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Emerald Article: A meta-analysis of humanitarian logistics research

Nathan Kunz, Gerald Reiner

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Nathan Kunz and Gerald Reiner
Faculty of Economics and Business, University of Neuchâtel, Neuchâtel, Switzerland

Abstract

Purpose – The purpose of this paper is to give an up-to-date and structured insight into the most recent literature on humanitarian logistics, and suggest trends for future research based on the gaps identified through structured content analysis.

Design/methodology/approach – The authors use a quantitative and qualitative content analysis process to analyse the characteristics of the existing literature, identifying the most studied topics in six structural dimensions, and presenting gaps and recommendations for further research.

Findings – It was found that existing humanitarian logistics research shows too little interest in continuous humanitarian aid operations, in slow onset disasters and man-made catastrophes. While several papers address different phases of disasters, very few focus particularly on the reconstruction following a disaster. Empirical research is underrepresented in the existing literature as well.

Research limitations/implications – While five of the authors' structural dimensions are inspired by previous reviews, the sixth dimension (situational factors) is derived from a theoretical framework which the authors developed and which has never been tested before. The validity of the study could therefore be increased by testing this framework.

Originality/value – The authors analyse the broadest set of papers (174) ever covered in previous literature reviews on humanitarian logistics. A quantitative analysis of the papers was conducted in order to analyse the situational factors which have mostly been studied so far in literature. This paper is also the first in humanitarian logistics to use content analysis as the main methodology to analyse literature in a structured way, which is of particular value to the academic community as well as practitioners.

Keywords Research work, Quantitative methods, Humanitarian logistics, Literature review, Content analysis, Situational factors

Paper type Literature review

1. Introduction

In recent years, an increasing number of natural and man-made disasters have 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 the vulnerability of developed countries, as well as emerging countries, to disasters. Most of the time, such disasters require external (international) assistance. This assistance may come from the government (military, civil defence, etc.), but also from international relief organizations, which have the knowledge and resources to help the populations affected by these crises. Following the Asian tsunami in 2004, humanitarian logistics was publicly recognized as playing a central role in the disaster relief effort (Kovács and Spens, 2007), 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 the efficient management of flows of goods, information and services, to respond to the urgent needs of the affected populations under emergency conditions, such as those encountered during and after natural or man-made disasters

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(Sheu, 2007). In particular, effective and efficient supply chain management enables humanitarian organizations to make the best use of resources, by matching the available supplies with the highest priority needs in the shortest possible time, under the constraint of limited funding (Van Wassenhove, 2006). 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" (Thomas and Kopczak, 2005).

The field of humanitarian logistics has been extensively studied so far, especially during the last three years. Five literature reviews have been published so far on this topic since 2006. However, they all take a different perspective and approach for analysing the literature. In order to provide an overview of the research history in this field of research, we present a meta-analysis of these reviews in Table I. This table presents the main characteristics of these reviews, and constitutes the starting point for our own literature review. Additional details about the methodology, findings and suggestions for further research of these reviews can be found in Appendix 1. These literature reviews analyse between 51 and 118 papers, which were published until 2009. Due to the strong increase in publications during the last two years, there is a need for a new, broader review. Although our review does not claim to include all papers published in this field, it is the most exhaustive so far, as we analyse 174 papers from 68 academic journals. This is mainly due to the fact that our review covers all papers available until end of 2011, and therefore reflects the strong growth in publication of these last years.

As can be seen in Table I, only two reviews cover specifically the literature on humanitarian logistics (Kovács and Spens, 2007; Overstreet *et al.*, 2011). In their paper published in 2007, Kovács and Spens (2007) conduct a qualitative literature review of the field of humanitarian logistics, with the aim of creating a classification framework for disaster relief logistics. They provide useful definitions and attributes of humanitarian logistics, which will be used in our review. Overstreet *et al.* (2011) also perform a review of papers focusing on humanitarian logistics, but they use a definition of disasters which implicitly excludes slow onset disasters. For this reason and because they focus on the most relevant papers only, their selection of papers (51) excludes a significant proportion of the literature.

The others reviews include papers on humanitarian logistics, but do not specifically focus their paper collection on this field. Altay and Green (2006) published a review of research conducted on disaster operations management in the field of operational research. Therefore, their analysis is limited to papers published in OR journals and does not specifically focus on humanitarian logistics. Natarajarathinam *et al.* (2009) concentrate mainly on the field of supply chain management in times of crisis, which has a broader scope than humanitarian logistics, but bears many similarities to this field. Natarajarathinam *et al.* (2009) provide a useful framework which inspired our classification of papers according to different structural dimensions. Pettit and Beresford (2009) perform a literature review on critical success factors in commercial supply chains, and consider their applicability to humanitarian aid. Although this review covers our research topic, it does not analyse humanitarian logistics literature.

These five existing literature reviews follow a rigorous research process, and provide highly valid results, although with different specificities and perspectives. In our paper, we will use several of the characteristics and concepts developed and

Table I.
Meta-analysis of previous literature reviews

Criteria	Altay and Green (2006)	Kovács and Spens (2007)	Natarajarathinam *et al.* (2009)	Pettit and Beresford (2009)	Overstreet *et al.* (2011)
Scope	OR/MS literature in disaster operations management	Literature on humanitarian logistics	Literature of supply chain management (SCM) in times of crisis	Literature about critical success factors in the commercial context	Literature on humanitarian logistics, sudden onset disasters
Aim of research	Issues in disaster operations management survey existing OR/MS literature suggest future research directions tutorial for interested researchers	Discover and describe characteristics of humanitarian logistics in disaster relief operations	Provide a framework to classify SCM literature in crisis management identify current and future research directions	Identify critical success factors for humanitarian aid supply chains discuss the applicability of success factors from commercial supply chains to humanitarian aid	Provide a framework for conducting research in humanitarian logistics analyse the primary focus of humanitarian logistics research review areas identified for further research
Search techniques	Keywords in databases citations from papers	Keywords in databases citations from papers	Keywords in databases searches in SCM, OR, logistics, management science journals	Not specified	Keywords in databases citations from papers
Number of papers	109	Not specified	118	Not specified	51
Time coverage	1980-2004	...-2006	…-2008	…-2009	…-2009
Inclusion criteria of papers	OR/MS literature all phases of disasters all types of disasters according to IFRC definition	Humanitarian logistics literature all phases of disasters all types of disasters	Literature on supply chain crisis all phases of disasters all types of disasters	Not specified	Humanitarian logistics literature all phases of disasters sudden onset disasters
Inclusion criteria of journals	Academic OR/MS journals	Academic journals practitioners journals web sites	Academic SCM and OR/MS journals case publications in SCM literature	Not specified	Not specified
Classification of papers?	Yes	No	Yes	No	Yes
Data analysis	Quantitative and qualitative	Qualitative	Quantitative and qualitative	Qualitative	Quantitative and qualitative
Differentiation	No other previous study surveyed OR/MS literature in disaster operations management	No other previous study developed a framework for humanitarian logistics	No other previous study analysed literature about managing supply chains in times of crisis	No other previous study analysed critical success factors applied to humanitarian aid	No other previous study developed a framework for future research based on theory of constraints

applied in these previous reviews, with the aim to increase the reliability of our work. For example, we defined our keywords for the material collection based on keywords we found in these reviews. We also designed our material collection process based on databases and list of bibliography used in these reviews. Finally, we developed our classification of papers based on structural dimensions and categories presented by these authors.

In addition to such specific elements taken from these existing reviews, the relevance and the contribution of our work to academic knowledge is provided by the following distinctive features. First, we include the most exhaustive set of papers and journals in our review. Second, we analyse the papers of our selection with the content analysis methodology as described by Seuring *et al.* (2005), which is particularly suitable for conducting a literature review, as it helps to identify the conceptual content of a field by analysing documents in a structured and reproducible way (Ryan and Bernard, 2000; Seuring *et al.*, 2005). Third, we develop a new theoretical framework which presents the exogenous situational factors impacting humanitarian logistics, and we analyse the contribution from existing literature on this dimension. Finally, we develop a quantitative methodology allowing us to analyse and categorise papers according to these situational factors, based on the occurrence of specific keywords.

In particular, we will try to answer the following research questions: What are the main characteristics of previous literature reviews done on humanitarian logistics? What are the main dimensions studied so far in the academic literature? Which situational factors found in disaster-affected areas influence humanitarian logistics? What are the situational factors most mentioned and studied so far in academic literature on humanitarian logistics? By answering these questions through our qualitative and quantitative content analysis, this work attempts to generate possible tracks for relevant future research that has not yet been addressed by previous authors.

First, we will present the content analysis methodology we used. Sections 2 and 3 introduces the theoretical framework and methodology we developed. Section 4 presents the main results of our analysis; then in Section 5 we discuss these results and compare them with the findings from the literature. Finally, we conclude the paper in Section 6.

2. Theoretical framework

As mentioned in the previous section, one of the specific contributions of our research is the analysis of situational factors found in the disaster-affected area. We define situational factors as exogenous contextual variables which are present in the disaster-affected area and impact the performance of humanitarian logistics. These factors cannot be modified by the relief organizations, yet their impact can be reduced depending on the organizations' abilities to handle them. In order to present these factors, and situate them in the humanitarian logistics context, we use a theoretical framework we developed in a previous study Kunz and Reiner (2011). The aim of the framework presented in Figure 1 is to develop an understanding of the way local situational factors influence the performance of humanitarian logistics. While the effectiveness of a process in a business environment can be measured by the value it creates (Goldsby and García-Dastugue, 2003), in the context of humanitarian logistics, effectiveness should instead be determined by its fit with the beneficiaries' requirements, in other words, timely delivery of the right relief items. Similarly, efficiency can be defined as the quantity of relief items delivered

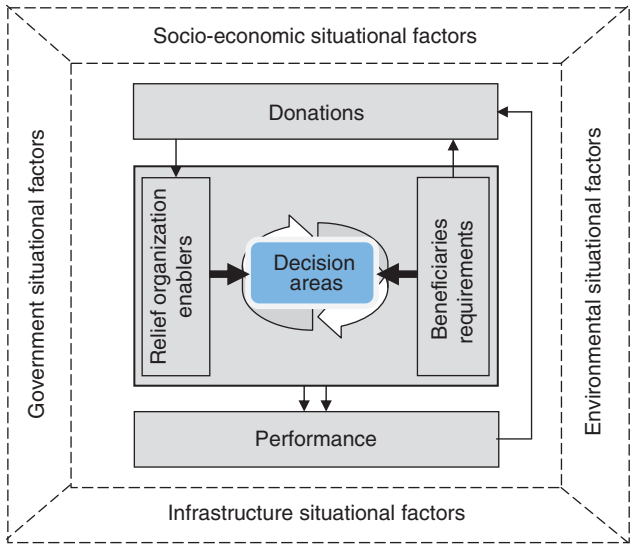


Figure 1.
Theoretical framework

within a given budget. Performance in humanitarian logistics can therefore be seen as the result of the strategic reconciliation (Slack and Lewis, 2002) of relief organizations' enablers (resources, processes and capabilities) and the requirements of the beneficiaries (e.g. survivability, speed, safety, sustainability). If there is a gap (unsatisfactory performance), it is assumed that relief organizations will adapt their strategies, thus dealing with the operational decision areas (allocation of resources, level of cooperation, outsourcing, etc.), in order to reach a strategic fit between the enablers and the requirements of the beneficiaries. As presented in Figure 1, relief organizations' enablers (resources, processes and capabilities) are influenced by the availability of donations, which in turn is influenced by the requirements of the beneficiaries and by performance as well.

One structural dimension of our literature review will analyse the situational factors impacting humanitarian logistics. The following situational factors were identified in the literature:

- Government situational factors, such as the type of regime, the national regulations toward relief organizations, the efficiency of the state, the level of corruption, are factors which influence organizations' operational decisions and their ability to conduct humanitarian logistics operations. A government which is suspicious of relief organizations' activities will, for example, tend to restrict the entry of staff and goods in the country in the aftermath of a disaster (Seekins, 2009), while a cooperative government will welcome relief organizations on its territory (McLachlin and Larson, 2011; Van Wassenhove, 2006). The security context in a country is also dependent from the government (or its absence), and strongly impacts the performance of the logistics response (Long and Wood, 1995).
- Socio-economic situational factors, such as the type of market economy, the presence of local suppliers, the level of education of the population, the local culture and religion will oblige relief organizations to adapt their operation to the

context, and can affect the performance of humanitarian logistics (Altay *et al.*, 2009; Dowty and Wallace, 2010; Kandiyoti, 2007; Leon *et al.*, 2009; Maon *et al.*, 2009). In a well-developed economy, some basic supplies can be purchased from local suppliers, and staff can be hired locally for logistical activities. In a less developed context, all supplies have to be imported and most tasks must be managed by expatriate staff.

- Infrastructure situational factors, such as the availability of a road network, railway, airports, power supply, play an important role in the performance of humanitarian logistics (Chakravarty, 2011; Nolz *et al.*, 2011; Pazirandeh, 2011; Vitoriano *et al.*, 2011). Indeed, the existence of a well-developed road infrastructure will, for example, facilitate the logistical operations, while a poor road network tends to disrupt and slow down the distribution of relief items, for example. The presence of an airport close to the disaster location will facilitate, for example, the delivery of relief aid. Environmental situational factors, such as the weather, the topography, geography, vegetation, presence of water, effects of climate change, also affect humanitarian logistics (Benini *et al.*, 2009; Jahre *et al.*, 2009; Linnerooth-Bayer *et al.*, 2005; Majewski *et al.*, 2010; Smirnov *et al.*, 2007). Heavy rainfall can for example hinder the dispatching of trucks delivering relief supplies. Delivering aid to victims of a disaster in a mountainous area of Pakistan requires different strategies and equipment than assisting beneficiaries in the Sahel.

In our review, we will analyse how frequently these situational factors have been studied so far, and determine if there are factors for which more research could be done.

3. Methodology

As mentioned by Seuring *et al.* (2005), a literature review fulfils two functions. First, it summarizes the existing state of research on a topic by identifying the main themes and issues, and thus provides a starting point for new research. Second, any scientific contribution has to be enfolded against the existing scientific knowledge and theories, and in this regard a literature review is a useful tool (Saunders *et al.*, 2009). However, despite the importance of this tool for academic research, the processes of collecting and analysing literature are often less thoroughly described than an empirical research process would be, which calls for more rigorous, systematic and reproducible literature reviews (Seuring *et al.*, 2005).

In this respect, and according to several authors, content analysis is particularly suitable for conducting a literature review, as it helps to identify the conceptual content of a field by analysing documents in a structured and reproducible way (Ryan and Bernard, 2000; Seuring *et al.*, 2005). Content analysis is a method used in empirical social sciences, which can be applied in a quantitative or qualitative way (Seuring *et al.*, 2005). Berelson, one of the founders of content analysis, defines it as a "research technique for the objective, systematic and quantitative description of the manifest content of communication" (Berelson, 1952). A broader definition states that content analysis is "any methodological measurement applied to text (or other symbolic materials) for social science purposes" (Shapiro and Markoff, 1997). A specific strength of this method is that it can combine qualitative approaches with powerful quantitative analyses (Duriau *et al.*, 2007). Due to these different strengths, the content analysis methodology has been used by many authors in the field of operations management

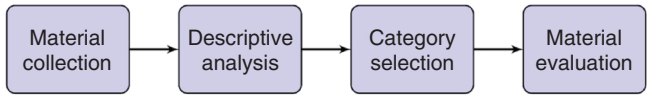
to analyse formal and content aspects of the existing literature (Bryman, 2006; Croom *et al.*, 2000; Denizel *et al.*, 2003; Giunipero *et al.*, 2008; Reisman and Kirschnick, 1994; Seuring, 2008; Spens and Kovács, 2006). However, to the best of our knowledge it has not been applied so far to humanitarian logistics.

For Brewerton and Millward (2001), both qualitative and quantitative aspects of the data have to be considered when performing a structured content analysis. According to Seuring *et al.* (2005), quantitative and qualitative methods are not contradictory methods, but can support each other well. Patton (2002) mentions that it is possible to move from qualitative data to quantitative analysis; however, she stresses that the reverse is not possible. In his book on mixed methodologies, Tashakkori (2006) calls this process the "quantification of qualitative data", which can include, for example, the occurrence count of certain themes.

For our literature review we will use both qualitative and quantitative content analysis. First, we will categorize the papers according to five structural dimensions, based on a qualitative analysis. Second, we will use a quantitative method in order to categorize the papers in the sixth structural dimension, the situational factors. In particular, we will apply the process model for content analysis described by Seuring *et al.* (2005). The four steps of the model are shown in Figure 2 and are described in detail in the next sections.

3.1 Material collection

In this first step, the unit of analysis was determined. For our review, we analysed single academic papers. Then, the papers to be collected were defined and delimitated following the process described in Figure 3. We used a hybrid identification method for the papers. First we collected academic papers from the extensive bibliography list



Source: Seuring *et al.* (2005)

Figure 2.
Process model for content analysis

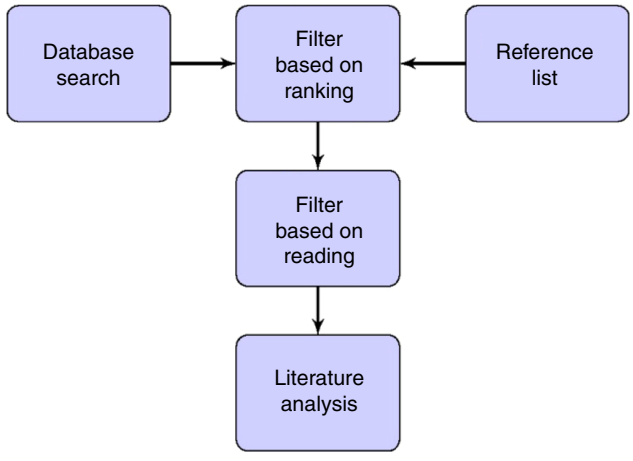


Figure 3.
Material collection process

published by Peter Tatham (2012) on the web site of the HUMLOG Institute, a research institute on humanitarian logistics regrouping the most well-known academic institutions in this field.

Second, we conducted a search in databases. The following keywords and Boolean operators were searched for in the fields "Title", "Abstract" or "Keywords":

(Logistic OR Supply Chain*) AND (Humanitarian OR Relief)*

These keywords were inspired by the keywords used in previous literature reviews. The search was limited to peer-reviewed publications only, and book sections, conference proceedings, reports and practitioner journals were excluded from our selection. This search was performed in March 2012 using the following databases: Business Source Complete, Science Direct, ABI/INFORM Global and Web of Science, and included all papers published or made available online until the end of 2011. After employing this hybrid selection mechanism, we filtered the papers according to a quality criterion, in order to analyse only highest quality contributions. Therefore, we retained only papers from journals which are included in at least one of the following rankings: the German VHB (2011), the British ABS (2010), the French CNRS (2008) or one of the US (Olson, 2005) rankings. In addition, we also kept papers from all journals contained in the Journal citation reports (Thomson Reuters, 2010), as well as from recent journals such as the *Journal of Humanitarian Logistics and Supply Chain Management* (because of the time it may take to get incorporated into journal rankings). This combination of rankings led to the selection of 68 journals, which are listed in Appendix 2.

After the above mentioned filter based on rankings, we filtered the papers based on their relevance to the topic. Therefore, the last step of the selection process was a reading of abstracts, as proposed by Jahangirian *et al.* (2010), and irrelevant papers were eliminated from the selection.

After this material collection process, we were left with 174 papers.

3.2 Descriptive analysis

In this step, the formal aspects of the selection of the 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 of publication trends. The aim of these analyses is to position our work in the dynamic context of the existing body of literature.

3.3 Category selection

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

First, we categorized the papers based on the context of operation, which can be either disaster relief or continuous aid work, as presented by Kovács and Spens (2007). 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 for up to several decades. It usually focuses more on development aid, and is rarely characterized by an emergency. In general, continuous aid starts in the last phase (i.e. reconstruction) of disaster relief.

Second, we used one of the criteria developed by Van Wassenhove (2006), which characterizes the speed of start of the disaster, 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 levels of the crises differ, as do the types of logistical response needed.

Third, we used another criterion developed by Van Wassenhove (2006), which is the cause of disaster. He differentiates between man-made and natural disasters (e.g. earthquakes, tsunami, cyclones, etc.). Typical relief organizations focus mainly on man-made disasters, such as terrorist attacks, political crises or the consequences of war, which more often occur in developing countries where the government has limited resources to respond to the crisis. In his paper, Van Wassenhove (2006) cites the former Director of Médecins Sans Frontières (MSF) France, who stated that between 1982 and 1994, as much as 97 per cent of MSF's operations dealt with the relief of man-made disasters. On the other hand, natural disasters occur in all parts of the world, for example the earthquake and tsunami in Japan in March 2011. In developed countries, governmental agencies usually respond to the crisis and perform, or at least steer, 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 the fourth classification criterion, we used the phase of disaster management. All the previous literature reviews use this criterion, albeit with slightly different terminology. We applied the model presented by Kovács and Spens (2007), which differentiates between preparation (i.e. evacuation plans, training, pre-positioning 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 reduction of the effects of disasters. As this phase cannot be observed in each type of disaster, we decided to include this phase in the preparation phase, because it is also conducted before the onset of a disaster.

The fifth classification we used was the research methodology, which is also used by Altay and Green (2006). However, as they review the OR literature in particular, we did not use their categories, which are too specific (i.e. different types of modelling techniques), but rather a more general selection of categories, which is common in operations management (Karlsson, 2008) and supply chain management (Kotzab *et al.*, 2005): simulation and modelling, conceptual research, literature review, case study and survey.

The sixth classification we used was motivated by our theoretical framework presented in Figure 1, and aimed at determining the situational factor which is mentioned most in each paper. Such a classification is more complex than the five previous ones, and would be too biased if only performed through the qualitative academic judgement of one single analyst. Therefore, we decided to develop a specific classification methodology, based on the previously mentioned idea of codification of text sections to groups (i.e. situational factors), which could later be evaluated quantitatively, based on the group that appeared most in each paper.

For this, we used the ATLAS.ti software package, which is useful to code and analyse the content of texts. We started our analysis by performing a word count in all 174 papers of our selection. This resulted in a list of over 40,000 words, but we only concentrated on the words occurring five or more times in our selection of

papers (12,000 words). We manually screened these words in order to identify those related to one of the situational factors described previously. This process was performed two times independently, in order to ensure that no word was missed, and resulted in a list of 388 keywords, which we reduced by combining words with the same root to one single keyword (e.g. "politics", "political", "politically", "politicization", "geopolitical", "politician" were regrouped in one keyword "politic"). We also added a prefix to keywords with were not specific enough (e.g. "local supplier" instead of "supplier"). Words with ambiguous meanings were removed from the selection in order to avoid having keywords representing several situational factors (e.g. "environment", which could be related to environmental issues but also to the business environment, was removed). After this refinement process, 120 keywords were left.

We then categorized these 120 keywords into the four situational factors identified previously. This process was performed independently by three researchers in order to increase the reliability of our categorization. A strong consensus was achieved in this process, as we achieved an inter-coder reliability of 88 per cent (i.e. 88 per cent of the keywords were assigned by all three researchers to the same situational factor) and a Fleiss' κ of 0.874, which can be considered as an almost perfect agreement (Landis and Koch, 1977). In case of disagreement, the choice with the highest number of votes was kept. The categorization of keywords into the different situational factors is presented in Table III, together with their absolute occurrence. This choice of keywords and their categorization into different situational factors can be described as an inductive approach, as they were derived directly from the literature. This adaptive approach is similar to Mayring's "inductive category development" method, in which categories are revised and eventually reduced during the coding activity (Mayring, 2000).

The word count was then conducted again with the final selection of 120 keywords. As the ATLAS.ti software tool gives the possibility to visualize and edit the words included in the count, we removed all words appearing in the bibliography and annexes sections, as well as in the names of authors, addresses and page headings of papers, in order to analyse only the real content of the papers. Also, a manual screening of the words counted allowed us to remove unrelated words which were counted because of their similarity to our keywords (e.g. "non-governmental" was removed from the "government" keyword, "important" was removed from "import" keyword, etc.).

As an output, ATLAS.ti provided a word count matrix [120×174], with the occurrence of each keyword in each paper. In total, the 120 keywords appear 9,233 times in our selection of papers. The lowest occurrence (three) is observed for keywords consisting of two words, such as "local capability" or "developing economy", and the highest occurrences are observed for more general keywords such as "government" (1,063) or "community" (986).

3.4 Material evaluation

In this last step, the literature was analysed and categorized according to the six structural dimensions defined in the previous section, similarly to the classification of papers done by Natarajarathinam *et al.* (2009)in their literature review.

Each paper was assigned to the first five structural dimensions based on academic judgement through the reading of abstracts and conclusions. When these parts did not contain enough information to categorize the paper, a more extensive

examination of the paper was carried out. There was not much ambiguity in assigning papers to categories in the five first structural dimensions.

For the sixth structural dimension, the determination of the situational factor mentioned most in each paper, we quantitatively evaluated the results of our keyword count, using an approach suggested by Mayring, who 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" (Mayring, 2002). Such text encoding and subsequent analysis is also proposed by Weber (1990) in his book about content analysis.

For this quantitative approach, we used two different processes. First we analysed the absolute occurrence of each keyword. This was performed through a simple occurrence count of each of the 120 keywords, and allowed us to find which keywords are used most in our selection of papers, in absolute terms.

Second, we analysed the relative occurrence of the four situational factors. For this, we summed up the number of times all keywords from a particular situational factor i were assigned in the analysed paper (n_i). Then, we calculated the average occurrence of all keywords belonging to this situational factor in all the publications ($\bar{N}_l$). Finally, for each paper we calculated the relative usage of the situational factor (U_i) by dividing n_i by $\bar{N}_l$:

$$U_i = \frac{n_i}{\bar{N}_l}$$

This means that if keywords from this situational factor were used more than average in an paper, U_i would be >1 (i.e. the situational factor is overrepresented in this paper), otherwise it would be <1 (i.e. the situational factor is underrepresented).

Then, we calculated the same figures for each of the other three situational factors in the same paper, which gave us the relative usage of each situational factor in this paper.

Finally, we assigned this paper to the situational factor which had the highest relative usage (U_i) of all the situational factors of this paper:

$$\text{Situational factor} = MAX\{U_{gov}; U_{socio\text{-}eco}; U_{infra}; U_{env}$$

This methodology of classification therefore allowed us to assign each paper to the situational factor which was relatively most mentioned. It has the advantage of sorting out quantitatively the most used situational factor from the situational factors addressed in each paper, and is therefore more objective and precise than if done only by academic judgement.

In order to concentrate our analysis only on the most significant results, we excluded papers from this selection process in the following cases:

- If the difference between the maximal and second highest relative usage (U_i) was <0.1, indicating an unclear distinction between situational factors. A total of 23 papers were excluded from the analysis due to this rule.
- If the maximal relative usage (U_i) was below 1, showing that none of the situational factors was overrepresented in this paper. A total of 45 additional papers were excluded from the analysis due to this rule.

For this reason, the analysis of relative occurrence was conducted on a subset of 106 papers.

Table II provides a list of all the structural dimensions and related analytical categories that we used to categorize the papers of our review, as well as the

Structural dimension	Analytical categories	Methodology of assessment
Context of operation	Disaster relief | continuous aid | both or not specific	Academic judgement
Speed of start	Slow onset | sudden onset | both or not specific	Academic judgement
Cause of disaster	Natural | man-made | both or not specific	Academic judgement
Phase of disaster	Mitigation and preparation | response | reconstruction | several	Academic judgement
Research methodology	Simulation and modelling | conceptual research | literature review | case study | survey	Academic judgement
Situational factors	Government | socio-economic | infrastructure | environment	Relative occurrence

Table II.
Structural dimensions and related categories for the classification of papers

methodology applied for assigning the papers to the different categories in each dimension.

3.5 Quality

As a thorough literature review process is crucial for performing substantive and valid research (Rao and Goldsby, 2009), it is important to discuss quality measures of content analysis, such as objectivity, validity and reliability (Spens and Kovács, 2006). All the steps of our literature collection and evaluation process are precisely described in our methodology section, which increases the transparency and reproducibility of our research design. In our review process, we ensured objectivity by designing clear decision rules for the coding in each category (Spens and Kovács, 2006). Our clearly defined classification scheme is based on theory, which increases the reliability of the coding and the internal validity of the findings. The use of three researchers for the allocation of keywords to the different situational factors increases the reliability of the categorization process (Spens and Kovács, 2006). External validity (generalization) is assumed because we examined a very broad set of papers, thus we believe that the content we analysed is representative of the field of academic knowledge in humanitarian logistics. A high level of construct validity (i.e. measuring what we want to measure) is achieved for the first five structural dimensions, as all of them are taken from the existing literature and are well accepted in the community. For the sixth structural dimension – the situational factor most mentioned in each paper – the construct validity is less strong, as these particular set of situational factors were developed inductively and have never been tested before. This was, however, compensated for by using a highly objective method (automatic word count of specific keywords) and through the use of multiple researchers for allocating keywords to the situational factors. Inter-subjectivity of data analysis was achieved by discussing the ambiguous decisions between the three researchers, with the aim of finding a shared understanding. The significance of the results of our relative analysis of situational factors is increased because we removed papers for which no clear result emerged Table III.

4. Results

4.1 Descriptive results

By following the methodology described in the previous section, a total of 174 papers written between 1993 and 2011 were retained and analysed. Figure 4 shows a growing

Government (2,973)	Socio-economic (3,913)	Infrastructure (1,528)	Environment (819)
Government (1,063)	Community (986)	Infrastructure (642)	Geography (240)
politic (521)	social (635)	road (506)	environmental (178)
law (121)	culture (374)	airport (111)	weather (86)
regulation (107)	women (239)	bridge (74)	climate (83)
legal (101)	gender (195)	highway (45)	tropical (49)
official (87)	society (146)	electricity (43)	rainfall (34)
enforce (83)	poverty (126)	generator (40)	mountain (32)
police (81)	male (119)	railway (29)	forest (24)
restrictions (77)	welfare (110)	utilities (15)	meteorological (24)
customs (74)	urban (102)	subway (13)	pollution (13)
citizens (60)	language (77)	harbour (10)	geophysical (12)
bureaucracy (51)	rural (75)		deforestation (10)
border (50)	female (69)		desert (10)
import (49)	ethnic (64)		ecology (10)
local authority (42)	religion (61)		topography (9)
ministry (40)	Islam (50)		geology (5)
regime (39)	local supply (36)		
democracy (36)	church (30)		
president (31)	psychosocial (29)		
constitution (29)	psychological (25)		
legislation (28)	demographic (23)		
court (26)	microenterprise (20)		
municipal (23)	local economy (19)		
colonial (22)	local partner (18)		
corruption (20)	local sourcing (17)		
coercion (19)	sociology (17)		
jurisdiction (17)	local capacity (15)		
diplomacy (16)	local organization (15)		
election (16)	Muslim (15)		
justice (15)	strike (15)		
parliament (8)	literacy (13)		
fiscal (5)	local actor (13)		
judiciary (5)	local market (13)		
public administration (5)	local procurement (13)		
national army (3)	local retailer (13)		
repression (3)	local NGO (12)		
	minority (12)		
	adult (9)		
	local staff (9)		
	supermarket (9)		
	anthropological (7)		
	inflation (7)		
	local expertise (7)		
	socioeconomic (6)		
	local manufacturer (5)		
	oligopolistic (5)		
	procured locally (5)		
	local business (4)		
	local personnel (4)		
	local worker (4)		
	developing economy (3)		
	emerging economy (3)		
	entrepreneurship (3)		
	local capability (3)		
	local distributor (3)		
	local production (3)		
	local provider (3)		

Table III.
Keywords (occurrence) for each situational factor

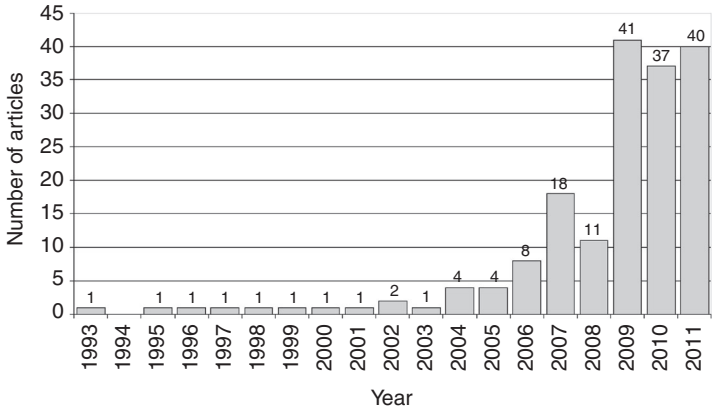


Figure 4.
Number of papers per year

trend in the number of publications per year, which justifies the need for an up-to-date literature review. It also demonstrates that humanitarian logistics is a new field of research that has attracted increasing interest in recent years.

This strong increase can be explained by the fact that in the years 2004-2006, three major natural disasters happened, and the logistic response suffered from inefficiencies, especially in the case of the Asian tsunami. Acknowledging this, several researchers started to investigate that area.

This increase can also be partially explained by the fact that during the years 2007-2011, several journals published special issues focusing on humanitarian logistics, and a new journal on this topic was launched in 2011 (*JHLSCM*, 2011).

The number of papers published in the different journals is presented in Table IV. The high number of papers published in some of them is due to the publication of special issues on humanitarian logistics.

4.2 Results by categories

In this section, we present the different classifications of our papers according to the structural dimensions described earlier. All the results are presented in Table V.

For the context of operation, we found that a large majority of the papers concentrate on disaster relief (86 per cent). Only 11 papers in the selection (6 per cent) focus on continuous aid aspects.

Regarding the speed of start, we found that most papers deal with sudden onset disasters (66 per cent) or both sudden and slow onset disasters (26 per cent). Only 14 papers (8 per cent) concentrate specifically on slow onset disasters.

Concerning the cause of disaster, we found that most papers focus on natural disasters (37 per cent) or both natural and man-made disasters (58 per cent). Only nine papers (5 per cent) focuses specifically on man-made disasters.

As for the phase of disaster management, 33 per cent of the papers cover several phases. Another 42 per cent focus on the response phase that immediately follows the outbreak of the disaster. The mitigation and preparation phase is covered specifically in 33 papers (19 per cent), while the reconstruction phase, following the response, is studied in depth in only ten papers (6 per cent) in our selection of literature.

Five different research methodologies were used in the papers of the selection. Simulation and modelling is by far the most used methodology (46 per cent), followed by conceptual research (24 per cent) and case study (23 per cent). Surveys were used as

Title of journal	Number of papers
International Journal of Physical Distribution & Logistics Management	22
International Journal of Production Economics	17
Journal of Humanitarian Logistics & Supply Chain Management	9
Supply Chain Forum: An International Journal	8
Transportation Research Part E: Logistics & Transportation Review	8
Management Research News	7
Disasters	6
OR Spectrum	6
International Journal of Logistics: Research & Applications	5
Journal of the Operational Research Society	5
Computers & Operations Research	4
International Journal of Risk Assessment & Management	4
International Journal of Services Technology & Management	4
Supply Chain Management: An International Journal	4
European Journal of Operational Research	3
Transportation Research Record	3
Interfaces	2
International Journal of Logistics Systems & Management	2
International Journal of Productivity & Performance Management	2
Journal of Business Logistics	2
Journal of Public Procurement	2
Transportation Research Part B: Methodological	2
Transportation Science	2
American Journal of Disaster Medicine	1
Annals of Operations Research	1
Asian Journal of Social Science	1
Business Horizons	1
Computers & Industrial Engineering	1
Decision Sciences	1
Development & Change	1
Expert Systems with Applications	1
Fuzzy Optimization & Decision Making	1
Harvard Business Review	1
IIE Solutions	1
Information Technologies & International Development	1
International Affairs	1
International Journal of Advanced Robotic Systems	1
International Journal of Educational Development	1
International Journal of Emergency Management	1
International Journal of Logistics Management	1
International Journal of Operations & Production Management	1
International Journal of Public Sector Management	1
International Journal of Services Sciences	1
International Journal of Strategic Property Management	1
International Studies Quarterly	1
International Transactions in Operational Research	1
Journal of Business Ethics	1
Journal of Global Optimization	1
Journal of Intelligent Transportation Systems	1
Journal of Manufacturing Technology Management	1
Journal of Multi-Criteria Decision Analysis	1

Table IV.
Number of papers per journal

(*continued*)

Title of journal	Number of papers
Journal of Network & Computer Applications	1
Journal of Operations Management	1
Journal of the Association for Information Systems	1
Journal of the Royal Statistical Society. Series C, Applied Statistics	1
Knowledge & Information Systems	1
Management Accounting Quarterly	1
MIT Sloan Management Review	1
Naval Research Logistics	1
Operations Management Research	1
Oxford Development Studies	1
Papers in Regional Science	1
Production & Operations Management	1
Science	1
Social Studies of Science	1
The Economic Journal	1
TOP: An Official Journal of the Spanish Society of Statistics & Operations Research	1
Transportation Research Part A: Policy & Practice	1

Table IV.

Dimension and related categories	No. papers	Frequency (%)
Context of operation		
Disaster relief	150	86
Continuous aid	11	6
Both or not specific	13	8
Speed of start		
Sudden onset	114	66
Slow onset	14	8
Both or not specific	46	26
Cause of disaster		
Natural	64	37
Man-made	9	5
Both or not specific	101	58
Phase of disaster management		
Mitigation and preparation	33	19
Response	74	42
Reconstruction	10	6
Several or not specific	57	33
Research methodology		
Simulation and modelling	80	46
Conceptual research	42	24
Case study	40	23
Literature review	5	3
Survey	7	4
Situational factor		
Government	24	23
Socio-economic	20	19
Infrastructure	34	32
Environment	28	26
Unspecified	68	–

Table V.
Number of papers per category for each structural dimension

main methodology in only seven papers (4 per cent), and literature reviews in only five papers (3 per cent).

Through our word count (see Table III), we found that in absolute terms the socio-economic situational factors are mentioned most (3,913 occurrences, 42 per cent), followed by governmental factors (2,973, 32 per cent), infrastructure factors (1,528, 17 per cent) and environmental factors (819, 10 per cent). Table III shows that some keywords such as "government" or "community" are used around 1,000 times in our set of papers. This is due to the fact that they represent concepts mentioned in most of the paper, even in those which do not focus specifically on a particular situational factor. Words such as "politic", "social", "infrastructure", "road" are also mentioned often as they are of central importance in humanitarian logistics. While this absolute occurrence of keywords is interesting, it does not provide enough information to identify the situational factor on which each paper is focusing.

Our quantitative methodology based on the relative occurrence of keywords addresses this limitation. By following the method described in Section 3.4, we were able to categorize papers into four major situational factors (see Table V). We found that the highest proportion of papers focus on infrastructure situational factors (32 per cent), mainly transport infrastructure. The second highest proportion of papers focus on environmental situational factors (26 per cent), mainly weather, geography or pollution. The third highest proportion of papers focus on governmental situational factors (23 per cent), and address topics such as local government, regulations, customs clearance, etc. The lowest proportion of papers focus on socio-economic situational factors (19 per cent), with topics such as gender, local economy, religion, etc. A total of 68 papers could not be classified with our quantitative method, because the result of our evaluation was not clear enough (i.e. not a clear difference between two situational factors mentioned in the paper), or when no particular situational factor was covered in the paper (i.e. situational factors mentioned, but none of them was overrepresented, i.e. had an above average occurrence).

5. Discussion

This section's objective is to discuss the results presented in the previous chapter following an integrated, holistic approach.

First, for the context of operation, the existing literature focuses mainly on disaster relief, with continuous aid being almost entirely overlooked. The reason for this is that continuous aid allows for better planning and continuous improvement activities and seems to be less challenging to manage than emergency disaster relief. Another possible explanation is that continuous aid operations are more complex to analyse as they require a multi-period approach, which is more complex to model. In our opinion, additional research should address issues from the continuous aid setting, such as partnerships with local companies, the inclusion of the aid effort in the economic development of an area, etc. This is confirmed by a recent publication of Kovács and Spens (2011b), which recognize that humanitarian aid is often embedded in long-term development programmes.

Second, regarding the speed of start of disasters, the current literature mainly concentrates on sudden onset disasters, with only few papers covering specifically slow onset disasters. Although slow onset disasters such as drought, famine and floods generally allow for more time to react, they can have worse consequences for populations because of their large scale (Long and Wood, 1995; Majewski *et al.*, 2010).

Therefore, careful logistical planning and operation is crucial even for responding to slow onset disasters. Hence, we think that future research should explore in more depth the particularities of slow onset disasters, such as wars, droughts or famines, as they have received only very limited attention so far.

Third, regarding the cause of disaster, almost all papers (95 per cent) focus either on natural disasters or on both natural and man-made disasters, but only nine papers deal specifically with man-made disasters. This lack of research on man-made disasters is surprising as for some organizations, such as MSF, man-made disasters represent a much larger proportion than natural disasters (Van Wassenhove, 2006). Maybe natural disasters are seen as more fatalistic and therefore generate more interest than man-made disasters, which are perceived as preventable (Altay and Green, 2006). The difficulty of accessing areas affected by man-made disasters is certainly another reason why less research has been performed so far on this type of disaster. Also, the higher complexity of man-made disasters (Long and Wood, 1995) complicates research in this field. Another possible reason for this lower proportion of research on this topic can come from the fact that some man-made disasters, such as industrial accidents, are generally handled by governmental agencies (e.g. armed forces, fire fighters, civil defence, etc.), and are therefore not reported in the academic literature on humanitarian logistics. Based on the high proportion of man-made disasters in relief organizations' programmes, and because of the complexity of such disasters, we suggest that future research put a stronger focus on the humanitarian logistic response to man-made disasters and their particular challenges.

Fourth, concerning the phase of disaster management, we found that most of the papers focus on the response, preparation or several phases, but only ten papers specifically address the reconstruction phase. This confirms results from previous literature reviews which also found that there is a lack of studies on the reconstruction phase (Altay and Green, 2006; Kovács and Spens, 2007; Natarajarathinam *et al.*, 2009; Overstreet *et al.*, 2011). While it is true that this phase generates less urgency, it should, however, not be forgotten that the quality of the logistical activities during this phase strongly impacts on the success of the whole disaster recovery process, especially in terms of sustainability and long-term effectiveness (Beamon and Balcik, 2008; Benson *et al.*, 2001; Besiou *et al.*, 2011; Kovács and Spens, 2011b). We therefore suggest that the long-term sustainability of humanitarian logistics should be analysed in more detail in the future, as mentioned recently by Kovács and Spens (2011a). The integration of humanitarian logistics into long-term economic development – for example through capacity building or local procurement – is another possible topic in this direction, which is also suggested by Kovács and Spens (2011b).

Fifth, the classification according to the research methodologies used in the papers shows that most of the papers use simulation and modelling, which confirms findings of previous reviews (Altay and Green, 2006; Natarajarathinam *et al.*, 2009). Only a few papers use empirical research (case studies and surveys represent together 27 per cent of all papers). As emphasized by several authors (Kovács and Spens, 2007, 2009, 2011b; Natarajarathinam *et al.*, 2009; Pedraza Martinez *et al.*, 2011; Pettit and Beresford, 2009), we think that empirical methodologies such as cross-organizational case studies as well as surveys should be used more in order to increase knowledge in the field.

Sixth, the analysis of the situational factors leads to interesting findings. The absolute occurrence of keywords shows that some concepts are used frequently in all publications. The word "government" for example is the most mentioned word, and

appears in 73 per cent of the papers, showing the high importance of governments in humanitarian logistics. The word "politic" is the fifth most mentioned word (521 times), which also confirms the importance politics play in humanitarian logistics, as mentioned by several authors. Tomasini and Van Wassenhove (2004) for example call for a de-politicization of humanitarian supply chains in order to avoid the manipulation of relief aid by stakeholders such as local governments. Kovács and Spens (2011b) as well as Seekins (2009) mention the strong impact of politics on humanitarian logistics, and recommend to include this aspect more in future research on humanitarian logistics.

Socio-economic situational factors are also mentioned in several papers. The keyword "community" for example appears 986 times, and is used in 69 per cent of the papers of our selection. "Social" is also of major importance, and is used 635 times, as well as "culture" which appears 374 times. The high absolute usage of these words shows the importance of socio-economic factors, which is proven by several papers focusing on issues such as gender (Kandiyoti, 2007; Kovács and Tatham, 2009a, 2010), education (Aguilar and Retamal, 2009) or the implication of local communities in disaster relief operations (Kovács *et al.*, 2010). The low absolute occurrence of keywords such as "local manufacturer" (five), "local business" (four), "developing economy" (nine) or "emerging economy" (three) is surprising and shows that these themes are underrepresented in current research, despite their importance in humanitarian logistics.

Infrastructure situational factors are also mentioned often. Obviously, the word "infrastructure" (642 times) appears in 71 per cent of all papers, and words such as "road" (506) or "airport" (111) are also used often, which is easily understandable as our paper focuses on logistics. In a disaster setting, the infrastructure is often destabilized, which strongly impacts the transportation capabilities (Kovács and Spens, 2007; Pettit and Beresford, 2009). Especially in natural disasters, the road infrastructure is often destroyed and emergency repair activities are needed before relief supplies can be dispatched to the beneficiaries (Yan and Shih, 2009). Power supplies are other examples of critical infrastructures which have to be restored in the immediate aftermath of a disaster in order to facilitate the response phase (Oloruntoba, 2010). Airports can are also be destroyed by disasters (Pettit and Beresford, 2005) and can represent major bottlenecks which slow down the delivery of supplies during the immediate response phase of a disaster (Tomasini and Van Wassenhove, 2004).

Keywords from the environmental situational factors were used less often than the other situational factors. Indeed, "geography" (240 occurrences) and "environmental" (178), the most used words in this situational factor, appear only in 55 and 31 per cent of the papers. This may seem surprising, but it has to be mentioned that words representing causes of natural disasters, such as hurricane, cyclone, drought, flooding were intentionally not included in our list of keywords, in order to concentrate only on exogenous factors influencing disasters, such as weather, pollution, geography, etc. The low use of keywords belonging to environmental situational factors may be due to the fact that the environment is a rather specific problem, affecting only some particular disasters settings. Thomas and Fritz (2006) mention that disasters occurring on large geographic areas increase the complexity of the logistical response. Geography and weather is also important when solving routing problems (Smirnov *et al.*, 2007) or facility location problems (Görmez *et al.*, 2011). Topography also has a strong influence on the logistics response, as mountainous areas, for example are much harder to reach than plains (Balcik *et al.*, 2010; Nolz *et al.*, 2010; Tatham, 2009; Thévenaz and Resodihardjo, 2010).

The quantitative methodology based on the relative occurrence of keywords shows different results than the absolute one, because it aims to identify the main situational factor addressed in each paper. This analysis shows that the share of papers focusing on each of the different situational factors is quite well equilibrated. There are, however, some differences which we will discuss now.

The infrastructure situational factors are focused on in the highest proportion of papers (32 per cent), which is certainly due to the fact that simulation and modelling problems are generally related to infrastructure, as, for example routing problems (Özdamar, 2011; Trautsamwieser *et al.*, 2011; Tzeng *et al.*, 2007), scheduling problems (Hu, 2011; Yan and Shih, 2009) or facility location problems (Görmez *et al.*, 2011; Horner and Downs, 2010; Mete and Zabinsky, 2010). This is demonstrated by the fact that 53 per cent of the papers focusing on infrastructure situational factors use this methodology (compared to 46 per cent in the full selection of papers). Interestingly, conceptual research papers are underrepresented among the papers focusing on this situational factor (6 per cent, compared to 24 per cent in the full selection of papers).

The environmental situational factors are focused on in the second highest proportion of papers (26 per cent). As mentioned earlier, this can be explained by the fact that environmental aspects are rather specific problems, and are therefore focused on only in specific studies. Such papers describe the use of meteorological data for preparing to disasters (Lodree and Taskin, 2009; McCoy, 2008; Taskin and Lodree, 2011), the challenges posed by geographic dispersion of disaster operations (Thomas and Fritz, 2006; Van der Laan *et al.*, 2009; Walker and Harland, 2008) or specific climatic or topographic conditions in the area of operation affecting the disaster response (Benini *et al.*, 2009; Listou, 2008; Tatham, 2009). Interestingly, the mitigation and preparation phase of disaster management is overrepresented in this situational factor (28 per cent, compared to 19 per cent in the full selection of papers), certainly because environment data are of particular interest in preparing for a disaster.

The governmental situational factors are focused on in the third highest proportion of papers (23 per cent). Several papers focus on country-specific disaster settings (Dadzie, 1998; Seekins, 2009; Seybolt, 2009), on the reliance of relief organizations on governments (Kovács and Tatham, 2009b; Long and Wood, 1995; Stephenson, 2005) or on the problem posed by corruption at the government level (Whybark, 2007). The majority of the papers focusing on this situational factor use conceptual research as a main methodology (54 per cent, compared to 24 per cent in the full selection of papers), which is explained by the fact that governmental factors are conceptual in nature and can hardly be addressed through tools such as simulation and modelling. Case studies are also often represented in this situational factor (32 per cent, compared to 23 per cent in the full selection of papers), as they are particularly useful to study highly complex settings (Stuart *et al.*, 2002).

Although the socio-economic situational factors are mentioned in most of the papers in our selection, the lowest proportion of papers in our selection (19 per cent) concentrate specifically on this factor. Even though socio-economic situational factors play a role in most disasters, they were not often recognized as the most important situational factor impacting humanitarian logistics. Most of the papers focusing on this topic mention the importance of culture in the collaboration inside and between organizations (Altay *et al.*, 2009; Dowty and Wallace, 2010; Maon *et al.*, 2009; Perry, 2007; Sandwell, 2011; Tatham and Houghton, 2011; Tatham and Kovács, 2010). The importance of ethnicity and religion is also mentioned in some studies

(Albala-Bertrand, 2000; Altay *et al.*, 2009). Topics such as gender (Kandiyoti, 2007; Kovács and Tatham, 2009a, 2010) also represent a part of the studies on the socio-economic situational factors, as well as the interactions between humanitarian logistics and the local economy (Herlin and Pazirandeh, 2012; Kovács *et al.*, 2010). Conceptual research is the most used methodology for studying this situational factor (50 per cent, compare to 24 per cent in the full selection of papers). Socio-economic situational factors are also conceptual in nature and can hardly be addressed though simulation and modelling methods. Papers focusing on the reconstruction phase are overrepresented in this situational factor (15 per cent, compared to 6 per cent in the full selection of papers), because the importance of the socio-economic factors of a country is higher during this phase than during the response phase.

As a conclusion to this discussion section, we will now present some limitations of our paper. First, our decision to concentrate on academic journals ranked in at least one of the major journal quality rankings may exclude some interesting contributions. The use of multiple rankings and the inclusion of new unranked journals should, however, reduce this risk and improve the representativeness of our selection. Another possible limitation for the qualitative content analysis of the papers (five first structural dimensions) is that the reading of the abstracts and conclusions may not be totally representative of the full content of papers. This risk is, however limited, because we performed a more complete examination when the abstracts and conclusions did not clearly provide the information we needed for our classification. Also, even though content analysis is one of the most objective methodologies existing for conducting qualitative text analysis, it nevertheless involves subjective decisions from the researcher (e.g. academic judgement for classifying a paper in one or the other category), which represents a limitation of this methodology.

The quantitative analysis of the keywords leading to the definition of the most studied situational factor also has some limitations. First, the selection of keywords related to each situational factor may have a selection bias. This risk has, however, been mitigated by conducting the process independently by three different researchers. Second, the word count method is not able to distinguish the context in which the words are used. Even though we removed keywords with a possible ambiguous meaning, it is still possible that some words were attributed falsely to a specific situational factor. In order to avoid this, a manual screening has been conducted in the selected papers, and when ambiguous keywords were observed, they were removed from the count. Finally, although the four situational factors presented in our theoretical framework were derived from the literature, the validity of these constructs has not yet been measured, and could therefore be further tested.

6. Conclusion

If we return to our research questions, we see that previously published literature reviews provide useful findings and suggestions for further research. However, only two of them focus specifically on humanitarian logistics. Also, because they were published some years ago, or because they did concentrate on a limited scope, some of these reviews analyse only a limited number of papers. Finally, each of these reviews concentrate on specific aspects of the literature, but none of them covers in particular the situational factors encountered in disaster-affected areas, a topic which our study analyses in detail.

We found that the most studied dimensions so far are relief operations, in particular sudden onset natural disasters, with a major focus on the disaster response

phase. Modelling and simulation constitute the most often used methodology. The keywords most often occurring in our selection of papers are related to socio-economic and governmental situational factors, which play a central role in most disasters. However, we found that a similar number of papers focus specifically on each of these factors, in other words that the repartition between the different situational factors studied so far is well equilibrated. There is, however, a slightly higher proportion of papers focusing specifically on infrastructure as well as environmental situational factors.

Based on our content analysis of the literature, we suggest that more attention be paid to the logistics of continuous aid operations, that more focus be put on slow onset man-made disasters and that the case study and survey methodologies be increasingly used to collect empirical knowledge. We also think that the reconstruction phase and its sustainability should be studied more. Finally, while governmental and socio-economic situational factors are mentioned in most of the papers, we suggest that more specific studies concentrate on these factors in the future, in order to develop the knowledge in this field.

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Appendix 1

Criteria	Altay and Green (2006)	Kovács and Spens (2007)	Natarajarathinam *et al.* (2009)	Pettit and Beresford (2009)	Overstreet *et al.* (2011)
Scope	OR/MS literature in disaster operations management	Literature on humanitarian logistics	Literature of supply chain management (SCM) in times of crisis	Literature about critical success factors in the commercial context	Literature on humanitarian logistics, sudden onset disasters
Database used	ISI Web of Science IFORS search engine Business Source Premier Cambridge Scientific Abstracts IDS Compendenx Engineering Village 2 Scirus Econbase Civil Engineering Database Scitation SciFinder	Several journal databases	ProQuest ABI/Inform EBSCO ScienceDirect	Not specified	EBSCOHOST ABI/Informs Academic Search Premier Google Scholar
Keywords	Disaster emergency catastrophe extreme event disastrous catastrophic	Humanitarian AND logistics humanitarian aid AND supply chains disaster relief AND logistics disaster relief AND supply chains emergency AND logistics emergency AND supply chains	Crisis risks disaster uncertainty emergency disruption catastrophe crisis management risk management disastrous catastrophic	Not specified	Logistics OR supply chain management and disaster OR emergency OR humanitarian OR relief
Classification of papers?	Yes	No	Yes	No	Yes
If yes, which categories?	Phase of disaster research methodology research contribution cause of disaster publication period problem scenario		Source of crisis scale of crisis phase of crisis management research methodology type of respondent to crisis		Complexities personnel equipment infrastructure information technology planning, policies and procedures proposed models areas for further research
Findings	Mathematical programming is most frequently used method system dynamics, constraint programming and soft OR techniques are underused most papers in	Literature focuses on the preparation phase few papers concentrate on the immediate response phase humanitarian world has insufficient	Increase in number of publications in the last years more research has been done for crisis caused by external sources than internal sources increase of number of paper focusing on	Critical success factors from commercial context are equally important in the humanitarian aid context cultural elements and political constraints play an	Foundations for a core body of knowledge in humanitarian logistics have been laid in literature most humanitarian literature concentrates on preparation or

(*continued*)

Table AI.
Characteristics, findings and proposed future research of previous literature reviews

Criteria	Altay and Green (2006)	Kovács and Spens (2007)	Natarajarathinam *et al.* (2009)	Pettit and Beresford (2009)	Overstreet *et al.* (2011)
	mitigation phase address man-made disasters only few papers in main-stream OR journals are on natural disasters no humanitarian disasters (epidemics, famine, war, genocide) addressed in OR/MS related journals more than 50% of research is on model development, 26.6% on theory development and 15.6% on application	investment in technologies, communication and modelling techniques shortage of logistics experts in humanitarian logistics supply chain processes are largely manual basic principles of business logistics can be applied in humanitarian logistics	several phases of disaster management more research on mitigation and preparation than response and reconstruction phases few research on the recovery of a supply chain after crisis limited empirical studies many analytical research using OR techniques applied research and models developed are specific to particular crisis situations	important role in decision making in humanitarian aid context effectiveness of a humanitarian supply chains is determined by structural or cultural factors	planning phase most authors recommend further research on planning, policies and procedures
Proposed steps for future research	Do more research on reconstruction phase develop mitigation tools develop theory on preparation, response and reconstruction phases do more research on management consulting research for recovery efforts develop measures of productivity and efficiency develop better understanding of inputs for models use new methodologies such as system dynamics, fuzzy systems, soft OR more multi-agency research, considering political issues more research on business continuity after disaster more research on resilient infrastructure and network design	Do more research on response and reconstruction phases do more research on planning and execution of operations in disaster relief do more research on links and similarities between humanitarian logistics and business logistics	Do more research on reconstruction phase develop scales for level of crisis management do more research on robustness and resilience of supply chains do more case studies and empirical research in crisis management for not-for-profit supply chains do more research on supply chain management crisis arising from internal sources do more research on non-profit organizations and humanitarian organizations, through case studies	Test the critical success factors proposed in the study through qualitative research in the context of humanitarian aid	Do more research on organization's personnel: recruiting, training, retaining, deploying personnel do more research on equipment: purchasing, positioning, deploying resources do more research on infrastructure: methods to overcome non-availability of roads, rail, bridges do more research on transportation: last mile distribution do more research on information technology/communication: use of common use software and hardware do more research on inventory management: quantity and location of prepositioning supplies

Table AI.

Appendix 2

Journal	Olson (2005) maximum: 1.1	VHB (2011) maximum: A+	CNRS (2008) maximum: 1	ABS (2010) maximum: 4	Thomson Reuters (2010)
American Journal of Disaster Medicine[a]					
Annals of Operations Research	2.97	B	2	2	0.675
Asian Journal of Social Science					0.053
Business Horizons		E		1	0.809
Computers & Industrial Engineering		C	3	2	1.543
Computers & Operations Research	4.05	B	2	2	1.769
Decision Sciences	3.27	B	2	3	2.233
Development & Change			2		1.359
Disasters					1.174
European Journal of Operational Research	2.83	A	1	3	2.159
Expert Systems with Applications				3	1.924
Fuzzy Optimization & Decision Making					0.702
Harvard Business Review		D		4	1.881
IIE Solutions[a]					
Information Technologies & International Development[a]					
Interfaces	2.53	C		2	0.826
International Affairs					1.198
International Journal of Advanced Robotic Systems					0.326
International Journal of Educational Development					0.983
International Journal of Emergency Management[a]					
International Journal of Logistics Management		D	3	2	
International Journal of Logistics Systems & Management[a]					
International Journal of Logistics: Research & Applications		C	4	2	0.558
International Journal of Operations & Production Management	4.1	C	2	3	1.812
International Journal of Physical Distribution & Logistics Management		B	4	2	2.617
International Journal of Production Economics	4.06	B	1	3	1.988
International Journal of Productivity & Performance Management		D		1	
International Journal of Public Sector Management		C		2	
International Journal of Risk Assessment & Management[a]					
International Journal of Services Sciences[a]					
International Journal of Services Technology & Management		C			
International Journal of Strategic Property Management					2.615
International Studies Quarterly					1.523
		D	3	2	

(*continued*)

Table AII.
Selected journals and their ratings according to different rankings

Journal	Olson (2005) maximum: 1.1	VHB (2011) maximum: A+	CNRS (2008) maximum: 1	ABS (2010) maximum: 4	Thomson Reuters (2010)
International Transactions in Operational Research					
Journal of Business Ethics		C	3	3	1.125
Journal of Business Logistics	3.71	B		2	3.905
Journal of Global Optimization					1.16
Journal of Humanitarian Logistics & Supply Chain Management[a]					
Journal of Intelligent Transportation Systems					1.273
Journal of Manufacturing Technology Management			4	2	
Journal of Multi-Criteria Decision Analysis		B	4		
Journal of Network & Computer Applications					0.66
Journal of Operations Management	3.02	B	1	4	5.093
Journal of Public Procurement[a]					
Journal of the Association for Information Systems		B			2.217
Journal of the Operational Research Society	3.27	B	2	3	1.102
Journal of the Royal Statistical Society. Series C, Applied Statistics			3	2	0.645
Knowledge & Information Systems					2.008
Management Accounting Quarterly		D	4		
Management Research News		C			
MIT Sloan Management Review		D		3	1.452
Naval Research Logistics	2.38	B	3	3	0.982
Operations Management Research		B			
OR Spectrum		A	3	3	2.03
Oxford Development Studies			3		
Papers in Regional Science			2		1.236
Production & Operations Management	2.99	A	1	3	1.851
Science		A+		1	31.377
Social Studies of Science					1.723
Supply Chain Forum: An International Journal		E			
Supply Chain Management: An International Journal		C	4	3	2.484
The Economic Journal					2.271
TOP: An Official Journal of the Spanish Society of Statistics & Operations Research			4		0.756
Transportation Research Part A: Policy & Practice		B	2	3	1.601
Transportation Research Part E: Logistics & Transportation Review		B	2	3	1.954
Transportation Research Record					0.482
Transportation Research, Part B		B	2	4	2.091
Transportation Science	2.42	A	2	3	1.514

Table AII.

Note: [a]These relatively new journals were included in the selection even if not ranked

About the authors

Nathan Kunz holds a Bachelor in Engineering degree from the Berne University of Applied Science, Switzerland and an MSc degree in International Business Development from the University of Neuchâtel, Switzerland. He worked for ten years as Deputy Director and Operations Manager for a Swiss humanitarian organization. Currently he is a doctoral assistant at the University of Neuchâtel, and his research focuses on humanitarian logistics and operations. Nathan Kunz is the corresponding author and can be contacted at: nathan.kunz@unine.ch

Gerald Reiner holds an MBA, PhD and Habilitation from the Vienna University of Economics and Business Administration, Austria. He worked for seven years as Assistant Professor at this university, and was also guest Professor at Aston Business School, Birmingham, UK. Since 2007 he has been full Professor of Production and Logistics at the University of Neuchâtel. His research focus is in integrated demand and supply management, as well methodological contributions in the context of multiple case study research. He also has a strong interest in humanitarian supply chains.