Reference Process Models and Systems for Inter-Organizational Ad-Hoc Coordination - Supply Chain Management in Humanitarian Operations

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ABSTRACT

In this work we present a general framework for process-oriented coordination and collaboration in humanitarian operations. Process management has been proven useful in many business domains, but humanitarian operations and disaster response management in general require different process management approaches. Related work has only recently introduced traditional process management approaches for emergency management. These traditional approaches have several limitations with respect to the domain of humanitarian operations and disaster management. Our approach points to design, run-time and monitoring of inter-organizational humanitarian logistics processes. It consists of two parts: A reference model for humanitarian logistics tasks and a system for ad-hoc process management of these tasks. We discuss how they can be integrated to provide additional benefits.

Keywords

humanitarian, logistics, ad-hoc, coordination, process, reference, management, system.

INTRODUCTION

Responding to a disaster introduces new challenges in comparison to day to day work or routine emergencies. The situation can be very dynamic and new tasks have to be performed as well as organizations have to collaborate that have not worked together before. This is particularly challenging in supply chain operations in sudden-onset disasters, where complex processes meet a complex situation. Such a scenario cannot be solved by one approach, but has to be seen as the integration of several approaches. In this paper we present two promising process-based approaches for coordination and collaboration between autonomous humanitarian aid

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organizations. The two approaches need to be integrated to address complex situations as described before.

The paper is organized as follows: In the next section, we describe related work. A reference model supporting a common understanding of activities and dependencies in supply chain operations in sudden onset disaster and a discussion of its application as a basis for collaboration are presented in section three. The reference task model was developed based on interviews with end users, established modeling techniques, and supply chain management requirements in relief operations. Afterwards, we describe a system that allows ad-hoc coordination of activities and dependencies within and between organizations in section four. We discuss in section five the integration of both approaches. Finally, we give an outlook on future research in section six.

RELATED WORK

We have analyzed several process management systems for operational routine emergency response processes (Franke et al. 2010a). However, these types of processes are different from disaster response processes. Thus, these technologies have limited coordination capabilities in more dynamic scenarios. Enterprise Resource Planning (ERP) packages can also be used for coordinating the response from a resource point of view, but not from an activity point of view. Blecken and Hellingrath (2008) describe requirements for ERP systems for supporting humanitarian logistics. Our approaches and ERP systems can be seen as complementary, because ERP systems focus on the resource perspective and we focus on the activity perspective. Based on our interviews and literature research (Blecken 2010; Franke2010a), we identified two main research problems for coordination between different organizations in humanitarian supply chains and disasters. The first research problem is that there needs to be a common ground on activities and their dependencies. The second research problem is that the coordination needs to be adapted ad-hoc based on the situation and coordination efforts (e.g. who is doing what) needs to be communicated ad-hoc to any relevant stakeholder. In the following sections, we describe two approaches that address these requirements and we explain how the integration of both can lead to further benefits.

REFERENCE MODEL

Humanitarian logistics significantly contribute to the effectiveness and efficiency of humanitarian operations (Tomasini and van Wassenhove 2009). Especially the immediate emergency response phase after a sudden-onset disaster causes particularly stiff requirements for inter-organizational coordination. Coordination of logistics activities in humanitarian supply chains have been already partly enhanced in the recent years. Some humanitarian actors installed shared equipment or globally pre-positioned stocks, for instance. Yet, cooperation and coordination of humanitarian organizations is still one of the major challenges in the humanitarian sector (Blecken, Hellingrath, Dangelmeier, Schulz 2009; Blecken 2010). In order to manage the high degree of complexity involved in the logistics and supply chain management of humanitarian operations, an application of the reference task model for humanitarian supply chain management developed by Blecken (2010) in a larger empirical study (interviews with experts) could be a first step to solve these shortcomings (Blecken, Hellingrath, Dangelmeier, Schulz 2009). The reference task model provides a tool for humanitarian organizations to rapidly visualize the tasks carried out by the organization and its supply chain partners. By clarifying roles, responsibilities, and definitions the reference task model is able to support the standardization of these tasks. By using the approved business process modeling language Business Process Modelling Notion (BPMN) a standardization of the formal framework and each organization-specific process models is enabled (cf. (Object Management Group 2008)). In combination with an adequate adjustment of the BPMN specification by Blecken, the model provides generality, reusability, modularity, adaptability, and simplicity in order to standardize humanitarian supply chain processes. It gives humanitarian organizations the possibility to communicate their tasks and processes with their supply chain partners. Thus, coordination and cooperation of humanitarian organizations is eased.

In the following it is illustrated how the reference process initiated by the task “Identify Demand” could be used for two different organizations. The first pool represents the local center and the operational assessment task (“Identify Demand”) of the relief organization A, which is exclusively responsible for the assessment and coordination during disasters. The start event is triggered by an information about a crisis occurred, which initiates the needs assessment. After deploying an emergency and exploratory team, local capacities, resources, and sources of supply as well as the number and needs of beneficiaries are identified. Based on the assessment, the required needs are able to be prioritized and can be communicated to other organizations involved in the relief operation. The process “Identify Demand” is completed at that stage. Next tasks of organization A have to be initiated by other dependent tasks (e.g. coordinate relief operation), specific events such as actions of other relief organizations (e.g. arrival of new organizations or delivery of goods in affected area) or changed circumstances (e.g. aftershocks).

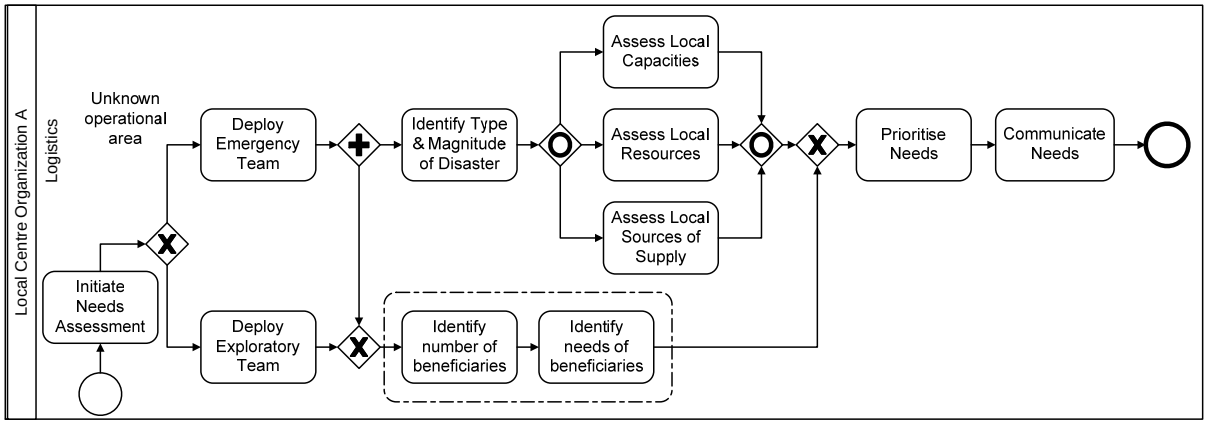

Figure 1: Identify Demand by Organization A (acc. to Blecken 2010)

Based on these standardized processes and its descriptions, different optimizations are possible. In the case of the task “Identify Demand” for example, organization A seems to have a core competency in assessment tasks as it is exclusively responsible for the assessment and coordination during disasters. Thus, a concentration on the deployment of an exploratory team seems advantageous. As an organization B aims to provide relief goods to the beneficiaries, it appears appropriate to focus on the deployment of the emergency team. The shared task “Identify Demand” should be finalized by merging the results of both exploratory and emergency team in order to prioritize needs. The following figure illustrates this procedure.

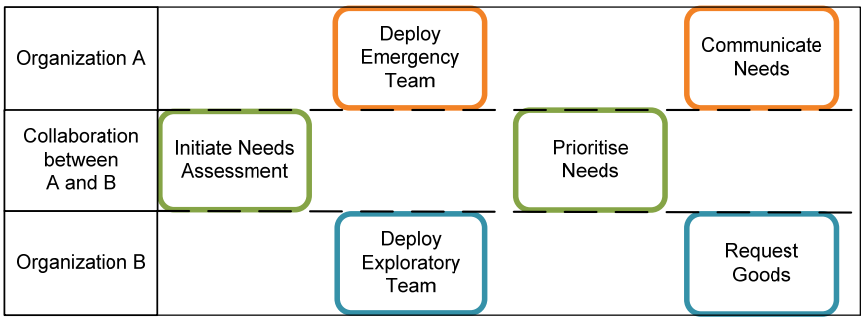

Figure 2: Shared Tasks of "Identify Demand"

TOOL SUPPORT FOR INTER-ORGANIZATIONAL AD-HOC COORDINATION

Currently, telephone, e-mail or fax, are used to coordinate during a disaster response within the organization, but also with other organizations. This means that it is very difficult to track the current status of activities or to detect conflicting views on the situation (e.g. an activity is perceived as canceled by the command center, but it is perceived as failed by the team in the field). Furthermore, every time the status of an activity changes, all relevant stakeholders of an activity have to be found from scratch in a huge pile of messages. We developed a system for ad-hoc coordination for activities within and between different organizations (see Franke2010a;Franke2010b) . It originates in end user needs within the SoKNOS project (Döweling et al. 2009). It is based on the experience made in this project and on interviews we conducted with disaster managers. The system allows amongst others:

- Modeling of activities with temporal dependencies (e.g. starts, meets, finishes or overlaps)
- Sharing of activities between different organizations so that they can integrate them into their processes. This is illustrated in Figure 5, where the commander of organization A shares the activity “Identify needs” with the commander of organization B. The commander of organization B can integrate it into his process and establish a dependency to the activity “Order Goods”.
- Detection of violation of dependencies when executing activities and highlighting violations to the users. They can then resolve the issue together with other stakeholders of the activities.

INTEGRATION

In this section, we illustrate how the reference model and an implementation of the ad-hoc coordination concepts in a tool can be integrated. Basically, the stakeholders use the terminology and concepts of the reference model in the tool. Figure 6 illustrates a screenshot of our prototype. More precisely, it shows the activity workspace of the commander BETA (Bob) of organization B, who describes the coordination of parts of the reference process illustrated in Figure 2. In the upper part we see that the activity "Identify needs" has been shared with Bob. Bob can now decide to integrate it in his managed activities. He may also create dependencies to his own activities. Bob's currently managed activities are illustrated as a table in the lower part. The activities and dependencies may also be visualized differently (e.g. as a timeline). Bob can publish state changes of an activity to all stakeholders with whom an activity is shared. In the bottom left box, we can see the Bob's social network in the contact list. He can share activities with these people. He may add further contacts to his list.

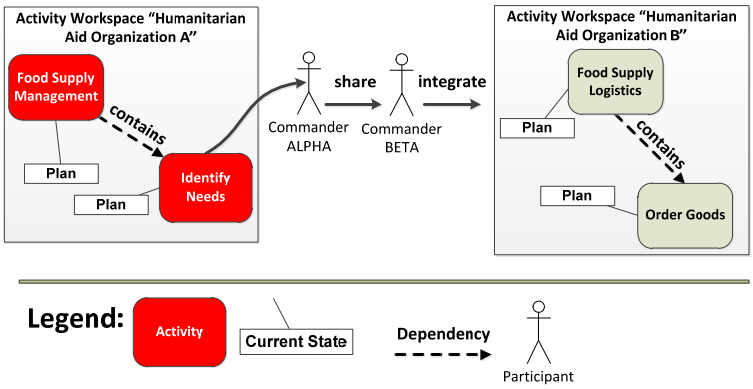

Figure 3 Sharing of Activities and their Current State

The tool supports also a graphical modeling notation as it has been described in Figure 5. Depending on the number of activities and the situation, one can have advantages over the others. For example, when there are many activities with few dependencies, then the table-based view seems to have advantages. On the other hand, the graphical notation has advantages when there are few activities with many dependencies. We are currently exploring how to automatically generate a graphical time-line based on information in the table to overcome the limitations of using individual views.

CONCLUSION AND FUTURE WORK

We presented here a reference process model for ensuring a shared common understanding on what needs to be coordinated by whom. This shared understanding facilitates coordination among different stakeholders in inter-organizational humanitarian logistic processes. An ad-hoc coordination tool has been presented that allows coordinating ad-hoc an inter-organizational humanitarian supply chain logistic process. This tool allows designing novel logistic processes with organizations that may never have collaborated before. The common understanding provided by the reference model in combination with the tool enables a more efficient and effective inter-organizational humanitarian supply chain. Although a shared understanding of what needs to be coordinated exists, the real situation may deviate from what is prescribed in the model. This can be detected by the system and highlighted to the user, so that further actions can be performed. In the future, we want to focus on the evaluation and extension of the reference task model and investigate how we can integrate the reference model and the ad-hoc coordination tool technically. We also want to investigate how to design a repository for reference processes that can be leveraged during a disaster. For example, it may give guidance what one can do next or what is needed to do something else. Furthermore, we need to investigate proper visualization mechanisms (e.g. list, graphs, timelines or maps). We think the next important steps for crisis management technology is not only to provide innovative technology, but also content, so that it can be easily deployed and used by crisis managers. This paper provides a first step into this direction with a reference process model providing the content and an ad-hoc coordination concept as an innovative technology for coordinating an inter-organizational humanitarian supply chain.

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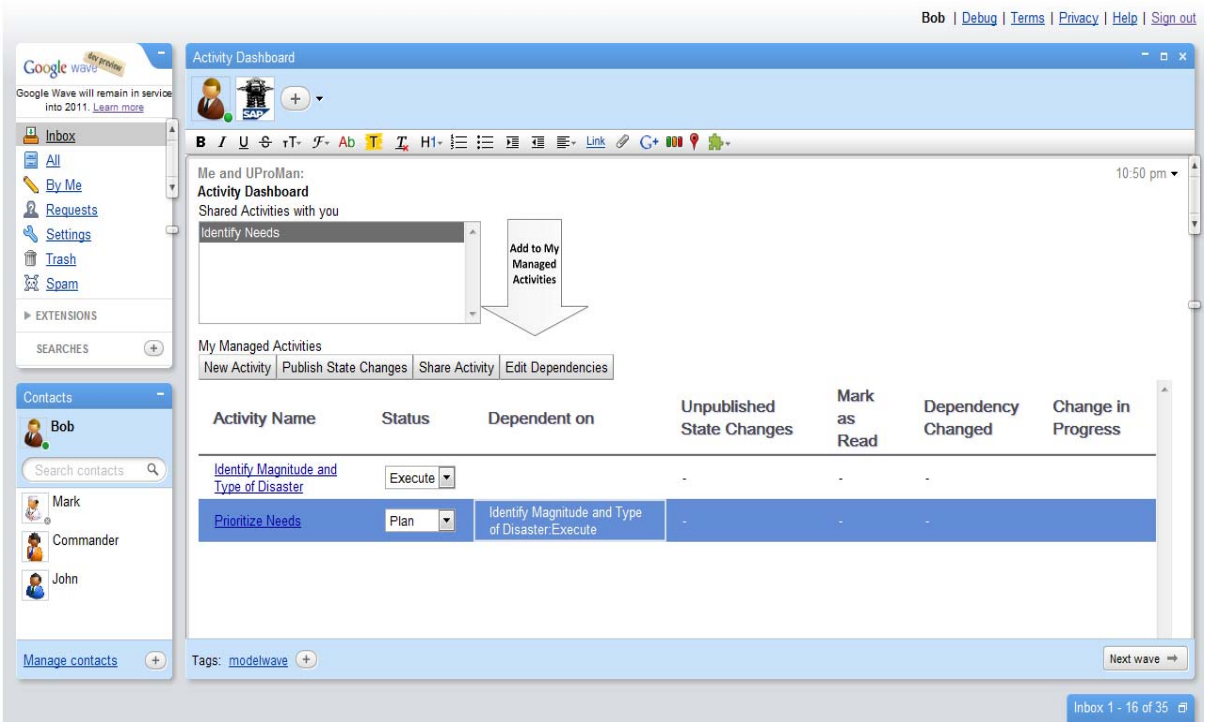

Figure 4 Screenshot from our Ad-Hoc Coordination Tool

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