Evaluating Disaster Operations Management: An Outcome-Process Integrated Approach

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Claudia Paciarotti, Inna Valiakhmetova

Humanitarian operations play a crucial role in alleviating human and social losses caused by natural disasters. The best way to know responders' preparedness and ability to conduct efficient and effective humanitarian operations is to perform an evaluation. When evaluating humanitarian operations, the focus is mainly on their outcomes while the option of concentrating on the process is only mentioned, without examining indepth the subject nor providing specific tools for its analysis. This study tries to fill this gap by proposing and testing an outcome/process integrated approach for the evaluation of disaster operations management. The output analysis and the process analysis of disaster operations management are performed jointly by means of a questionnaire and a modeling tool, respectively. The integrated framework proposed has been applied to the emergency response of a small nonprofit organization to a flood. It has been shown that the two methods applied separately could give a distorted or partial picture of the operations under study, while the integrated framework proposed has proved to be effective, since it has brought to a deeper understanding of the processes. The approach can be used by practitioners to evaluate disaster operations management, and accurately and efficiently identify the key elements, strengths, and main weaknesses of relief operations.

1. Introduction

In 2018, 3.9 billion people were potentially exposed to natural disasters (CRED, 2019). In 2020, it is estimated that nearly one in about 45 people in the world, that is 168 million people, will need humanitarian assistance (OCHA, 2019). In this context, disaster operations play an increasingly important and crucial role in alleviating human and social losses caused by natural disasters (Machuca et al., 2018). Humanitarian operations are measures aimed to "save lives, alleviate suffering, and maintain human dignity during and in the aftermath of manmade crises and natural disasters, as well as to prevent and strengthen preparedness for the occurrence of such situations" (GHD, 2003).

Since 2011, appeals for fund by humanitarian organizations have constantly grown, and with a mean coverage of about 60% of requirements (OCHA, 2020). Due to the discrepancy between people in need and resources available (OCHA, 2019), the efficiency and effectiveness of measures are the main challenge for disaster management systems (Kunz et al., 2017). Responders' preparedness (RodrıguezEspındola et al., 2018) and ability to conduct efficient and effective humanitarian operations are the critical elements of a disaster relief process (De Treville et al., 2006; Leiras et al., 2014; Alem et al., 2016). The best way to know if humanitarian operations are

successful is to perform an evaluation (Cosgrave and BuchananSmith, 2016).

The operations performed in the aftermath of a disaster are characterized by specific and unique features (Crawford and Bryce, 2003; HolguınVeras et al., 2012):

- A large number of heterogeneous stakeholders (e.g., governmental organizations, humanitarian agencies, and civil society) are involved, each with different perspectives, interests, and cultures (Brancalion et al., 2016, Ravindra et al., 2016).
- The planning phase in humanitarian operations is often very quick, and project objectives might not be clearly expressed in planning documents (Beck, 2006).
- The operating environment is often characterized by peculiar features, like sociopolitical instability, disordered conditions, rapid change in circumstances, particular bureaucratic rules and procedures, lowtech context, and high corruption level (Abbasi and AlMharmah, 2010; JolaSanchez et al., 2016).
- Data and information collection processes may be really challenging due to the complexity of the contexts of interventions and other internal factors such as, for example, the high turnover

of staff working in the aid sector (Beck, 2006). The lack of consistent and reliable data is one of the major constraints in the evaluation process (Dabelstein, 1999; Puri et al., 2017; Sundberg et al., 2019).

Drawing on the above, the uniqueness of humanitarian operations makes the traditional evaluation processes less suitable and effective.

The aim of this study is i) to propose and test an integrated framework for the evaluation of disaster operations that includes both process and outcome analyses; ii) to use the case study as a starting point for defining a standardized model for onfield organizations, even those with no/little experience in emergency management.

The article is organized as follows. The main contributions in the literature concerning Evaluation of Humanitarian Operations management are discussed in Section 2. The description of the evaluation framework proposed is explained in Section 3. Section 4 demonstrates the practical usefulness of the framework through its application to the natural disaster experienced in Senigallia, Italy, in 2014. Section 5 discusses the results obtained, and Section 6 gives the conclusions.

2. StateofTheArt of Evaluation of Disaster Relief Operations

The Development Assistance Committee of the Organisation for Economic Cooperation and Development (OECDDAC) defines evaluation as: “The systematic and objective assessment of an ongoing or completed project, program or policy, its design, implementation and results. The aim is to determine the relevance and fulfillment of objectives, development efficiency, effectiveness, impact and sustainability. An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decisionmaking process of both recipients and donors.” (OECDDAC, 2002).

Since the mid1980s donor organizations and relief agencies have started being interested in the actual effectiveness of humanitarian endeavors, even though, initially, evaluations were casual (Polastro, 2014). In 1995–1996, findings from the Joint Evaluation of Emergency Assistance to Rwanda (Eriksson, 1996) raised some serious issues on the work of humanitarian organizations and encouraged different agencies to carry out researches in this field with the aim of developing guides for the evaluation of humanitarian actions and the creation of networks for improvement in the performance of humanitarian sector (Dabelstein, 1999). Thus, in 1997, the Active Learning Network for Accountability and Performance in Humanitarian
Action (ALNAP) and the Sphere Project were established.

ALNAP is a network of organizations and experts interested in learning accountability and performance issues for the humanitarian sector. In 2006, ALNAP published a guide for the evaluation of humanitarian actions based on the use of adapted OECDDAC criteria (Beck, 2006): Appropriateness, Effectiveness, Efficiency, Impact, Connectedness, Coverage, Coherence, and Coordination. In 2016, a complete and comprehensive Evaluation of Humanitarian Action Guide (Cosgrave and BuchananSmith, 2016) was launched which consolidates the current knowledge about each stage of the humanitarian action, from the decision to perform an evaluation to final dissemination.

The Sphere Project is a voluntary initiative that brings a broad range of humanitarian agencies together around the shared aim of improving the quality of humanitarian operations and accountability (Sphere Project, 2011, Sphere Association, 20182018). The first edition of the Sphere Handbook was published in 2000; however, the publication is periodically revised through sectorwide consultations to make sure it reflects new evidence and practice in the humanitarian sector. The handbook identifies a set of minimum standards in key lifesaving sectors and establishes essential process standards shared by all sectors.

In 2007, DG ECHO supported the commissioning of the “Evaluation of Humanitarian Aid by and for NGOs guide” (European Commission, 2007). The guide does not aim at creating a new evaluation methodology, but rather at providing practical overall 'guidance' in order to make evaluations simpler, more accessible, and nonobstructive. It explains how to plan and manage an evaluation, provides examples, and then focuses on the dissemination of results.

Some agencies developed their own guidelines that could be consulted during performing an evaluation (e.g., Beck, 2006, UNHCR, 2007, USAID, 2005).

A more indepth review of evaluation methods can be found in the research report commissioned by the Humanitarian Policy Group at the Overseas Development Institute (Hofmann et al., 2004).

In literature several classifications of the different types of evaluation are proposed based on various perspectives and approaches. For example, as for the ALNAP Guide, there are evaluations with different scopes, evaluations at different levels of results, evaluations with different timing, evaluations involving a

different number of actors, evaluations carried out by different stakeholders, as well as other types of evaluations. An evaluation usually falls into more categories at the same time. Among the types of evaluations at different levels of results, process evaluation is described as "an evaluation that focuses on the processes by which inputs are converted into outputs; it may also examine the intervention as a whole." The aim of process evaluation is to assess the processes behind the humanitarian action. The ALNAP guide focuses again on the process including process review among the evaluation designs able to answer all evaluation questions. Process review is defined as a design that "compares how processes function with how they were planned to function." Process review is used to evaluate if processes fit the requirement of wider standards. It is described as a good tool for answering questions about process efficiency, but no guidance specific to the humanitarian context is available.

The European Commission guide (European Commission, 2007), in its categorization of evaluations, introduces two evaluation types based on their focus –focus on outcomes and focus on process. Process evaluation is defined as "an evaluation of the internal dynamics of the implementing organizations, that is, their policy instruments, their service delivery mechanisms, their management practices, and the linkages between these." The guide suggests a combination and good balance between outcome and process evaluation in order to learn how to improve organizational efficiency keeping in mind that the only point of humanitarian interventions is to result in benefits to beneficiaries and longterm improvements in their quality of life.

The guide "Evaluating humanitarian action using the OECDDAC criteria" affirms that, until now, the use of the DAC criteria has been mainly focused on results rather than processes. However, this is not due to the nature and structure of criteria. These criteria, in fact, could enable evaluators to detect both what happened during a project and why it happened.

Despite the increasing amount of publications in humanitarian operations research and management (Galindo and Batta, 2013) and the large amount of evaluation practitioner reports and guides, academic literature on the evaluation of humanitarian operations is still scarce (Mohammed and €Ozdemir, 2019, Oloruntoba, 2010, PedrazaMartinez and Van Wassenhove 2016, Puri et al, 2017). This might be due to the fact that humanitarian operations management is "a relatively new field of study" (PedrazaMartinez and Van Wassenhove 2016). In his research, Pe·rouse de Montclos (2012) focused on "who" evaluates a humanitarian action rather than on "how" the evaluation is performed and proposed a framework to develop thirdparty evaluations. He suggested that, to facilitate learning, evaluation methodology and results should also be available to the general public. Furthermore, an evaluation should point out the context, recognize limits and subjectivity, and focus on processes rather than results, so as to be better accepted by evaluated groups/organizations. In their work Okazumi and Nakasu (2015) conducted an analysis of the damage caused by two mega floods occurred in Asia in 2011 by performing literature and field surveys and qualitative questionnaire interviews to 37 victims. Meduri (2016) discussed the relief and recovery operation from the damages caused by Hudhud cyclone in India in 2014. He provided the information collected from focus groups as well as from personal interviews with personnel involved in the relief operations. Puri et al. (2017) performed a literature review to assess whether rigorous impact evaluations can enhance humanitarian assistance during an emergency. They stated that there is a vast need for studies in the context of humanitarian assistance. Impact evaluations might give an additional value to the logistics, organization, and content of humanitarian action. Oloruntoba et al. (2018) presented a framework for the identification of key activities and processes in the preparedness and recovery phases of disaster management. With their framework they help decisionmakers choose from the options available when it comes to starting preparation and recovery processes based on their objectives. Mohammed and Ozdemir (2019) proposed an assessment model to measure the performance of humanitarian actions using the balanced scorecard (BSC). They argued that their model shows the relations between essential resources and their connection to humanitarian actions' objective in giving prompt help to the affected population. As in the case of the work of Mohammed and Ozdemir (2019), the scientific literature focuses mainly on performance measurement (e.g., Abidi et al., 2014, Beamon and Balcik, 2008, D'Haene et al., 2015, Haavisto and Goentzel, 2015, Schiffling and Piecyk, 2014), while there is a scant interest in evaluation, that is a further step: evaluation not only assess the achievement of performance measures but also look at why of such measurements (United States Environmental Protection Agency, 2007). As concern the evaluation, worldrecognized guides and scientific literature focus mostly on impact evaluation, which, however, cannot answer all the questions donors pose (Puri et al., 2017). Impact evaluations alone do not allow complete and quick understanding of ongoing interventions and how they can be improved (Puri et al, 2017). Anyhow, the

aforesaid guides and documents on evaluation only mention the option of focusing on the process, but they do not examine the subject indepth and do not provide specific tools for "total system" analysis (Mohammed and €Ozdemir, 2019, Oloruntoba et al., 2018). The aim of this study is to start research activity on total system analysis and try, although partially, to fill this gap. This study, in fact, proposes an innovative evaluation approach which does not exist neither in guidelines nor scientific literature and which can be used to evaluate disaster operations management in different contexts. Drawing on a reallife example, we show how process–outcome evaluation approach can be successfully used to extract lessons on how to effectively and efficiently provide humanitarian aid.

3. Methodology

The research method used in this study is described in Figure 1.

Literature review: The research follows a postpositivist scientific method (Creswell, 2014) which "starts with exploration of the theory, data collection that supports/refutes the theory, then makes necessary revisions, and conducts tests." Thus, the study started from the exploration of academic and gray literature using subject terms such as "performance measurement", "evaluation", "operation management" together with "disaster", "emergency" and "humanitarian" within the following research databases: ScienceDirect, Google Scholar, Emerald, and Springerlink. When reviewing the papers, "snowball" sampling of the works cited was performed.

Theoretical gap: The analysis of the scientific and gray literature found revealed the existence of a theoretical gap due to the lack of specific tools for "total system" evaluation of humanitarian operations management.

Framework development: The theoretical gap found has brought to the creation of an integrated framework which can help analyze the humanitarian action from both process and outcomes perspectives. The framework developed is explained in detail in paragraph 3.1.

The stateoftheart analysis revealed the need i) to use a specific tool for the process evaluation and ii) to integrate the outcomes and process perspective. For these reasons the modeling technique IDEF0 that is mainly used in the manufacturing sector, but also tested in emergency management and that is easy to understand, and easy to modify and use, was associated with a popular method of evaluation, the questionnaire. As suggested by Haavisto and Goentzel (2015), the mixed methods approach can strengthen a study, it can avoid some drawbacks emerging from the use of a single method and the different methods complement each other because the two provide complementary results.

Framework test: After reviewing and identifying content areas of both scientific and gray literature, the authors sought to answer the main research question:

Is the framework proposed effective for a simultaneous outcomeprocess evaluation? What are the concrete benefits of this approach?

The practical utility of the framework was tested through a case study: the evaluation of the humanitarian assistance in response to a natural disaster experienced in Senigallia, Italy, in 2014.

Results: The results of the study made it possible to confirm the validity of the framework.

3.1. An OutcomeProcess Evaluation Approach

The framework proposed, which is named outcomeprocess evaluation approach, is designed for a combined "total system" evaluation that focuses on both process and outcomes (see Figure 2).

Step 1. In the first step, the keyevaluation questions are specified. These are highlevel questions and express the main issues that will be explored during the assessment. The definition of the research questions has a strategic importance for the following steps of the evaluation process: the research questions drive the selection of the appropriate evaluation criteria as well as the decision on what data must be collected and how they must be analyzed and synthetized.

Step 2. In the second step, a set of humanitarian criteria is identified. The use of evaluation criteria makes the evaluation process easier and helps capture the weaknesses and strengths in humanitarian actions. "Examining the extent to which an intervention met each of these criteria makes it possible to answer the overall question" (Cosgrave and BuchananSmith, 2016).

Step 3. In the third step, the framework suggests focusing on both process and outcomes. In fact, Taylor and Taylor (2009) highlighted the need for a greater use of multiple/mixed research methods in operations management research to provide more triangulation.

Depending on the different sources used, data for the evaluation can be primary data, that is, data which are collected for the evaluation purpose, and secondary data, that is, data which have been previously collected for any other purpose but that are used in the evaluation. Both primary and secondary data need to be collected in order to enable evaluators to

Figure 1 Research Methodology

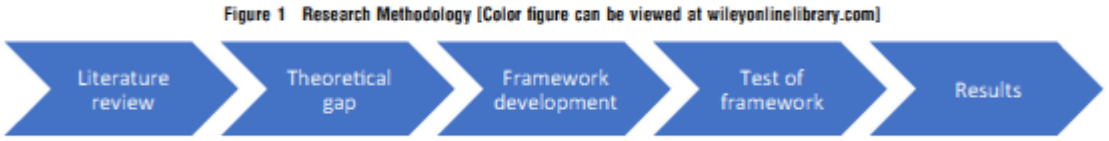
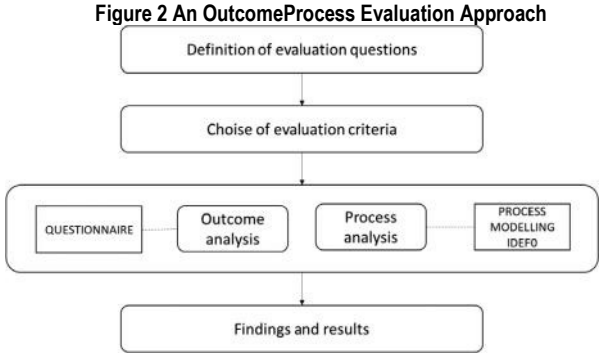


Figure 2 An OutcomeProcess Evaluation Approach



perform the analysis and transform the data into findings. Triangulation of the information gathered shall be performed to ensure the coherent and credible evidence base.

Questionnaires are the most used data collection method for *outcome analysis*.

To have the possibility to judge a process, it is necessary to reconstruct it (Dabelstein, 1999). The first step in *process analysis* is to represent the narrative history told by each participant in the focus group in a piece of the process in order to then combine the pieces into a consistent model. Interviews to the different actors who performed different roles in the emergency response provide the necessary details of what happened, who was involved, equipment used and linkages between the events. The documentary evidence available shall then be added. The adoption of a process modeling tool makes it possible to enhance the level of disaster operations management analysis. The modeling tool, in fact, makes it possible to individuate the different subsystems by decomposing a complex system, which makes the reading of the entities involved, the relevant roles and functions, and the respective levels of interaction easier.

Step 4. Findings based on multiple sources and approaches are the basis for the evaluation conclusions and recommendations. Through the combined outcome/process analysis approach it will be possible to identify not only the output of a humanitarian action performed, but also the process that caused its outputs. The more indepth analysis of the activities makes it possible to understand the causes of the weaknesses and strengths detected by the output analysis and avoid and replicate such causes/processes, respectively.

3.1.1. IDEF0 Modeling **Tool.**

Being now a standard of the Institute of Electrical and Electronics Engineers (KBSI, 1998), the IDEF0 modeling technique is based on combined graphics and texts that are presented in an organized and systematic way to gain understanding, support analysis,

provide logic for potential changes, specify requirements, or support systemslevel design, and integration activities. The IDEF0 model is based on two basic constructs: function box (activities, processes, and transformations) and arrows (data and objects related to the functions).

IDEF0 is a model composed of a hierarchical series of diagrams that gradually display increasing levels of detail describing functions and their interfaces within the context of a system. These functions are

decomposed into more detailed diagrams (Figure 3) until the subject is described at a level necessary to support the goals of a particular project.

The hierarchical structure of the tool ensures the building of a manageable model and makes it possible to tackle big and complex systems (Pandya et al., 1997). Other kinds of flowcharts, such as graphical representations of plans, do not provide an adequate level of detail (Karagiannis et al., 2010). IDEF0 was developed for military purposes, but its potentialities in Business Process Reengineering were successfully adopted by different businesses: from the banking field (Climent et al., 2009) to food processing (Abt et al., 2009) and health care (Kenneth et al., 2010, Waring and Wainwright, 2002).

The first application of IDEF0 in the field of emergency management as a Business Process Reengineering approach was done by Piatyszek and Karagiannis

Figure 3 IDEF0 Hierarchical Structure

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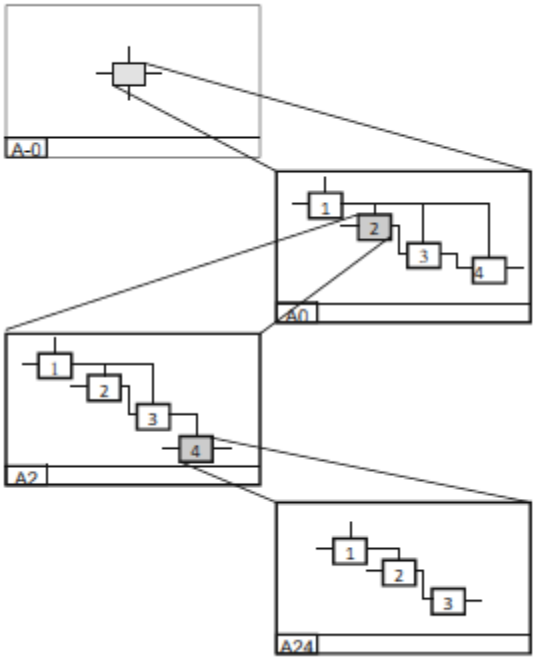


(2012). They engaged IDEF0 and faulttree checklists to identify the failures in local flood emergency operational plans. Bevilacqua et al. (2012) used IDEF0 to improve the safety and security plan of an industrial plant. Bevilacqua et al, (2014) used IDEF0 to reengineer the hydrogeological risk management plan of the Italian National Civil Protection Department.

Among the diverse techniques for process modeling, IDEF0 was chosen as one of the most appropriate for this study as it provides the static representation of the system, interpreting human actions as a mechanism for the transformation of input data into outputs, since it is focused on the description of actions and their order, and the instruments by which actions are performed. IDEF0 is "a well tested language and a comprehensive systems modeling technique. The resulting IDEF0 models are well defined, well structured, easy to understand, easy to modify and use, and can be extended to any depth of detail" (Waissi et al., 2015).

4. Integrated Process/Output Evaluation Applied to the Flood Experienced in Senigallia, Italy, in May 2014

The study was based on the rules proposed by Kunz et al. (2017) for relevant humanitarian research, in particular: Know the context; Select problems that matter; Open agendas; Establish longterm partnerships; Get

involved in data collection; Validate findings with practitioners; Translate to managers and staff members; and Disseminate results.

There are two main and purely pragmatic reasons for focusing on the Caritas Senigallia response to the flooding:

1. vicinity to the emergency site;
2. willingness of Caritas Board of Directors to assess their humanitarian actions in response to the flood and therefore allow access to information that would have been difficult to capture elsewhere.

"*The role of Caritas was important... during the flood, Civil Protection representatives have shown interest... we shall try to take care of what has been achieved, learn from mistakes made, identify the best practices in order not to lose the results of the experience and start thinking of a possible standardized and general model that can be applied by the various Diocesan centers in similar contexts*" Responsible of Administration Office of Caritas Senigallia.

In this manner, it is possible to say "the case selected the researchers" (Dubois and Gadde, 2014).

4.1. The Case Study

On the May 3, 2014, torrential rain caused a severe flood in the town of Senigallia (Center East Italy) and neighboring localities. The town and its districts remained isolated: a serious electrical and telephone blackout, which lasted for thirtysix hours, created many difficulties for rescuers, leaving many people in their homes without the possibility of asking for help. Hundreds of people took refuge on the roofs and on the upper floors of houses and buildings.

When the disaster occurred, the local government and the Marche Region put in place a joint action to restore the sites affected. On the onset, the local municipality invited the local NGO Caritas Senigallia to take part in the disaster response to provide an immediate humanitarian assistance (accommodation and food services) to the population affected and coordinate the management of spontaneous volunteers. Founded in 2018, Caritas Senigallia is a faithbased organization which operates in the humanitarian sector providing services to the poor, weak, and outcast in the Diocese of Senigallia. Considering its role during the disaster relief, Caritas Senigallia can be categorized as an extended organization (Dynes, 1970): Caritas Senigallia had not been involved in emergency management before the flood and broadened its activities *ad hoc* to respond to the disaster. This was possible since Caritas Senigallia had a good knowledge of local characteristics and needs and could rely on existing skills and resources (Whittaker et al., 2015).

4.2. Research Questions and Evaluation Criteria As illustrated in the framework proposed, the first step is to define the evaluation questions. The questions to which the evaluation presented should give answers are as follows:

1. What weaknesses can be found in the disaster operations management operated by Caritas? How can the process be modified so as to avoid such weaknesses in future disasters?
2. What were the strengths of the disaster operations management operated by Caritas that could be used as a reference point for the design of a disaster relief operation plan?

Starting from these research questions, the following were selected as evaluation criteria: all nine commitments of Sphere core humanitarian standard (Sphere Association, 20182018) and two OECDDAC criteria (Cosgrave and BuchananSmith, 2016), namely appropriateness and coverage, which are those relevant for the purpose of this study.

These criteria formed the basis for the questionnaires and interviews directed to the actors involved.

4.3. Data Collection

Data collection started in January 2015 with the exploration of Caritas internal reports on the emergency, internet articles, and six unstructured interviews with Caritas staff in order to reconstruct the event and the response. A questionnaire survey directed to beneficiaries and aidworkers (Caritas operators and spontaneous volunteers) started in summer 2016. This is because the aim was to capture the responses of beneficiaries and Caritas staff on longterm assistance and on how people evaluated the assistance received as well as their psychological state with the passing of time. This lapse of time between the event and the administration of the questionnaire made it possible to attenuate the emotional burden of the subjects

involved and provide answers that were more connected with the facts and less influenced by the emotional state.

Process mapping. The initial data necessary to map the humanitarian response were obtained from the exploration of Caritas internal reports and from six individual unstructured interviews conducted with Caritas operators who were members of the emergency team which took part in the operations. The participants interviewed covered different areas during the emergency, so this provided the study with the necessary knowledge of the actions performed, mechanisms and controls involved and related outputs. Later, two individual interviews were conducted with the founders of the emergent group (Dynes, 1970) "SOS Alluvione," which collaborated closely with Caritas for the management of spontaneous volunteers. The involvement of this group of key stakeholders made it possible to include in the assessment some important questions that otherwise might have been neglected and helped lay the foundations for a credible and useful evaluation (Dabelstein, 1999). All the data collected from the unstructured interviews provided the basis for the reconstruction of the humanitarian assistance management. The narrative story of each interviewee was carefully written down. The draft versions of each process were prepared using IDEF0 modeling logic. The unclear and missing points that emerged during the mapping process were then analyzed indepth in the following interview sessions. Once the IDEF0 mapping sessions were completed, two briefings were organized with the participants of the Caritas emergency team. During these briefings, socalled "mirror meetings" (Wybo et al., 2002), participants were explained the project as well as the process identified by the use of IDEF0 to give them "a global view of the existing collective experience" (Wybo et al., 2002).

The experience reflexion method (Wassenhove and Wybo, 2002) was used to support the briefings. This method is a management tool that allows the participants of a meeting to analyze their experience, the development of the event and possible lessons learned. Furthermore, this method makes it possible to focus not only on what went wrong but also on the positive aspects (Wassenhove and Wybo, 2002). Thus, from the debate and discussion held during the briefings, several areas for the improvement in Caritas emergency response emerged.

Questionnaire

Questionnaire creation. On the basis of the desk research results available and the analysis of the evaluation questions identified and related criteria, three questionnaires were created and conducted with each group of main actors: Caritas operators, population affected, and spontaneous volunteers. The development of the questionnaires included a test phase: the drafts of the questionnaires were developed by a team composed of two academics with experience in both IDEF0 modeling technique, quantitative and qualitative studies using questionnaires and a practitioner from humanitarian operations. The draft questionnaires were submitted to two people affected by the disaster, a Caritas operator, and two spontaneous volunteers, in order to refine and complete the multiple choice questions proposed and test the intelligibility of questions. The questionnaires were consequently revised.

The questions made it possible to assess the criteria of interest from different points of view: the perspectives of both aidworkers and the population affected. The viewpoint of the local Municipality is missing, due to their unwillingness to collaborate to the research project.

Questionnaire survey sampling. The questionnaire survey was conducted through phone calls, by interviewing a total of 300 local residents from the 850 families badly affected (confidence interval 5 and confidence level 95%), according to Caritas database. Data from Caritas database were considered to be a representative of the whole population affected, since the Municipality and Civil Defense units redirected all people in need (except those whose needs required specific equipment and competencies) to Caritas open front office. The population contacted for the survey (i.e., beneficiaries) was extracted from the census database of Caritas Senigallia. With regard to the sampling procedure, due to the spatial characteristics of the flooding hazard, a contextspecific methodology was required to select the respondents so as to provide a reliable and valid account. The area affected by the flood was divided into four zones. In each zone the number of respondents to be contacted was in proportion to the total number of the families assisted in that zone. The unit of analysis was the individual, therefore only one person per household was contacted.

Spontaneous volunteers, registered in the Caritas Senigallia database, were invited to answer the online questionnaires by text message. They were then sent a reminder text message each month from July to November 2016. Hard copies of the questionnaires were provided to communitybased organizations (SOS Alluvione, Social Center Arvultura). A total of 179 responses were collected.

All Caritas staff (a total of 11 people) involved in the emergency response filled out the hardcopy questionnaires.

4.4. Process Analysis: IDEF0 Mapping of Caritas Operations

The relief operations provided by Caritas were basically divided into the following three main activities: collection of information (A1), provision of services (A2), and management of volunteers (A3). Each activity was decomposed and analyzed in detail.

Collection of information (A1): The information collected by Caritas Senigallia staff and volunteers was shared and used internally to decide which services to provide and how to manage the volunteers available.

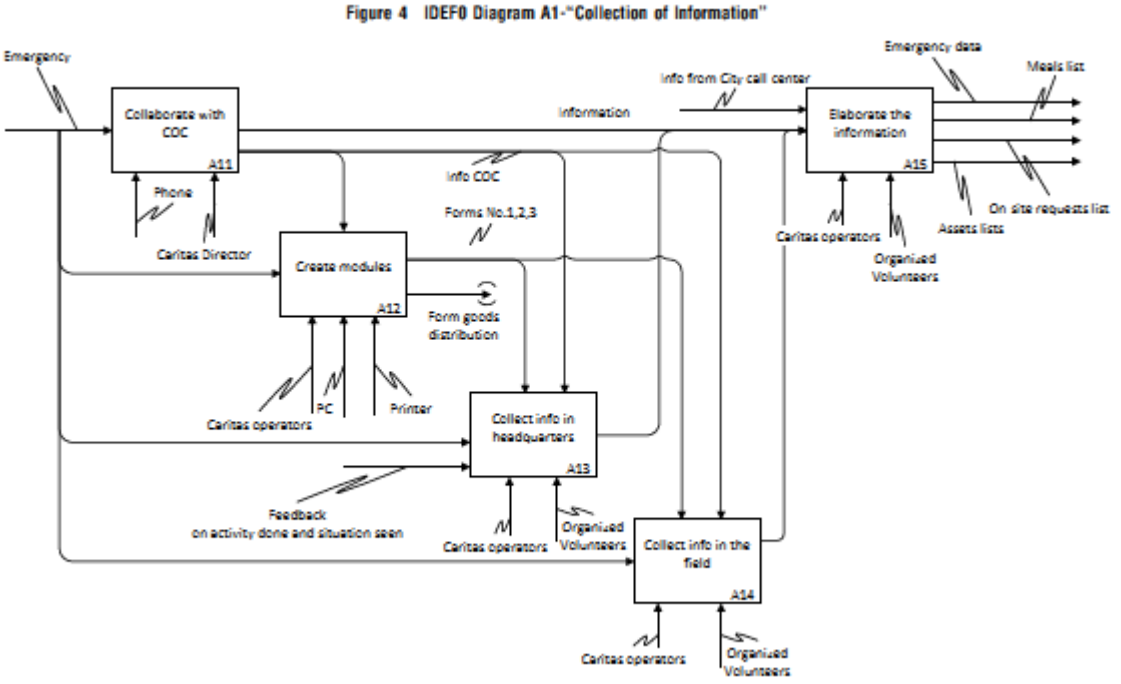
As in Figure 4, the information relevant to the emergency came from different sources: collaboration with COC (Centro Operativo Comunale, i.e., the Municipal operational center) (A11), direct collection in headquarters (A13) and in the field (A14).

In order to collect information and assign appropriate priority to the people affected, Caritas operators, in cooperation with local authorities, created three questionnaire forms to take a census of people's needs and one form for the distribution of goods (A12).

The collection of information in headquarter1 (Curia) was performed through the activation of a dedicated call center where people in need could call to ask for food and goods needed. Additionally, a mobile phone number was activated to provide a further contact point for both people in need and volunteers reporting on the activity performed. At headquarter2 (Episcopal Seminary), an open front office was organized in order to provide a physical place where all information about people's needs could be collected through the use of the forms created *ad hoc*. Furthermore, Caritas supported a communitybased group that created and managed a social network page, "SOS Alluvione," dedicated to the emergency.

The collection of information on the territory (A14) was conducted by Caritas staff and volunteers through both a census carried out onsite and at four distribution points using the questionnaires developed, and direct inspection of the zones affected.

Figure 4 IDEF0 Diagram A1"Collection of Information"



People's requests were ranked following a firstinfirstout criterion, except for critical situations that required specific attention, that is, from elderly or disabled people, families with small children, and people in other difficult situations.

Provision of services (A2): The operations performed by Caritas can be summarized in six main activities (Figure 5), namely provision of first accommodation (A21), provision of meals (A22), provision of onsite assistance (A23), management of goods (A24), provision of information (A25), and provision of proximity and counseling (A26) to those in need.

Temporary first accommodation (A21) was provided to people who could not enter their homes.

Meals (A22) were provided to hosted people, people who were at home with no possibility to cook and Civil Protection workers. On the basis of the request list, meals were cooked, packed into disposable packaging, and then distributed in the canteen and at the distribution points. Once used, the secondary packages were then collected, washed, and returned to the kitchen.

Onsite support (A23) can be classified into four main activities, namely clearance of mud, clearance of rubble, cleanup of houses and furniture, and dehumidification of the spaces cleaned. The activities were scheduled following the priority list and the resources available.

Management of goods (A24): a warehouse near the headquarters was arranged to store the goods, both purchased and donated (A241). Goods and equipment storage and distribution were monitored daily with the scope of identifying the items that were missing/near to miss. The goods available (longlife food products, bottled and canned drinking water, cleaning supplies, clothes, bed linen and towels, and other goods such as children's books and toys) were identified and classified, and then distributed at the four distribution points (A244) and in the open front office (A245) at the Episcopal Seminary (Figure 6).

A form was used to manage the flow of people from the open front office to the warehouse. People requesting food or goods were sent to the warehouse with a filled out form to collect the food and articles they needed. Warehouse operators then sent back the list of handed over items and forms to the open front office to be archived.

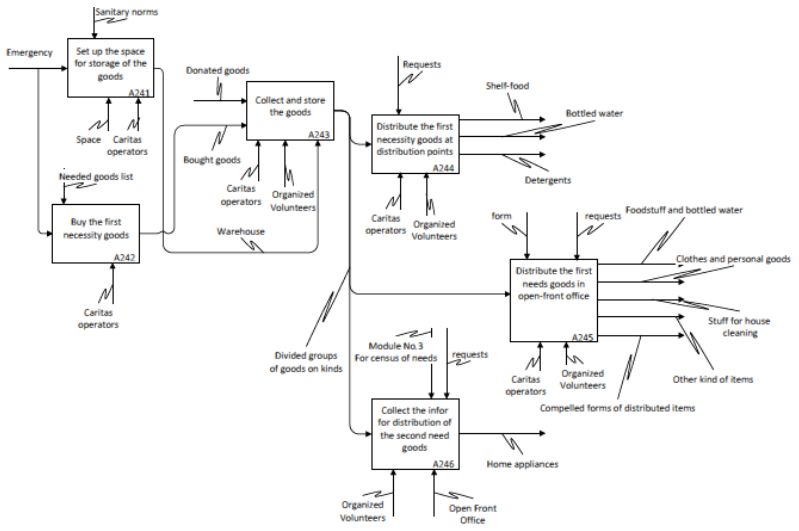


Figure 5 IDEF0 Diagram A2"Provision of Services" Figure 6 IDEF0 Diagram A24"Management of Goods"

Provision of information (A25): Caritas increased its level of communication to reach all the territory involved as much as possible. Based on the information requests from the population and COC advice, information to be shared (e.g., useful phone numbers, services provided by the Municipality) and leaflets were prepared and distributed in the territory. Caritas chose not to provide information on its own services.

Provision of proximity and counseling (A26): volunteers in the open front office and onsite offered people moral support by listening to their experiences. Of course, as they were nonprofessional

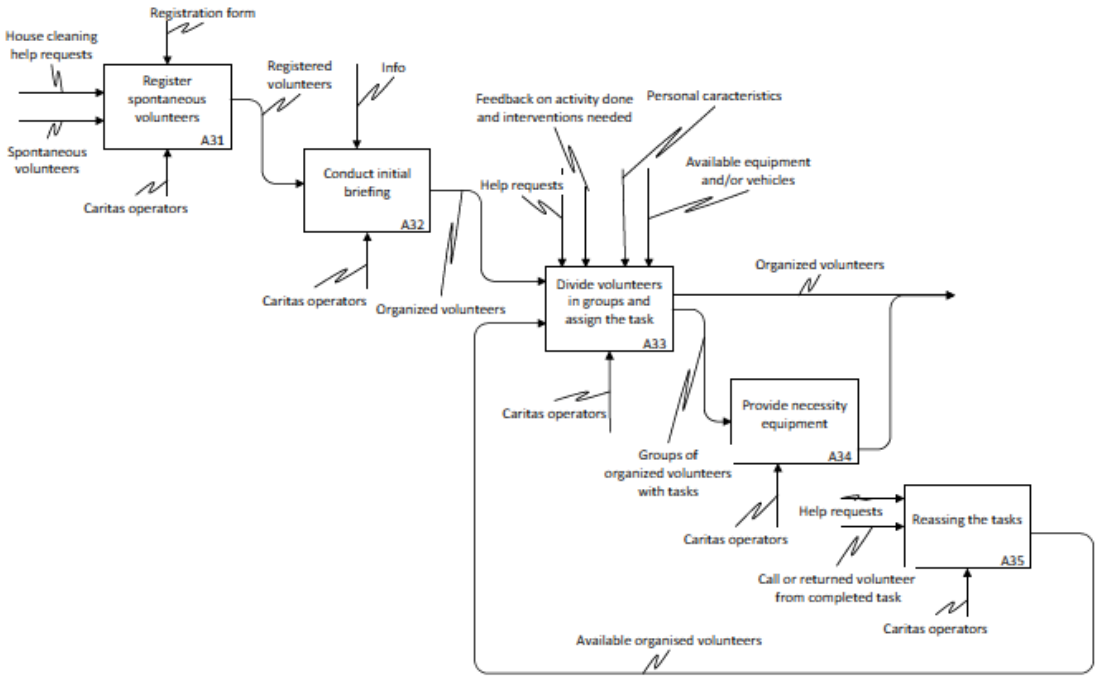
volunteers, theirs was not a specific psychological support; nonetheless, their availability to spend time with and pay attention to the people in need was useful in reducing the negative emotional impact of facing the emergency. Additionally, a group of emergency psychologists (Civil Protection) worked to give the population affected and aidworkers the necessary help.

The Management of volunteers (A3; Figure 7) started with their reception and registration (A31) by a Caritas operator at Curia. An initial briefing (A32) was arranged for volunteers in order to train them on the activities permitted, the procedures to follow,

personal safety, as well as on physical and emotional stress. Volunteers were advised of the possibility to speak with a psychologist in case of emotional need. The briefings were held twice a day at the scheduled time (9 am and 2 pm) at Curia. Volunteers were then divided into groups (A33) based on the requests for help received, personal equipment available and personal characteristics. Each group consisted of about five volunteers of both genders, different age, and social background, who had never met before, so as to avoid possible marauding and guarantee mutual control. Each organized group was then assigned to specific interventions and equipped with the necessary apparatus (A34): cleaning tools, detergents and gloves, as well as Tshirts branded with the Caritas logo for identification purposes. As soon as they completed the task, assigned volunteers were reassigned other activities (A35). In addition, volunteers were asked to return to or call the headquarters in order to give feedback on the activities performed and update on the situations of the families met.

4.5. Outcome Analysis: Questionnaire Results The first design of the response operations was based on the collection of the basic, urgent survival needs of the population affected in the immediate aftermath of

Figure 7 IDEF0 Diagram A3"Management of Volunteers"



the disaster: 49% of survey responders were contacted to ask about their needs in the first three days after the flood. By using disaggregated assessment data, the emergency team designed the necessary operations to meet the needs of the population affected. The most active channels for the collection of information about particularly vulnerable situations and needs of the population affected were call centers (55%) and the open front office at the Seminary, where people could fill out the Damage Recognition Form (51%) and

be interviewed by Caritas volunteers (31%). Other available, although less used, information collection channels were volunteers and operators in the territory (21%), distribution points (15%), parish counseling center (15%), FB posts (2%), and informational leaflets (1%).

All Caritas operators stated that the map of requests and needs of the population affected was updated twice a day, every day. The program was continuously monitored during each daily meeting of the emergency team and revised, if necessary, to reflect changes in people's needs and conditions and progressively reduce their vulnerability.

Sixtytwo percent of Caritas operators communicated that they received feedback from the affected population giving evidence of some expectations not being met. Sixtynine percent of respondents among

Caritas operators believe that there were some inefficiencies in the help provided and some unidentified needs as the affected zone was wide. At the same time, only 17% of volunteers noted these problems.

Concerning the level of satisfaction with the services received, the survey shows that 82% of the population appreciated the services and reported that, at the time, they did not need any other interventions or goods. Eightythree percent of respondents did not report any delays or inefficiencies in the help provided.

"I can't ask for more, I am satisfied" said Respondent Nr. 211.

"*Caritas guys were kind to my 90yearold mother and my disabled wife. I have a good remembrance*" stated Respondent Nr. 3.

Among those who were disgruntled (17%), the majority complained about the shortage of non staple items while only 3% complained about the lack of information about the services provided and, consequently, expressed dissatisfaction for their primary needs not being appropriately considered.

The sources of information used by beneficiaries are shown in Figure 8 (Multiple responses were allowed).

The data presented in Figure 9 put in evidence the percentage of people who were informed about

Figure 8 Sources of Information used by Beneficiaries

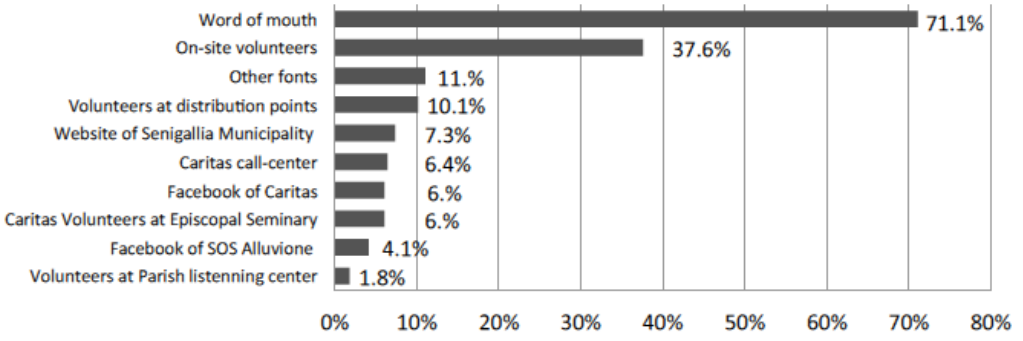
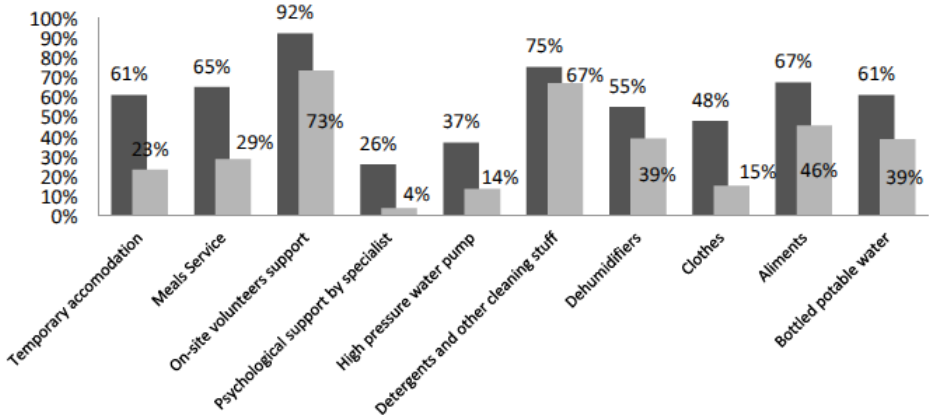


Figure 9 Services used by the Population Affected



service availability (black bars) and the percentage of those who actually used the services provided (gray bars).

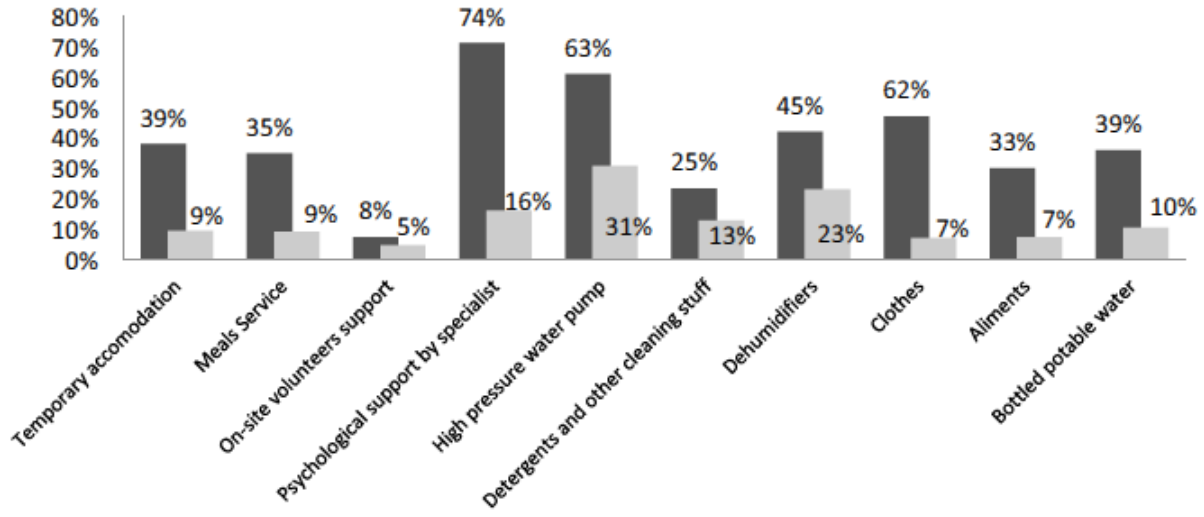
Figure 10 represents the percentage of those who were not informed about the services available (black bars) and the percentage of those who would have used them if given the opportunity to (gray bars).

The main services such as temporary accommodation, bottled water, hot meals, other foodstuff, support from volunteers, provision of detergents and cleaning items, as well as the use of dehumidifiers were known and actively used by the majority of the population affected. However, more than a half of the population affected did not know about the provision of some other services such as professional psychological support, clothes, and the use of a highpressure water pump.

All Caritas operators claimed that, in the course of the response stage, changes were made to respond to the requests and observations made by the population. Volunteers were also asked if they were providing their feedback to coordinators on the work done and on the situations that could have needed particular attention. Sixtyfour percent of them stated that they provided feedback to their coordinators. Only 18% of respondents among volunteers noted some deficiencies in the flow of information with their coordinators.

Only 26% of respondents among the population affected communicated that they were aware of the channels for leaving feedbacks on the services they received. Thirtyone percent of respondents gave their opinion on if/how their claims were taken into consideration by Caritas: 32% of them responded that

Figure 10 Services not used by the Population Affected Due to Missing Information



their claim was not considered at all, 31% believed their claims were marginally considered, while 37% were satisfied with the correct action applied to their claim.

Before the flood, most of the operators of Caritas Senigallia (61.5%) had no experience in disaster operations management. Three respondents had experience as volunteers in previous emergency operations, one operator had experience in the supervision of volunteers, while a further operator declared to have been the coordinator of the Emergency Relief Support Team of Caritas Internationalis during earthquake and flood emergencies in other countries. In this regard, through the Caritas network, a representative of Caritas Ambrosiana was invited to lead the emergency team and help organize the operations.

Volunteers were asked if they had been provided with adequate equipment and information. Sixtyfour percent of them claimed they were using only their own equipment, 75% of them stated that Caritas had provided them with the correct information for the best performance of the duties assigned.

Eightyfive percent of Caritas operators claimed that the activities of volunteers were under constant control. Most Caritas operators did not report cases of inadequate behavior on the part of volunteers, while only a few of them reported rare cases of inappropriate behavior. Only 5% of respondents among the population affected reported inappropriate behavior on the part of volunteers (e.g., things missing which had probably been thrown away or stolen, volunteers unable to respond to people's questions, confusion created by the presence of too many volunteers, volunteers being too young and inexperienced). To solve the single cases of inadequate behavior of volunteers identified, meetings between the interested parties were organized to work out a joint decision on the settlement of the situation.

All aidworkers (Caritas operators and volunteers) were offered psychological support to help them minimize the stress and elaborate their experience. Thirtyone percent of Caritas operators and 42% of spontaneous volunteers received psychological help and appreciated it. They were asked if they considered having received adequate psychological assistance during the response phase at the time of the event important, and how important they considered psychological assistance at the time of the survey. The analysis of their responses reveals a growing understanding of the importance of receiving adequate psychological assistance. In fact, in the aftermath of the disaster, 30% of Caritas staff and 47% of volunteers considered psychological assistance important, while at the time of the survey the percentages of those who considered psychological support important reached 61% for Caritas staff and 67% for volunteers.

4.6. Overall Evaluation Findings and Results

An important feature of the evaluation approach proposed is the multidirectional perspective. IDEF0 modeling technique made it possible to map the operational structure of the emergency response of Caritas Senigallia. Meanwhile, the outcome analysis was carried out by assessing the results obtained through the questionnaire survey conducted on the population affected, Caritas operators, and volunteers. The analysis of the data obtained consisted in examining if Caritas emergency response was conducted in accordance with the criteria established by the main guides in the field of humanitarian relief,

ALNAP (Cosgrave and BuchananSmith, 2016), and the Sphere Association (2018)2018. The results of the process analysis were triangulated with those obtained through the questionnaire survey. The symbiosis of these two methods made it possible to identify the key elements and main weaknesses with high efficiency.

The first step of the approach proposed (paragraph 4.2) consisted in the definition of a set of evaluation questions. The answers to these questions are listed below in random order.

In particular, the following are the answers given to the first question: *What weaknesses can be found in the disaster operations management operated by Caritas? How can the process be modified so as to avoid such weaknesses in future disasters?*

Relationship with donors. Due to the complicated nature of the event and the unpreparedness of Caritas, the large amount of donations that kept pouring in made their management chaotic. Stock inventory and inventory update were mostly improvised: there was no database for the goods received and distributed. A procedure for the reception of goods should be established and communicated to donors.

Inefficient warehousing management. The goods requested were not always available and sometimes other goods were distributed instead. Distribution forms were not digitized.

No communication office nor person in charge. Caritas operators claimed that the communication tools put in place were not used accordingly to their potential. There was no Communication office or, at least, no person in charge for the coordination of communicative activities. For example, the Facebook page was not frequently updated, despite receiving more than one thousand contacts in a few hours. Therefore those contacts were not used and no followup activity was performed.

Inefficiencies in psychological assistance. Based on the results of the questionnaire survey, it emerged that the provision of psychological assistance was not adequately organized. There are people who still have not coped with their fears related to their trauma.

"*I am afraid when it rains*" said Respondent Nr. 207.

"*She stopped walking after the flood*" reported Respondent Nr 58 speaking about his/her 85yearold mother.

Missing of clear and exhaustive information on services provided and goods available. Instead of advertising information about all the services available, Caritas tried to provide targeted responses on the basis of the situation and needs of each single person who turned up at the distribution points or the open front office. This was done to make sure people asked only for what they actually needed. The decision not to share information about all the services

available but instead provide targeted responses led to low understanding of what services the people affected could actually receive.

"*Little clarity on the help they were supplying*" answered Respondent Nr.185.

The following are the answers given to the second evaluation question: *What were the strengths of the disaster operations management operated by Caritas that could be used as a reference point for the design of a disaster relief operation plan?*

Accurate and updated need assessment. In an attempt to provide the correct humanitarian actions to the population affected, Caritas operators put in place a cyclic process of collection of information (A1) and provision of services (A2). The data collected and elaborated were used to decide what services to provide. Feedbacks on the services provided were then collected for further elaboration, and therefore included in the cycle. This was confirmed by the questionnaire survey conducted with Caritas operators, who stated that the feedback received from the population was used to adjust the operations management to the constantly changing needs of the territory. An assessment of the needs of the population affected was performed periodically, at least during the first two weeks after the flood.

Efficient management of volunteers. Caritas Senigallia's managerial and supervisory support to its employees and volunteers made it possible to efficiently use all the human, technical, and material resources available. Thanks to its previous experience in coordinating affiliated volunteers in ordinary activities, Caritas Senigallia's management of spontaneous volunteers proved to be effective (Paciarotti and Cesaroni, 2020). The provision of timetables at the Seminary, the two daily briefings with volunteers, the short training to volunteers, the feedback and work assignments, all these actions were positively evaluated.

Coordination and collaboration. In the aftermath of the disaster, there were many emergency responders, including government and local communitybased organizations working in synergy, trying to cooperate and not to compete (Nagurney et al., 2016). Caritas Senigallia's involvement was requested by COC, based on a preexisting relationship of mutual knowledge and trust. The network of trustful relationships Caritas had established before the flood, enabled a rapid and efficient cooperation and collaboration among the actors (Martin et al., 2016). Caritas Senigallia cooperated and shared information with already existing communitybased organizations (Social Center Arvultura, UltrasAncona) and gave support to the new spontaneously formed communitybased group SOS Alluvione. Contacts within the national Caritas network made it possible to timely

receive highpressure water pumps and dehumidifiers but also the precious help of an external expert who coordinated the emergency team. Figure 11 provides a scheme of the network established in the aftermath of the flood to deal with cooperation, information exchange and coordination activities.

The alignment between the operational level and the centralized perspective is recognized as a powerful means to increase responsiveness, flexibility, and interaction between organizations (RodrıguezEspındola et al., 2018).

4.7. Recommendations to Caritas Senigallia

Starting from the results obtained by applying the process–outcome evaluation approach presented, the synergy between the experience of operators, knowledge of researchers, and the suggestions from academic literature made it possible to define some recommendations which are listed below. The first two items of the list also illustrate the modification of the ASIS IDEF0 model connected to the recommendation given. This is done to show that IDEF0 is an efficient tool that makes it possible not only to visualize the stateoftheart of a

process and have both an overall and selective and indepth view of the process (ASIS), but also to represent possible changes and improvements (TOBE).

1. Set up a communication office. This will help improve the provision of clear and accessible information about the services and material resources available to all categories of the population affected (Sankaranarayanan et al., 2018) and communication with donors (Mohd et al., 2018) about the donation policy (Australian Government Initiative, 2011). In the light of the experience gained from the flooding event, it is proposed to add a new A251 activity, that is, "establish a communication office and appoint a person in charge" who will supervise the process of information management.
2. Establish a registration procedure (digitalization and archiving) to keep track of the movement of donated goods. In order to improve the management of the donated goods, the modification proposed consists in reengineering activity A243 as shown (as an example) in Figure 12.
3. Prepare the emergency response plan and the necessary forms to be filled out in advance. The plan shall provide guidance on the actions to be performed.
4. In order to manage large volumes of donations, establish a procedure for request,

Figure 11 Scheme of Cooperation and Information Flows

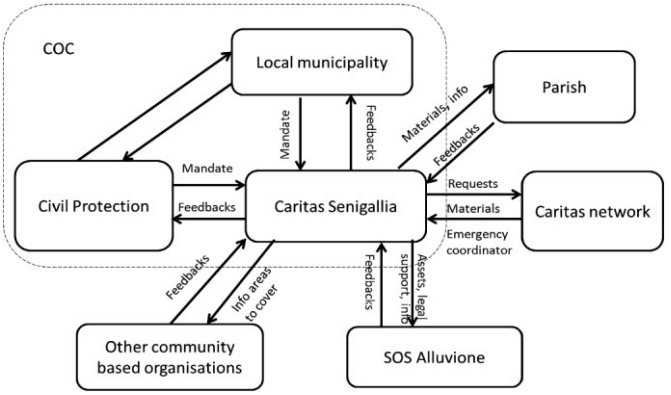
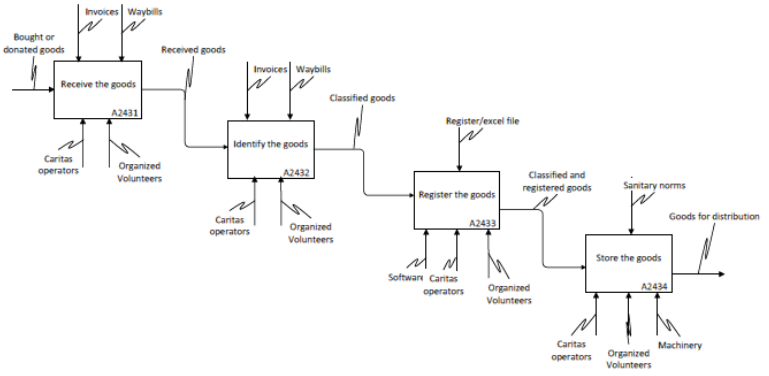


Figure 12 IDEF0. Diagram A243 – TOBE Collect and Store the Goods



approval, and reception of goods and communicate it to donors.

5. Train staff with no emergency experience; make sure that new hires receive appropriate training (Kunz et al., 2014) and supervision.

6. Establish a complaints system that clearly defines how people can complain about the work being carried out by an agency if they need to do so (Sphere Association, 20182018: commitment 4: key action 4.4).
7. Inform the population affected and aidworkers about the availability of psychological support service and its importance in order to minimize the stress and elaborate what was experienced (IASC, 2007, IFRC, 2003).
8. According to the high value of communitybased approaches (Kovacs and Spens, 2011), strengthen local resilience capacity, establish a strong and close cooperation with local authorities and communitybased organizations (Nagurney et al., 2016) and make efficient use of local human resources by effectively managing volunteers.
9. Design and revise disaster relief operations based on an indepth and updated assessment of needs (Sphere Association, 20182018: commitment 1: key action 1.3).

These recommendations alone cannot represent the final guidelines for the best implementation of this kind of emergency relief operations. The elaboration of general guidelines, in fact, requires the analysis of more than one case study and the intervention of a team of experts from different organizations, and is not the scope of this study. However, the recommendations provided together with the strengths of the disaster operations management operated by Caritas could be used as a reference point for the development of a disaster relief operation plan.

5. Discussion

This study is intended to improve the evaluation of disaster operations management by introducing an integrated evaluation approach. While other scientific papers have detailed models that provide a *theoretical* foundation to the further improvement in the assessment of Humanitarian Operations management
€
(Oloruntoba et al., 2018; Mohammed and Ozdemir
2019; Jahre and FabbeCostes, 2015; Nagurney et al., 2016), the evaluation approach proposed in this study has an immediate *practical* application. The framework proposed incorporates the "union of methods" (Taylor and Taylor, 2009): outcome analysis (through questionnaires) and process analysis (by IDEF0). The model offers a high level of perspective on the operational execution of humanitarian actions and their linkages during response to a disaster. Based on the results found in this study, the integrated approach proposed proved to be effective, since it has brought to a deeper understanding of the processes. The framework proposed was applied to the evaluation of the humanitarian operations performed by Caritas Senigallia in response to the flood occurred in 2014.

IDEF0 modeling allowed the reconstruction of a complex emergency response process. This complexity was graphically and concisely represented, considering all the key elements of the individual processes and the reciprocal interrelations at the same time. The model was then presented to the Caritas operators who participated in the emergency response to offer them an overall vision, which was missing in the stressful moments of the emergency. Caritas staff who took part in the focus group observed that the IDEF0 model helped them critically reexamine the whole intervention and go through every detail *ex post*. They perceive IDEF0 modeling as a useful guide for managing a disaster response operation and keeping focused on the operation goals.

The use of the questionnaire survey for the outcome analysis made it possible to add a qualitative evaluation of Caritas Senigallia emergency response in accordance to OECDDAC criteria (Cosgrave and BuchananSmith,016) and Sphere minimum standards (Sphere Association, 20182018) by assessing the perception the population affected and the aidworkers involved had about the assistance provided.

The efficiency and advantages of the integrated framework proposed, which includes the IDEF0 modeling technique and the questionnaire analysis, can be deduced from the following examples.

EXAMPLE 1. IDEF0 *diagram A2 "Provide the services"* did not reveal any problems in the supply of psychological assistance to the affected population and aidworkers. However, the results of the questionnaire survey conducted underlined that the psychological assistance offered was not well organized.

This might have happened due to the following reasons:

- The availability of psychological assistance service was not properly advertised. Data from Figure 10 illustrate that 74% of the affected population was not informed about it.
- Insufficient work was done to inform about the need for psychological assistance. The data from Figure 9 illustrate that only 4% of the population affected among those who were informed of the availability of psychological assistance actually took advantage of it. Similarly, the data from Figure 10 show that only 16% of the population would have used the service if they had known of its availability. While, according to the assessment of the results from the questionnaire survey conducted, the aidworkers showed a growing understanding of the need for psychological assistance: some representatives of the poll groups at the time of the event did not deem it necessary to receive psychological assistance; however, later, many of them admitted that that help would have been useful for them to overcome the consequences of stress.

In order to ensure the correct provision of psychological assistance and increase the awareness of its importance, dedicated policies should be applied as a control, as illustrated in Figure 13. These policies might be Psychological support policy (IFRC, 2003) and IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings (IASC, 2007). The TOBE model also includes a further important output which has not been previously contemplated: "Increased awareness of the importance of psychological support."

EXAMPLE 2. Based on the results of the survey presented to the population affected, the procedure for the management of goods donation was considered sufficiently effective: most of the population affected, in fact, was satisfied with the volume and quality of the material resources and services received. On the contrary, when analyzing data using IDEF0 modeling, deficiencies in the management of donations were observed: missing registration of goods movements, missing digitalization and archiving of the few forms filled out, etc.

Summarizing the above, these two methods applied separately could give a distorted or partial picture of the operations under study, whereas their combination into a single framework enhances the evaluation, benefiting from the advantages of both while reducing the potential bias (Taylor and Taylor, 2009). This, in turn, will make it possible to get the most objective

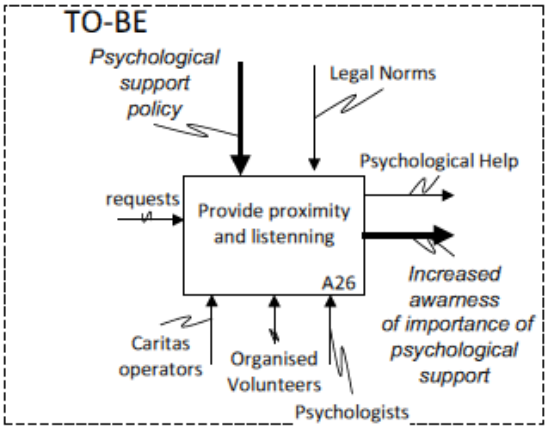


Figure 13 Proposed ToBe Model of Psychological Assistance

picture of humanitarian operations in response to a disaster, which will provide the opportunity to carry out appropriate corrective actions and improve the processes under study in order to improve their effectiveness. Additionally, by using the questionnaire survey in conjunction with IDEF0 "As Is" modeling of emergency response, the analysis of the overall operations management becomes more systematic, rigorous, and exhaustive.

6. Conclusions

The review of humanitarian operations management literature indicates that researchers have started to lay the basis for a deeper knowledge in this field; however, academic research on the evaluation of humanitarian operations is still limited (Puri et al., 2017). This study has emphasized the need for a well-structured Evaluation Humanitarian Approach framework for on-field organizations with no/little experience in disaster relief. The application of the framework to the case study presented has highlighted the crucial aspects that could determine the success or failure of the management of some humanitarian operations.

Based on an in-depth analysis from the perspective of both process and outcomes, the humanitarian actions carried out by Caritas Senigallia have been evaluated and this has led to the identification of the strengths, weaknesses, and improvable aspects of the interventions in accordance with international guides and manuals on the management of humanitarian assistance.

The approach presented in this study offers opportunities for further research. The integrated framework proposed shall be tested on other types of emergencies to verify its multi-applicability. Other types of modeling techniques should be tested too. The definition of a standardized model for those on-field organizations with no or little experience in disaster relief cannot be based on the analysis of a single intervention. The study of other disasters will make it possible to identify and consider the contextual barriers that could arise and the organization features that can affect the process. An analogous modeling of the management of other disaster operations will make it possible to identify other best practices as well as reduce the probability of wrong procedures. A close consultation between the main actors involved, including institutional representatives, should lead to shared and optimized guidelines for the engagement of local associations and communities in emergency management. The processes represented by the IDEF0 modeling need to be refined, modified, improved, and generalized, in order to lay the basis for effective guidelines for disaster operations management.

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