology*, which is also used by Altay and Green²⁷. However, as they reviewed in particular the OR literature, we will not use their categories which are too specific (i.e., different type of modeling techniques), but rather use a more general selection of categories which is common in Operations Management²⁸ and Supply Chain Management²⁹: Simulation & modeling, Conceptual research, Literature review, Case study and Surveys.

An additional classification was introduced in order to determine the *main topic* of each paper. However, such a classification is much more complex than the five previ-

²³Van Wassenhove (2006), S. 476.

²⁴Van Wassenhove (2006), S. 476.

²⁵Van Wassenhove (2006), S. 476.

²⁶Kovács/Spens (2007), S. 101.

²⁷Altay/Green (2006), S. 478.

²⁸Karlsson (2008).

²⁹Kotzab/Seuring/Müller/Reiner (2005).

ous ones, and would be too biased if only performed through academic judgment of one single analyst. Therefore, one solution to reduce this bias would be to involve one or two additional researchers as mentioned by Seuring³⁰. However, this methodology would still have some limitations, because most papers address several problems from different categories, and in such a context, a global qualitative judgment, even if performed by several analysts, can be difficult. Therefore, we decided to develop a specific classification methodology, based on Mayring's idea of codification of text sections to categories, which can later be evaluated quantitatively, based on the category which was most coded in each paper³¹. For this, we created a list of codes which all represent a particular problem or issue in humanitarian logistics. These codes were organized in five categories, which all represent a particular topic (i.e., Cooperation, External influences, Management, Resources, and Technology). The choice of categories can be described as a deductive approach, as we selected these topics before the material was analyzed. Then, we coded the abstracts and conclusions of each paper with the qualitative analysis tool ATLAS.ti. Codes were assigned over 1300 times, in a total of 450 quotations (often, multiple codes were assigned to the same text section). During the coding work, some codes were added when a new topic appeared, and at the end of the coding work, some codes were merged in one unique code, and some codes were split in two codes, in order to have categories as close as possible to existing theory³². This adaptive approach is similar to Mayring's "*inductive category development*" method, in which categories are revised and eventually reduced during the coding activity³³.

2.4 Material Evaluation

In this last step, the literature was analyzed and sorted according to the six structural dimensions defined in the previous section.

Each article was assigned to the first five structural dimensions basing on academic judgment through the reading of abstracts and conclusions. When these parts did not contain enough information to categorize the article in all dimensions, a complete lecture was done. Because there was not much ambiguity in assigning articles to categories in the five first structural dimensions, this activity was performed by only one researcher.

For the sixth structural dimension, the determination of the *main topic* of each article, we first summed up the number of times the codes of a particular category i were assigned in the analyzed paper (n_i). Then we calculated the average occurrence of codes of this category in all publications (N_i). Finally, for each paper we calculated the relative usage of the code category (U_i) by dividing n_i by N_i .

³⁰Seuring/Müller/Westhaus/Morana (2005), S. 95.

³¹Mayring (2002), S. 117.

³²Seuring/Müller/Westhaus/Morana (2005), S. 95.

³³Mayring (2000), S. 4.

$$U_i = \frac{n_i}{N_i} \quad (1)$$

This means that if this category was coded more than average in an article, U_i would be higher than 1 (i.e., code category is overrepresented in this paper), otherwise it would be smaller than 1 (i.e., code category is underrepresented).

Then we calculated the same figures for all other code categories, which gave us the relative usage of all code categories for this article.

Finally, we assigned this article to the code category (i.e., topic) with the highest relative usage (U_i) of all code categories of the article.

$$TOPIC = MAX \{U_1; U_2; U_3; U_4; U_5\} \quad (2)$$

This methodology of classification basically assigns an article to the topic which has the highest relative occurrence. It has the advantage of sorting out quantitatively the main topic from the variety of topics which are addressed in each article, and is therefore more objective and precise than a multiple reviewer method.

In order to validate this methodology, we compared the results with an intuitive classification method (i.e., reading the article and assigning it to one of the categories basing on academic judgment), and the results were generally similar. We also found that all authors always published in the same category (topic), which is consistent with patterns observed in reality, where an author is generally specializing in one particular topic of research³⁴.

Structural dimension	Analytical categories	Methodology of assessment
Context of operation	Disaster relief Continuous aid work Both	Academic judgment
Speed of start	Slow onset Sudden onset Both	Academic judgment
Cause	Natural Man-made Both	Academic judgment
Stage of Disaster	Preparation Response Reconstruction Several	Academic judgment
Research Methodology	Simulation & modeling Conceptual research Literature review Case study Surveys	Academic judgment
Main Topic	Cooperation External influence Management Resources Technology	Quantitative analysis of coding

Table 1: Structural dimensions and related categories for the classification of papers

³⁴ There was only one exception, J.-B. Sheu, who published papers in three different topics.

Table 1 provides a list of all structural dimensions and related analytical categories which will be used to categorize the papers of our review, as well as the methodology used for assigning the categories in each dimension.

3 Results

3.1 Descriptive results

By following the methodology described in the previous section, a total of 41 articles written between 1993 and 2010 were retained and analyzed. Regarding the chronology of articles, Fig.3 shows the number of publications per year, as well as a growing trend. This strong increase can be explained by the fact that in the years 2004 to 2006, three major natural disasters happened, and the logistic response suffered from inefficiencies, especially in the case of the Asian Tsunami. Acknowledging this, several researchers got interested in this sector and started to perform research in that area. In the years 2007, 2009 and 2010, three journals published special issues focusing on humanitarian logistics, which explains this dramatic increase in publications since then.

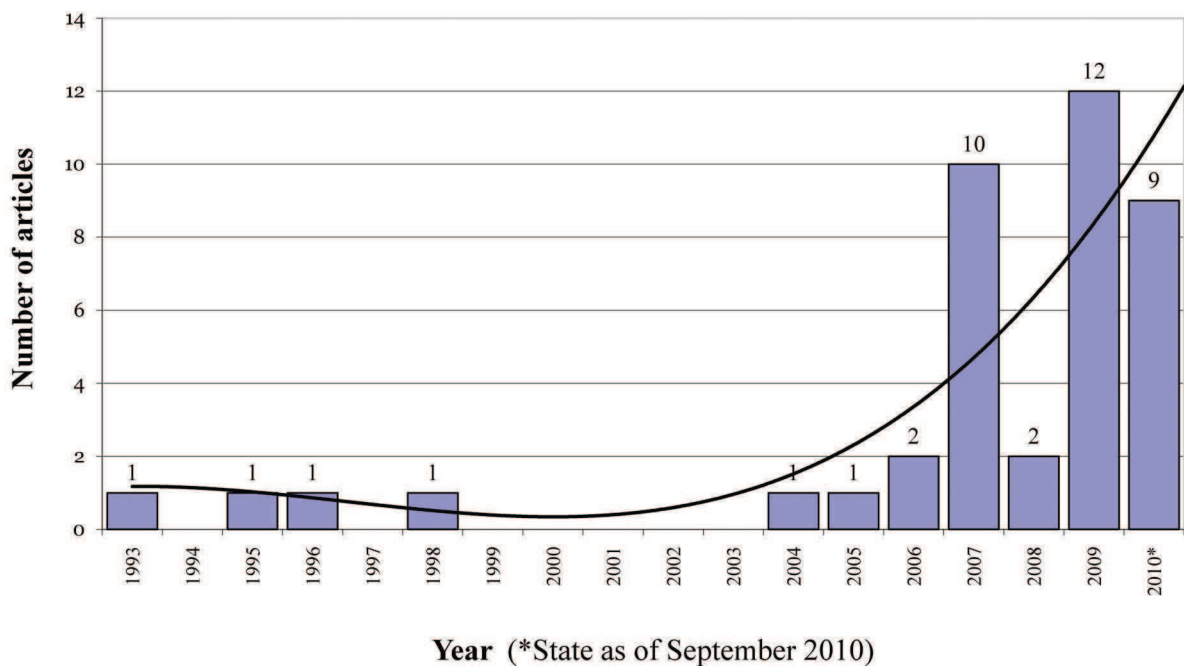


Fig.3: Number of articles per year

The number of articles published in the different journals is presented in Table 2, together with the type of journal (Operations Research, Management related, Information Systems).

From this table, we can see that relatively few Management type journals (M) published papers on the topic of humanitarian logistics (4 out of 15 journals, or 27%), however these journals published more than 51% of all papers (21 out of 41 papers). On the other hand, several Operation Research journals (OR) published articles on the topic (67%), but those represent only 46% of all papers.

Title of Journal	Type of Journal	Number of papers
International Journal of Physical Distribution and Logistics Management	M	11
International Journal of Production Economics	M	7
Transportation Research Part E: Logistics and Transportation Review	OR	7
Computers and Operations Research	OR	2
European Journal of Operational Research	OR	2
Journal of Business Logistics	M	2
Journal of the Operational Research Society	OR	2
Annals of Operations Research	OR	1
Decision Sciences	OR	1
Journal of Multi-Criteria Decision Analysis	OR	1
Journal of the Association for Information Systems	IS	1
Naval Research Logistics	OR	1
Production and Operations Management	M	1
Transportation Research Part A: Policy and Practice	OR	1
Transportation Science	OR	1

Table 2: Number of papers per journal and type of publication

3.2 Analytical results

In this section, we present the different categorizations of our papers according to our structural dimensions described earlier. All results are presented in Table 3 on the next page.

For the *context of operation*, we found that a large majority of the papers are concentrating on disaster relief (93%). Only one paper in the selection (2%) deals mainly with continuous aid aspects.

Regarding the *speed of start*, we found that most articles deal with sudden onset disasters (76%). Eight papers (19%) focus on both sudden and slow onset disasters, and only two papers (5%) concentrate just on slow onset disasters.

Concerning the *cause of disaster*, we found that most articles deal with natural (47%) or natural and man-made (51%) disasters. Only one paper focuses exclusively on man-made disasters.

Dimension and related categories	# papers	Frequency
<i>Context of Operation</i>		
Disaster Relief	38	93%
Continuous Aid	1	2%
Both	2	5%
<i>Speed of Start</i>		
Sudden Onset	31	76%
Slow Onset	2	5%
Both	8	19%
<i>Cause of Disaster</i>		
Natural	19	47%
Man-made	1	2%
Both	21	51%
<i>Stage of Disaster</i>		
Preparation	5	12%
Response	23	56%
Reconstruction	0	0%
Several	13	32%
<i>Research Methodology</i>		
Simulation and modeling	21	51%
Conceptual Research	8	20%
Case Study	7	17%
Literature Review	4	10%
Surveys	1	2%
<i>Main Topic</i>		
Cooperation	14	34%
Technology	12	29%
External Influence	6	15%
Management	5	12%
Resources	4	10%

Table 3: Number of papers per category for each structural dimension

As for the *stage of disaster*, more than half the papers (56%) focus on the response phase, which immediately follows the outbreak of the disaster. Another third covers several stages of disasters (32%). The preparation phase is covered specifically in 5 papers (12%), while the reconstruction phase, following the immediate response, was never studied in depth in our selection of literature.

Five different *research methodologies* were used in the articles of the selection. Simulation and modeling is by far the most used methodology (51%), followed by conceptual research (20%). Interestingly, surveys were used in only one article (2%).

By using the quantitative methodology described in the previous section, we classified the articles in five *main topics*. The highest proportion of papers deals with cooperation (34%) i.e., the coordination inside and between organizations, cooperation between international and national organizations, cooperation with military and governments. The second most studied topic is technology (29%), i.e., modeling software, information technologies, communication tools, and tracking systems. Third come external influences (15%), which include infrastructure and governmental influences on humanitarian logistics operations. Finally, management (12%) and resources (10%) are the least studied topics, and regroup all general management problems as well as resource acquisition and management issues.

4 Interpretation

This section has the objective to discuss the results presented in the previous chapter with an integrated, holistic approach.

4.1 Descriptive results

The strong increase in the number of publications during the last three years justifies the importance of performing an up-to-date literature review. It also demonstrates that humanitarian logistics is a new field of research, which has attracted more and more interest in recent years. This increase in the number of papers per year can however be partially explained by the publication of special issues on this topic, and it is possible that the number of publications per year will drop in the coming years, as major journals will not publish again such special editions. Therefore, it is hard to draw some conclusions for the future.

The higher number of OR journals publishing in that topic compared to OM journals is also interesting, however it is certainly biased to some extent because of our qualitative selection criteria basing on the VHB Ranking which tends to higher rank OR journals against general management journals. Therefore it cannot be concluded that the OR community shows more interest in the topic than the OM community.

4.2 Analytical results

Here we will discuss the most interesting results of our analysis of structural dimensions. First, for the *context of operation*, existing literature mainly focuses on disaster

relief, with continuous aid being almost inexistent. The reason for this is certainly because continuous aid allows for better planning and continuous improvement activities and seems to be less challenging to manage than emergency relief disaster. We think that this is the reason why research up to now has focused only on disaster relief.

Second, regarding *speed of start* of disasters, the current literature mainly concentrates on sudden onset disasters, with only two papers covering specifically slow onset disasters. The reason here is certainly the same as for the context of operation, i.e., because there is more time to plan and respond to the disaster, the interest of the researcher is lower.

Third, regarding the *cause of disaster*, almost half the papers focus on natural disasters and the other half cover both types of disasters. Only one paper deals specifically with man-made disasters. The reasons for this lack of research in this last topic are harder to understand, but could be because natural disasters are seen as more fatalistic, while man-made disasters are perceived as “avoidable”, and thus generate less interest to researchers.

Fourth, concerning the *stage of disaster*, we found that over half of the papers focus on the response phase, and one third on several phases. Preparation was the stage covered in 12% of the papers, but no one specifically addressed the reconstruction phase. The same reasons can be mentioned here than previously, namely that due to more available time and less urgency for the reconstruction activities, this last phase is less challenging in terms of logistics. While this is certainly true, it should however not be forgotten that the suitability and quality of the logistical activities during this phase strongly impacts the success of the whole disaster recovery process, especially in terms of sustainability and long term effectiveness.

Fifth, the categorization according to *research methodologies* used in papers shows that most of the papers are using simulation and modeling, while only one article uses surveys as a research methodology. As presented earlier, this is impacted by the fact that our selection criteria of articles are based on the VHB ranking, which over-represents quantitative articles.

Sixth, the categorization of papers by *main topic* shows that the highest proportion of articles deal with cooperation (34% of all articles). This result is not surprising, as cooperation is a central factor in supply chain management and logistics. It is therefore encouraging to see that this important area has been well covered until now in existing literature. For the topic technology (29%), which is the second most studied topic, it seems that there is an over-representation compared to other topics. This is mainly due to the high number of researches on simulation tools and modeling (16 articles out of 41 are focusing on the design of a modeling method). It is questionable whether the humanitarian logistics community really needs so many different modeling tools, especially when most of them are not applicable in the field because they are on a “too theoretical level” and are not responding to requirements from practitioners. There is only very little evidence showing that such models were successfully implemented and used in a sustainable way in humanitarian logistics. As presented before, the high rep-

resentation of this topic may come from our selection criteria of journals, which tends to focus more on quantitative journals and therefore introduces a certain bias in our selection. Another explanation of the high number of studies focusing on computational models could be that often scholars in Operations Management and Logistics have a scientific background, and are used to solve problems through modeling, which is suitable in commercial supply chains, but perhaps not yet in the highly variable and unpredictable supply chains found in humanitarian logistics. The third most often addressed topic in the selection of articles is external influence factors (15%). This is an important and very practical aspect which should receive more attention in research. However these factors often transcend the scope of Operations Management and Logistics. This certainly explains why there is only limited research in this area. The fact that management (12%) and resources (10%) are the least studied topics is surprising, given the importance they have in humanitarian logistics operations. Indeed, staff, finance, logistical equipments are central problems in logistics, and should be represented more in the literature. While it is possible for management problems to be addressed by operational staffs, problems related to resources are much harder to influence because of resource unavailability which cannot be solved solely at the organization level. This may be one of the reasons why this last topic received so little attention until now.

4.3 Major findings

In order to give a better view of the conclusions of existing literature, we will now present and discuss the major findings of the articles of the selection.

Several authors emphasize that information sharing between organizations and governments, as well as cooperation between organizations, is important and beneficial for humanitarian logistics³⁵. However, instead of cooperating and sharing information as proposed by these authors, organizations often compete with each other and do not share information well, which reduces the efficiency of their work³⁶. Another paper states that partnerships between companies and humanitarian organizations are currently increasing, with positive results on effectiveness³⁷. According to some authors, the efficiency of humanitarian logistics depends on the capabilities of an organization to develop relationships with stakeholders³⁸. Several authors suggest that known concepts from commercial supply chains could improve the effectiveness of humanitarian logistics and should be increasingly used³⁹. Similarly, according to some authors, humanitarian logistics has specific strengths and attributes, like quick response capabili-

³⁵Long/Wood (1995), S. 227, Day/Junglas/Silva (2009), S. 655, Van Wassenhove (2006), S. 488, Perry (2007), S. 428, Kovács/Spens (2009), S. 521, Kovács/Tatham (2009), S. 225.

³⁶Oloruntoba/Gray (2009), S. 497.

³⁷Balcik, et al. (2010), S. 33.

³⁸Kovács/Spens (2009), S. 521, Kovács/Tatham (2009), S. 224.

³⁹Van Wassenhove (2006), S. 488, Kovács/Spens (2007), S. 110, Kovács/Tatham (2009), S. 225, Pettit/Beresford (2009), S. 463, Ergun/Heier Stamm/Keskinocak/Swann (2010), S. 119.

ties and high flexibility, which could serve as examples for commercial supply chains⁴⁰. Altay and Green recognize different problems in humanitarian logistics, for example, that existing planning and support tools are not used enough⁴¹. Based on a survey conducted among humanitarian logisticians, Perry finds that generally there is a lack of preparedness, poor need assessments, and that the availability of logistical expertise is a major concern⁴². This last problem is also recognized by Dadzie as well as Tatham and Kovács, which recommend developing specific training for humanitarian logisticians that would integrate the specificities of logistics in Third World countries⁴³.

Whybark presents current challenges for humanitarian logistics, such as inventory management which is difficult because high capacity is needed, demand is uncertain, and product expiry poses problems, especially for medicines⁴⁴. Gatignon et al. mention that the limited availability of funding reduces the efficiency of pre-disaster activities, like pre-positioning of supplies in vulnerable areas⁴⁵. Another challenge recognized by these authors is the implementation of decentralized supply chains, which offers a large potential for humanitarian logistics⁴⁶.

4.4 Further research

In this section, we will give an overview of the proposed steps for further research presented in the papers of our review. The main recommendation in the existing literature is to perform more empirical research in the field of humanitarian logistics⁴⁷. This suggestion is also confirmed by our findings from the analysis of research methodologies.

Coordination is another field of proposed research. Altay and Green suggest further research should be done in multi-agency coordination⁴⁸, and Balcik et al. propose that coordination mechanisms in humanitarian supply chains should be studied⁴⁹. Van Wassenhove mentions that future research should develop new ideas for encouraging stronger cooperation between humanitarian organizations, businesses and academics⁵⁰.

Altay and Green propose to further analyze the social and political nature and impact of disaster relief operations, as well as the continuity of local businesses after a disas-

⁴⁰Long/Wood (1995), S. 213, Van Wassenhove (2006), S. 475.

⁴¹Altay/Green (2006), S. 487.

⁴²Perry (2007), S. 428.

⁴³Dadzie (1998), S. 282, Tatham/Kovács (2010), S. 43.

⁴⁴Whybark (2007), S. 231-232.

⁴⁵Gatignon/Van Wassenhove/Charles (2010), S. 109.

⁴⁶Gatignon/Van Wassenhove/Charles (2010), S. 109.

⁴⁷Dadzie (1998), S. 282, Kovács/Spens (2007), S. 99, Kovács/Spens (2009), S. 522, Pettit/Beresford (2009), S. 450.

⁴⁸Altay/Green (2006), S. 484-485.

⁴⁹Balcik, et al. (2010), S. 33.

⁵⁰Van Wassenhove (2006), S. 488.

ter⁵¹. Another article suggests that future research should address the local procurement of relief supplies, which would bring advantages in terms of purchasing and logistical cost, in addition to supporting the local economy and guaranteeing better adaptation of supplies to the needs of the affected populations⁵². This is certainly a very promising field of future research, which seems to be beneficial for donors, humanitarian organizations and affected countries.

Perry suggests that the responsibilities for coordinating, supervising and financing the disaster response operation should be addressed by future research⁵³. The author finds that best results have been achieved so far when the government had this responsibility, but in cases where the government lacks financial and human resources, this is a particularly difficult question. Should the United Nations take this role, or one of the major INGOs? Kovács and Spens suggest that the impact of import tariffs on relief supplies should be analyzed⁵⁴.

Inventory management is another topic for further research. Whybark proposes to further study the benefits and implications of co-ownership of inventories by different organizations, and the advantages gained from new tools such as monitoring and tracking⁵⁵. Others suggest that inventory replenishment strategies, in the context of humanitarian logistics, should be studied in the future⁵⁶.

The development of new performance metrics is also proposed by some authors, who suggest that existing concepts and tools from the commercial sector could be adapted to humanitarian logistics⁵⁷. Oloruntoba and Gray propose that future research should develop metrics for the donors, which would provide early warnings in case of problems in the supply chain⁵⁸.

Human resources are another field where further research is needed. Kovács and Spens suggest analyzing the reasons of a lack of sufficiently skilled logisticians in most disaster affected countries and finding solutions on how this could be improved⁵⁹. Tatham and Kovács see the development of common rules of qualification across countries and organizations as a crucial step for facilitating communications between organizations and inter-operability of logisticians, and recommend that more research should be done on this⁶⁰.

Management issues in humanitarian logistics are also addressed in some articles. Kovács and Spens mention that tools such as risk management, crisis management or pro-

⁵¹Altay/Green (2006), S. 485.

⁵²Trestrail/Paul/Maloni (2009), S. 436.

⁵³Perry (2007), S. 429.

⁵⁴Kovács/Spens (2009), S. 522.

⁵⁵Whybark (2007), S. 233.

⁵⁶Ertem/Buyurgan/Rossetti (2010), S. 223.

⁵⁷Kovács/Tatham (2009), S. 225, Oloruntoba/Gray (2009), S. 497.

⁵⁸Oloruntoba/Gray (2009), S. 497.

⁵⁹Kovács/Spens (2009), S. 522.

⁶⁰Tatham/Kovács (2010), S. 43.

ject management, which are well studied in commercial logistics, should be adapted to humanitarian logistics⁶¹. Another article proposes to further study the management of humanitarian operations in case of internal crisis, for example the bankruptcy of a supplier, strike of workers, or the loss of an important donor⁶². Kovács and Tatham suggest that the mobilization of financial resources should be studied more⁶³. These are certainly very useful topics for further research, and have a strong potential to improve humanitarian logistics.

4.5 Identifying gaps

By comparing the findings and further research identified in the existing literature with the results of our content analysis, we found some gaps which should be studied further.

In terms of *context of operation*, additional research could be done on logistics in continuous aid, which is almost absent in the existing literature. Although this context is maybe less challenging due to better planning possibilities and more time available, we think it may be useful to give more interest to existing problems in continuous aid settings, such as partnerships with local companies, inclusion of the aid effort into the economical development of an area, etc.

When it comes to the *speed of start*, here also, there is a gap in research on slow onset disasters. Future research should explore more this type of disaster, which is typical for man-made disasters such as wars, droughts and famine. Slow onset disasters allow for more time to react, but can have worse consequences on populations, therefore, a careful logistical planning and operation is crucial.

Regarding the *cause of disaster*, more focus should go to man-made disasters, as for some organizations such as Médecins Sans Frontières they represent a much larger share of disasters than natural disasters⁶⁴.

Concerning the *stage of disaster*, we found that the reconstruction phase was not yet studied specifically. Long term sustainability of humanitarian logistics operations, their impact on the local economy, and effective exit strategies should therefore be analyzed more in detail in the future. Integration of humanitarian logistics in the long term economic development – for example through capacity building or local procurement – is another possible topic in this direction.

Regarding the *research methodology*, simulation and modeling has been extensively used so far, but we think there has not been enough application and validation of models in real operations. Another gap we identified is the lack of empirical research done so far, and we think that methodologies such as case study and surveys should be used more in order to increase the empirical base of knowledge in the field.

⁶¹Kovács/Spens (2007), S. 110.

⁶²Natarajarathinam/Capar/Narayanan (2009), S. 549.

⁶³Kovács/Tatham (2009), S. 226.

⁶⁴Van Wassenhove (2006), S. 476.

Concerning the *topics* to study further, we identified a gap in the relatively low amount of research done so far in the fields of external influence, which concentrates among others, on the impact of infrastructure and local governments on logistical operations. Indeed, barriers set by foreign governments are an important factor affecting the effectiveness of humanitarian logistics, as can be observed from several relief operations during the last years (e.g., import tariffs on relief supplies, administrative barriers to imports, special legislations, embargos, etc). Positive influencing factors from governments could also be studied further. Issues related to the topic management, such as internal structures of organizations, process management, risk management, problems with corruption are also not present enough in existing literature. The topic resources could also be studied further, and issues such as efficiency of funding mechanisms, pooling of resources between organizations, and reduction of turnover of staff could be addressed in future works.

5 Conclusion

If we come back to our research questions, we see that the most studied managerial problems so far are coordination as well as technological tools such as modeling and simulation. The findings of existing literature are numerous. Many authors insist on the importance of cooperation and information sharing between organizations. Some authors find that the application of principles from commercial logistics would be helpful for humanitarian logistics. Authors recognize different problems in humanitarian logistics, among them are a lack of qualified logistic personnel in countries of operation, lack of use of existing planning and decision making support tools, lack of preparedness and poor need assessments. In the challenges faced by humanitarian logistics, authors report inventory management, demand uncertainty, product expiry and limited availability of funding for pre-disaster preparation.

The main proposed steps for further research are to do more empirical research and to further study the coordination between organizations. Local procurement is another proposition for further research. Other authors mention human resources and management practices in humanitarian logistics to be studied more.

Based on our content analysis of the literature, we suggest that more attention should be given to the logistics of continuous aid operations, which more focus should be put on slow onset man-made disasters, and that case studies and surveys methodologies should be increasingly used to collect empirical knowledge. We also think that the reconstruction phase and its sustainability should be studied more. Finally, we suggest that topics such as external influences from local governments on humanitarian logistics, as well as resources should be further analyzed.

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