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IMPROVING COORDINATION IN HUMANITARIAN SUPPLY CHAINS: AN ENTERPRISE MODELLING APPROACH

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ABSTRACT: *Humanitarian Supply Chains have to develop operational solutions to overcome obstacles to effective delivery of aid to the more than 200 million people each year around the world affected by natural disasters and humanitarian crises. Geographical dispersion, insufficient or inaccurate communication and information flows between the field and the head offices of a same relief organization as well as between several organizations are limiting factors to a good coordination. This poor coordination often contributes to complexity at the disaster site, but also hinders visibility and motivation of donors. Thereby, despite undeniable qualities of agility and reactivity, many Humanitarian Supply Chains could gain in efficiency by improving their capabilities of coordination. This paper highlights the characteristics of these relief chains and tries to propose a framework that relates to the different problem of coordination, and particularly the problem of vertical coordination. Then, an Enterprise Modelling approach is developed in order to support the coordination improvement in case of humanitarian operations. A case study on the International Federation of Red Cross intervention after the earthquake of Yogyakarta in 2006 is finally presented.*

KEYWORDS: *Supply Chain Management, Humanitarian, Enterprise Modelling, Coordination,*

1 INTRODUCTION

Historically, poorly designed supply systems, limited professional training for logistics professionals, and lack of objective performance metrics have hindered delivery of humanitarian aid and goods to those who need them most. Indeed, humanitarian operations are more and more complex and so, are more and more difficult to understand and to manage. Actually, in an environment where needs escalate at a higher pace that society's ability to respond, agencies and donors are forced and praised for finding innovative ways to maximize impacts of their actions. This is a particular challenging task in operations so large, so urgent, in uncharted territories.

Today, very often, the magnitude of the needs, the unprecedented numbers of affected populations, and the travel distances exacerbated the complexity while surpassing the logistical capacity of the agencies on the ground. Although humanitarian actors (agencies, NGOs, Donors, etc.) are very reactive and agile, they are forced to work closer in order to create new solutions at the operations and policy levels. In other words, they have to coordinate themselves. But because humanitarian organizations have different, occasionally contradictory mandates, coordination is a difficult process and time-consuming (de Mul, 2002). And in emergency, relief time is not just a question of money but a difference between life and death.

Consequently, the issue of how to achieve improved operational coordination among those parties seeking to provide international humanitarian emergency relief has received persistent attention from analysts in recent years (Stephenson, 2005). The trouble is that the operating environment in which humanitarian agents must work and the typical features of humanitarian operations do not encourage broad and open cooperation among them.

Thus, the aim of this research is on the one hand, to analyze the main features of the Humanitarian Supply Chains (HSC) and on the other hand, to address the problem of coordination in these HSC.

The paper is split up in four main parts. Firstly, a brief literature review is developed to identify the salient features of HSC. Secondly, the paper presents the key success factor for a relief operation and identifies the necessity to improve the coordination capabilities of the humanitarian stakeholders. Thirdly, our Enterprise Modelling approach to diagnose these capabilities is exposed. Fourthly, a part of a case study (currently in progress) is explained in order to show how our proposition can be run.

2 SALIENT FEATURES OF HUMANITARIAN SUPPLY CHAINS

Various approaches and definitions (Stadtler and Kilger, 2000; Mentzer *et al.*, 2001; Arnold and Chapman, 2004) consider Supply Chain Management (SCM) as coordinated system that manages flows. Cooper and Ellram (1993), for example, define the SCM as "an integrative philosophy to manage the total flow of a distribution channel from the supplier to the ultimate user". Simchi-Levi et al. (2003) precise that the SCM is "a set of approaches utilized to efficiently integrate suppliers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system wide costs while satisfying service level requirements".

If we except some unsuitable terms as "user", "store" or "service level", the concept of SCM explains what humanitarian organizations, suppliers and donors must do to minimize the impact of crisis: that is the Humanitarian Supply Chain (HSC).

According to Luk Van Wassenhove (2005), HSC are about 15 years behind their private sectors counterparts who realized way back the importance of using efficient supply chains. He explains also that humanitarian logisticians have been struggling for recognition and humanitarian organizations are just beginning to wake up to the fact that logistics is crucial. Indeed, the effectiveness of the supply chain is a critical factor in the performance of humanitarian relief organizations, yet this sector has been slow to make much-needed investments in logistics (Synergos, 2005).

Although humanitarian world becomes aware about logistics, work in the context of natural or man-made disaster is very different from logistics in the business context. Several authors (Beamon, 2004; Stephenson, 2005; Van Wassenhove, 2005; Oloruntoba, 2007) have tried to identify the characteristics of its particular context. We have retained seven different categories:

1. the stakeholders,
2. the funding process,
3. the categories of flows managed,
4. the dynamic,
5. the humanitarian operation lifecycle,
6. the environment complexity,
7. and the humanitarian space.

2.1 Stakeholders

The humanitarian distribution channel go through different many stakeholders - that we call Strategic Humanitarian Units (SHU) - starting from suppliers to beneficiaries (and not, consumers or users). These HSU are of different nature: international agencies such as the World Food Programme (WFP), International Non-Governmental Organizations (INGOs) such as Care International, Non-Governmental Organizations (NGOs), Implementing Partners, Military, Donors, Private Companies. All these HSU get, more or less, the following proprieties:

- Under resourced, limited skills availability and high employee turnover that limits institutional memory and efficiency;
- Ineffective leverage of technology (non robust equipment…) and particularly, information systems are relatively basic. Many relief logistics departments rely on manual systems without any Information Technology;
- Command / Control lacking;
- Several operations to do at a same time.

In addition, all these stakeholders do not have the same incentives.

2.2 Funding process

HSC are financed by donors (governments, companies, private…) through a funding process. The funding process is a channel for the donation from individual people or donor organizations to the beneficiaries (through several SHU). So, contrary to Commercial Supply Chains (CSC), the financial flows are not parallel with the material flows.

2.3 Categories of flows managed

Thirdly, if the humanitarian distribution channels manage the traditional categories of flows, these ones present some specificities:

- Physical flows are material (food, items, etc.) and human (organization's skills);
- Informational flows (order transmission, tracking and coordination of physical flows) are poorly structured and managed;
- Financial flows are unilateral (from donors).

Moreover, because media places high pressure on the agencies to compete for visibility, organizations have to consider the media flow (even if they do not manage it). For instance, Van Wassenhove (2005) explains that a bad use of media by humanitarian organizations can lead to inundate the supply chain with unsolicited donations (and cause bottlenecks) as much as needed resources.

2.4 Dynamic

The dynamic of HSC is very specific because they try to respond to some vital needs due to sudden or long term crisis. A HSC does not start with a customer need expression and does not want to maximize a profit. In this condition is quite difficult to apply the good practices in terms of planning and scheduling. There is evidence of a frequent lack of planning in relief supply chains, resulting in inefficiencies. For example, the overuse of expensive and unsafe air charter, failure to pre-plan stocks, congestion at ports caused by unplanned

deliveries, delivery of useless or unwanted items to disaster victims and a lack of inter-organizational collaboration for information systems (Oloruntoba, 2007). More generally, a HSU has to:

- assess themselves the needs;
- consider unforeseeable things and very short temporality;
- work in emergency conditions and so to be adaptable and reactive;
- consider a lack of transparency and lead times.

2.5 Humanitarian operation lifecycle

If we consider a project as a temporary endeavor undertaken to achieve a particular aim then HSC operations can be assimilated as a project. In fact, humanitarian organizations are responsible for producing relevant outputs and hence they must be constantly aware of the project goal (minimizing the impact of a crisis), project purpose, and of course the project management internal measures of efficiency. Concretely, there are two kinds of project environment for implementing humanitarian logistics operations:

- Slow onset disasters: Droughts, epidemics, famine/food insecurity, population movements, man-made disasters. In this case, the focus is done on capacity building, using national staff, cost savings, low budgets, planning and scheduling, and long time frames.
- Sudden onset disasters: Hurricanes, cyclones and typhoons, earthquakes, floods, volcanic eruptions, technological and man-made disasters. In this case, the focus is done on providing medical assistance, providing food and non food items, launch appeals, to assess globally the needs, using international staff, high budgets and very short time frames.

The Figure 1 distinguishes the four different phases that describe the lifecycle of a humanitarian operation (inspired from (Pettit and Beresford, 2005; Van Wassenhove; 2005)): Preparedness, Immediate Response (Ramp up), Support (Maturity) and Dismantling (Ramp Down). Function of the project characteristics (Sudden or Slow onset), the duration of the operations are more or less long. Despite all, the duration is much less important than any comparable industrial project.

2.6 Environment Complexity

The environment of HSC includes several specific characteristics that participate to its complexity:

- A politically volatile climate in which humanitarian organizations have to operate A-political missions;
- A high level of uncertainty in terms of demand, supplies and assessment;
- Some unforeseeable, complex, particular and unstable external actors in place as Local Governments (where the crisis takes place), Donor Governments, Military (3rd party service providers), or private sector logistics providers (transportation, warehousing...) that bring many constraints to manage the HSC.

2.7 Humanitarian Space

Humanitarian organizations live by their principles of humanity, neutrality and impartiality. In other words, they will help everyone in need wherever found; will not influence the outcome of a conflict with their intervention; and will not favour one group of beneficiaries over another. These principles define the 'space', both physically and virtually, in which they need to be able to operate to do their job effectively (Van Wassenhove, 2005).

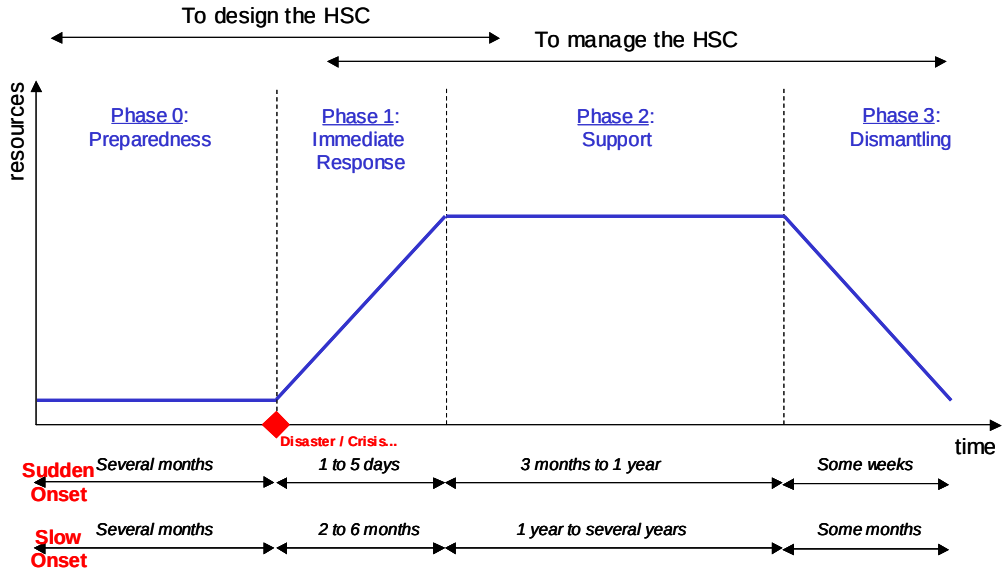

Figure 1. Humanitarian Operation Lifecycle

2.8 Synthesis – Global Model of HSC

The Figure 2 summarizes how a HSC runs (inspired from (Handfield and Nichols, 2002; Oloruntoba, 2007)).

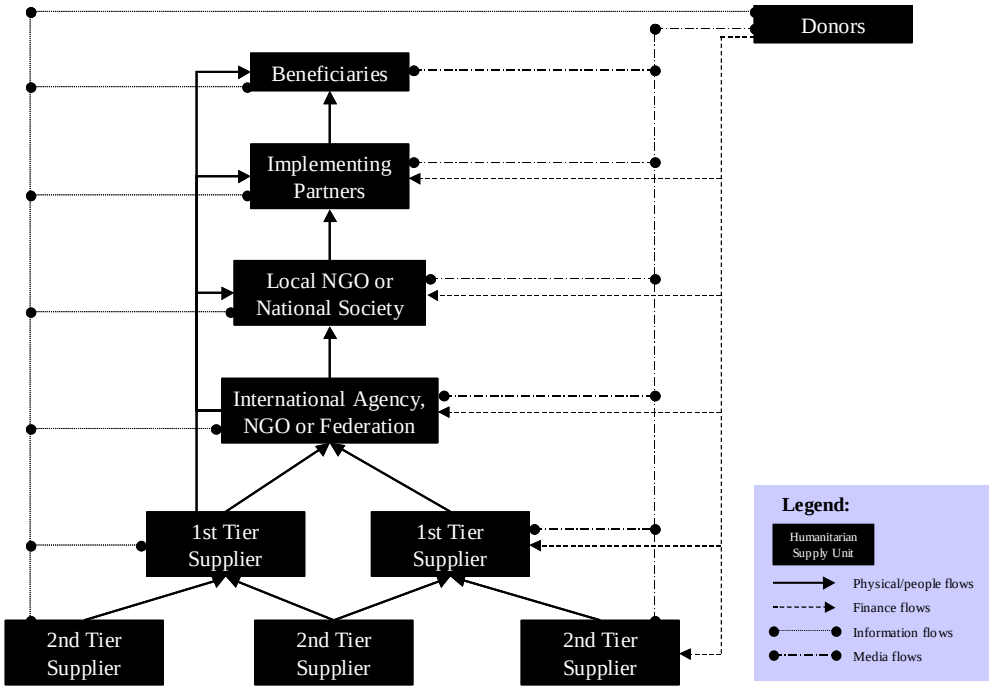

Figure 2. Global Model of a Humanitarian Supply Chain

3 THE COORDINATION NEEDS IN HUMANITARIAN SUPPLY CHAINS

3.1 Key elements for a successful humanitarian operation

"A successful humanitarian operation mitigates the urgent needs of a population with a sustainable reduction of their vulnerability in the shortest amount of time and with the least amount of resources" (Tomasini and Van Wassenhove, 2004). Consequently, a successful response to a disaster is not improvised and must be prepared to be effective. Humanitarians have begun to heed to the lessons learnt from previous disasters and realize that they have to work hard not only during disasters but also between disasters (Van Wassenhove, 2005). Preparedness consists of five key elements that have to be in place to produce effective results. These in turn lead to effective disaster management. They are as follows (Van Wassenhove, 2005):

1. Knowledge management: Learning from previous disasters by capturing, codifying and transferring knowledge about logistics operations.
2. Financial resources: Preparing sufficient money and financial resources to prepare and initiate operations and ensure that they run as smoothly as possible.
3. Human resources: Selecting and training people who are capable of planning, coordinating, acting and intervening where necessary.
4. The community: Finding effective ways of collaborating with other key players such as governments, military, business and other humanitarian organizations.
5. Operations and process management: Recognizing logistics as a central role in preparedness. Then setting up goods, agreements and means needed to move the resources quickly.

In the following parts, we discuss briefly the existed works associated to its five key elements in order to release potential lacks and perspective of research.

3.1.1 Knowledge management

A brief literature review shows clearly that a lot of works exist on this point (Bui and Sankaran, 2001; Kaiser *et al.*, 2003; Benini *et al.*, 2003; Tomasini and Van Wassenhove, 2005).

3.1.2 Financial resources

On this subject many works as for example (Kunreuthe and Linnerooth-Bayer, 2002) have already been developed due to the transparency requirements imposed by donors.

3.1.3 Human resources

The problem of human resources in humanitarian operations is probably the most forsaken one in terms of academic researches. Nevertheless many authors as (Beamon, 2004; Stephenson, 2005; Synergos, 2005; Van Wassenhove, 2005; Oloruntunba, 2007) have demonstrated how crucial this problem is. The qualified staff shortage and the important turn-over often have harmful consequences on the management of crises. However, methods exist in business management that should be adapted to design relevant skills management systems for the humanitarian sector.

3.1.4 The community

Many works have studied different aspects of the coordination between stakeholders in HSC, as for instance:

- Military and humanitarian organizations (Pettit and Bereseford, 2005);
- Centralized coordination around a UN Agency (Kent, 2004; de Mul, 2002; Van Wassenhove and Samii, 2003);
- Application of "organizational design" best practices to humanitarian relief (Benini, 1999; Stephenson, 2005).

Donini (1996) has identified three categories of coordination in this context:

- Coordination by command where there is central coordination; agreement on responsibilities and objectives; and common territorial areas of responsibility.
- Coordination by consensus where organizations have access to compatible or shared communications equipment, liaison and interagency meetings and pre-mission assessments.
- Coordination by default includes routine contact between desk officers and civil military operations centres.

Classically the problem of community considers that at any one time, there can be as many as several hundred humanitarian organizations at the scene of a disaster, not always acting in a coordinated fashion (Van Wassenhove, 2005). Consequently, there are too many participants in the field without a clear division of labor, and refer to differences between the focus of NGO headquarters and their field workers, with the former more concerned with relationships with donors than with delivery to aid recipients (Byman *et al.*, 2000). All these contribute to complexity in the delivery of relief. This part highlights the fundamental problem of what we call the *horizontal coordination needs* in the relief operations. Generally, this kind of coordination relates to a slow onset disaster as: Mozambique in 2000, Afghanistan in 2001/2002, Angola in 2002 or Darfurs for 2004. A majority of these disasters were coordinate through the United Nations Joint Logistics Center.

3.1.5 Operations and process management

Several works could have been identified concerning the operations and process management in HSC. These ones study essentially the improvement of unitary operations or business process in a humanitarian context, as for instance:

- Transportation and inventory management: an abundant literature (Okasaki, 2003; Beamon and Kotleba, 2006; Van Wassenhove, 2006) extends some best practices of business sector to the particularity of the humanitarian sector.
- Development of flexible technology and software allowing to support humanitarian operations (Bui and Sankaran, 2001; Kopczak and Jonhson, 2004).
- Metrics and performance measurement in humanitarian context. Davidson (2006), for example, addresses feasibility issues of implementing a measurement system in the non-profit sector and also describes the next steps of opportunities related to measurement systems within humanitarian logistics.

Because humanitarian organizations continue to face challenges in several areas at a same time, it is becoming necessary to coordinate all these operations, in a consistent way. Moreover those which have an important network can operate at different level of a HSC and have to guarantee the coherence of their actions (especially when several members of the network operate at a same time in a same place). No particular work seems to have clearly explored this problem. This is what we call the *vertical coordination needs*. We propose to develop it in the following part of this paper.

3.2 Problem Under Study: Vertical Coordination

3.2.1 Mobilization and affectation

Some humanitarian organizations evolve in several fields at a same time. So, there are several projects to manage in parallel. Such organizations have to control globally all theses operations. Because they are under-resourced they have to define priorities in order to dispatch properly the funds and of course personnel. Globally, this is a problem of *balancing* (Figure 3).

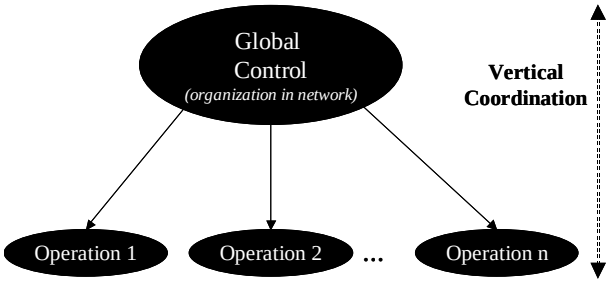

Figure 3. Balancing component of vertical coordination

3.2.2 Coherence and efficiency

Moreover a same humanitarian organization can fulfill various HSU in the HSC. A typical example is the International Federation of Red Cross (IFRC) that have a headquarter in Geneva, three Relief Logistics Units (in Panama, Dubai and Kuala Lumpur) and more than, 180 National Societies all over the world. Consequently, when a crisis occurs, several members of the Federation operate in a same place. The head quarter has to guarantee the coherence and the efficiency of the global action of the network on this crisis. Consequently HSU must synchronize their actions in order to be more and more effective and reactive. Globally, this is a problem of *synchronization*.

3.2.3 Empowerment and best practices

The two precedent component of the vertical coordination needs relate to the phases 1, 2 and 3 of the lifecycle (Figure 1). But the phase 0 could also be included in the vertical coordination. Actually, during the preparedness phase, a humanitarian organization should capitalize on their past experiences in order to define best practices in terms of supplier selections, business processes, skill management, etc. The aim of the coordination could be to ensure the use of these best practices during the future operations. Moreover, personnel probably have to learn from each other in order to be more efficient in the future. Of course, the objective is not the standardization because each crisis is unique. Globally, this is a problem of *training*.

3.2.4 The vertical coordination components

To summarize, the vertical coordination seems to include three major components (Figure 4):

1. Balancing: To mobilize and affect properly the funds and skills on different crisis at a given time;
2. Synchronization: To guarantee the coherence and efficiency on a relief operation;
3. Training: To facilitate the empowerment between the network members and the implementation of best practices.

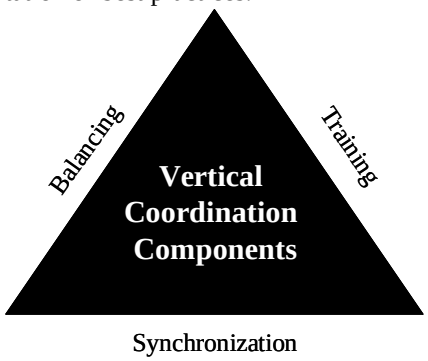

Figure 4. Vertical Coordination Framework

Basically, this type of coordination will be particularly relevant in case of sudden onset disaster. According to the framework, the *vertical coordination* seem to require relevant operation reports, formalized strategies, business processes and procedures, and probably also an efficient Information System.

In the following part, we develop an approach to analyze these three components in order to improve globally the vertical coordination capabilities in HSC.

4 AN ENTERPRISE MODELLING APPROACH TO IMPROVE THE COORDINATION CAPABILITIES

4.1 Strategy: Business Process Reengineering

As we have seen before, HSC are complex systems. To improve the coordination capabilities – particularly the vertical one - of all actors of HSC must fully understand and harness the way they operate and they communicate and share information. In this paper, we try to properly address this problem and to propose a method allowing humanitarian actors to have a realistic representation of the system under their responsibility.

Business Process Reengineering (BPR) constitutes a natural approach to define transitions from a given state of supply chain processes (current state under coordinated, "As Is") to target ones (desired state well coordinated, "To Be"). A BPR approach imposes to make a diagnosis of individual and collaborative processes at the network level.

4.2 Methodology: Enterprise Modelling

We propose to use an Enterprise Modelling (EM) methodology to achieve this goal. Actually, the essential goals of EM are to understand and explain, to experiment (analyze, compare, test, evaluate/predict performances), to learn and decide (what-if scenarios), to operate and to control (Vernadat, 1996). EM could be resumed as the art of externalizing knowledge which adds value to the organization or needs to be shared (i.e. to describe the things of the organization). The major advantage of EM is to allow building a common consensus on how operations work or should work. The EM approach brings some methods and tools to represent the structure, behavior, components and operations of a business entity to understand, (re)engineer, evaluate, optimize and even control business operations and performance. An other advantage consists in the fact that we can implement this approach as well inside a single organization as a distributed organization.

Concretely, our proposition wants to establish a conceptual model of an existing HSC (analysis phase) in order to be able to propose improvement orientations in terms of function, behavior, information, resource, organization, economic or any other aspects of each HSU. Of course, this conceptual model varies according to what

we want to put forward. Then, the objective is to implement the actions of progress on the real world.

4.3 Implementation: functional, decisional and organizational views

Consequently, we have to define the EM constructs to model HSC. EM framework is a reference into which the knowledge that we need could be localized, and assumptions done, with respect to (standard CEN ENV 40003):

- The genericity defines the detail level of the enterprise-model: generic; partial or particular.
- The model Life-Cycle specifies the step currently under study of the life-cycle of the system from Domain identification to Decommission definition.
- The model view specifies the nature of the objects highlighted: the resource view, the informational view, the functional view and the organizational view. To be complete, we must add another view which will appear in a nearest evolution of the standard: the decisional view.

Taking into account these definitions, our problem of coordination capabilities improvement requires us to define the operational processes of a HSC, by a representation of the functional view of the system. Because HSC is done on several decisional horizons and on several frames of responsibility, it is appropriate to be able to accurately locate the total articulation of the decision-making centers. The multi-actors and multi-plans nature of the HSC requires us to locate the responsibilities associated with the activities in the organizational view. Our work relates to existing Supply Chains. We attempt to propose a model specific to this one. Lastly, concerning the abstraction, working on an operating system, our goal is to explain how does it work when the HSC is associated to a slow onset crisis. On the other hand, for a sudden onset, a specificity of a HSC is to manage all the steps from the design to the dismantling of the Supply Chains for each disaster. Three models are finally necessary:

- A model dedicated to the process representation for the functional;
- A model dedicated to the decisional representation;
- A model dedicated to the organizational representation.

4.4 Summary of the step

Finally, the approach that we propose to model coordination in HSC consists in:

1. Identifying the HSC associated to a relief disaster;
2. Modelling each phase of humanitarian activities through three views: decisional, functional and organizational ("As Is" description);
3. Analyzing these cartographies in order to extract improvement axes – particularly regarding to the balancing, synchronization and training components for vertical coordination;
4. Defining the targets in terms of operations and process management (ideal "To Be");
5. Moderating the propositions function of field constraints (realistic "To Be");
6. Designing an action plan to implement the propositions.

5 CASE STUDY: THE IFRC RESPONSE TO THE YOGYAKARTA EARTHQUAKE

The Year 2006 has marked a further step in the revitalization of the Internal Federation of Red Cross and Red Crescent societies (IFRC). Its disaster management process has been entirely revised to enable quicker and better response to disasters. The necessity of improvement in this area has been unfortunately clearly demonstrated for many years already. After many adjustments, a radical change has been launched in November 2005: the federation will centralise its policy - Geneva - and decentralise its operational capacity by creating 3 Regional Logistics Units (RLU) - Dubai, Panama and Kuala Lumpur - with capacities in terms of mobilization, procurement, stock and warehousing and fleet support.

To reach the potential benefits of this strategy, an efficient coordination (vertical) is of course required (the more important decentralisation is, the more critical coordination is).

5.1 The Yogyakarta earthquake

The earthquake happened on the 27th of May 2006. More than 70% of the houses and buildings were damaged. Thousands people were injured caused by this disaster. The earthquake caused an electricity black out and, in several area, the telephone were line off, causing severe communication problems. Moreover all gas station were reported off and some roads and bridges were damaged. Moreover, in Yogyakarta, the international airport was out of operation and flights from or to the city had to be redirected to Surakarta (60km of Yogyakarta) or Semarang (120km of Yogyakarta). The figures ended up at 6000 dead and 1,5 million of disaster victims.

5.2 Step 1 – Identifying: The HSC of IFRC

During the phase of response, the Indonesian Red Cross worked together with the regional logistic unit in Kuala Lumpur and the head quarters in Geneva. Other national societies also mucked in by sending resources. British, American, Spanish and Danish Red Cross sent trained people to give a hand in relief operations. Japanese, Belgian, Spanish Red Cross sent goods.
In may 2006, Kuala Lumpur RLU was finalizing its implementation. Consequently, during the first days after the earthquake, the global coordination was ensured by Geneva, as it used to be done before the decentralisation process. In following, beginning of June, Kuala Lumpur

took the lead in the coordination of the logistics services response, as it supposed to do with the new organisation.

IFRC get off to a good start in the response process. Indeed, logisticians were presents from day 1 and some stocks were also available. Actually, the local delegation could benefit from the post tsunami works in progress at this time and from the fact that Mont Merapi, a volcano 70km from Yogyakarta, woke up 2 months before. For these reasons, even if Kuala Lumpur RLU was not fully operational (no central warehouse with available stock ; human resources still lacking), the situation in Yogyakarta (stock and technical staff available) justifies the hypothesis that the actual response to the crisis in Yogyakarta is close to what it would have been should the RLU have been 100% operational.

The main Red Cross entities that operated during the crisis were:

- IFRC (Geneva) ensured the strategic coordination for this operation but potentially also for other operations in other places.
- RLU (Kuala Lumpur) coordinate locally the operations. Concretely, they consolidate the needs and control the pipeline for the field distributions (procurements, central warehousing, etc.). RLU is also used to coordinate shipments and to track what is done.
- The British Red Cross was the Logistics Emergency Response Unit. Actually, they were responsible of receipt at air port, storage and shipment execution on the field.
- The American and Spanish Red Cross were the Relief Response Unit, helping with the field distribution organization.
- The Indonesian Red Cross, as local National Society, was responsible for the operations, asking the assistance of the others where it lacked skilled resources and doing itself where it could. Concerning logistics, it was concretely on the field by allowing the distribution (refuges, infrastructures, etc.) and by executing the relief distribution.
- A last entity was the Disaster Management Unit (DMU in Panama). This was the "disaster management" reference skill in Red Cross Federation. Consequently, some actors on the field had refereed to them during the crisis response.

5.3 Step 2 – Modelling: The vertical coordination in IFRC response

Because the work is in progress, we discuss in this paper only one model. We have chosen to develop the functional view through a Business Process Modelling Notation (BPMN). This representation allows to model the relationships between the HSC's entities and to describe the activities that are fulfilled and their sequencing. An overview and some applications of BPMN are presented, for instance on www.bpmi.org.

The model presented on the Figure 5 represents the main business processes run by the Red Cross stakeholders from the 2nd of June (end of the response phase and beginning of the support phase according to the lifecycle described on the Figure 1) to the end of the relief response. There are 6 different pools on this diagram that relate to the 6 different entities.

5.4 Step 3 – Analyzing: The Business Model informs on the Synchronization capabilities

According to the three components of the vertical coordination defined previously (Figure 4), we can make the following comments on the model:

- Synchronization Analysis: Roles of each stakeholder seems to be quite well defined except the DMU for which its activities are not clearly linked with the other ones. Actually, the DMU is not managed by the logistics department but by another one. Despite all, the coordination of operations is well identified (4 activities) and hierarchically structured: global coordination in Geneva, local coordination by the RLU and field coordination by ERU. Consequently, the problem consists in guarantying a global coherence at each stage. Typically, the business process shows clearly that there is very few information that feedback to the IFRC in Geneva.
- Balancing Analysis: The direct consequence of the last previous point is how difficult is it for Geneva to properly adjust the funds and skills on the field operations. The model underlines a miss in terms of macro-vision and control on the operation (no systematic feedback loops).
- Training Analysis: The model puts forward the role of the DMU whereas they are not clearly in charge of the crisis. These interferences seem to be caused by a deficit of training (disaster management) of some logisticians. This garbled situation may be related to the fact that "logistics and resource mobilization" and "disaster management" are two separated department at the IFRC. They often work as partners with logisticians, but with their own hierarchic systems.

Of course, this analysis is partial. To be complete, the analysis must consider the 2 other modeling views (decision and organization) and all the lifecycle phases.

5.5 Steps 4, 5 and 6

Concerning these phases, an analysis is still to be produced. Its implementation is in progress.

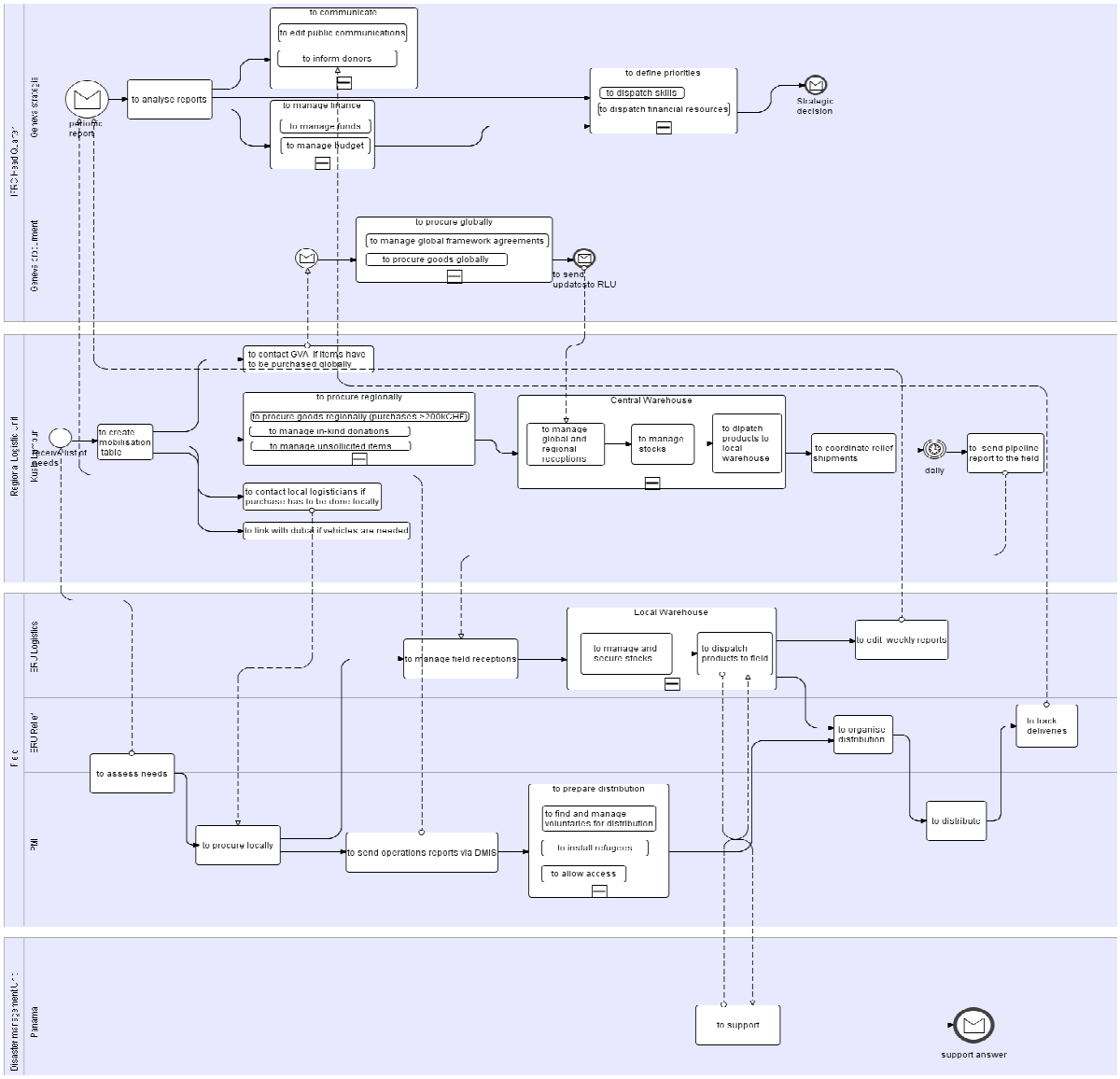

Figure 5. Business Process Model of Red Cross Federation from the 2nd of June.

6 CONCLUSION AND FUTURE WORKS

International emergency relief operations require the establishment and management of supply chains. If these Humanitarian Supply Chains get a lot of common characteristics with their commercial counterpart, they have also some important particularity as funding issues, employee turnover, weak use of technology and poor manual processes (Beresford and Pettit, 2007). Relief systems are much more reactive than proactive, leaving only a reduced space to performance improvement. A brief analysis of the literature on the key elements that participate to a successful humanitarian operation (knowledge management, financial resources, human resources, community and operations and process management) shows two different ways to improve the HSC:

- Management of humanitarian skills;
- Coordination capabilities and especially, vertical coordination capabilities.

In this paper we have addressed partially the problem of vertical coordination needs, focusing our work on the IFRC. This problem relates to the control of the different:

- operations that an organization has to manage in several areas at a same time,
- stakeholders of a networked organization that intervene on a same operation.

We have proposed three dimensions to characterize the vertical coordination: Balancing, Synchronization and Training capabilities. According to this framework, we have proposed an Enterprise Modelling approach to diagnose the vertical coordination capabilities of a HSC. This approach is based on three different models that develop three views: functional, decisional and organizational. The relief response proposed by the IFRC to the Yogyakarta earthquake is finally presented to illustrate the business process model analysis.

Four major perspectives that would be considered in the Aurélie Charles PhD thesis, arise from this study:

- The first one consists probably in validating the robustness of our modelling approach to diagnose the coordination capabilities of a HSC. This work is in progress on the IFRC case study presented in this paper.
- A second perspective could be to identify some best practices to improve the vertical coordination capabilities of humanitarian stakeholders regarding to the three dimensions: balancing, synchronization and training.
- A third perspective addresses the possibility to use the modelling approach to formalize the natural agility capabilities of humanitarian stakeholders in order to be able to "transpose" to commercial supply chains.
- A fourth perspective relates to the problem of human resources management that we have rapidly discussed. The problem can be summarize as "are there adequacy between skills sent on the field and necessary ones?". Consequently, there is probably some interesting perspectives to develop a planning decision making support to manage properly this problem (for instance relative to the type of crisis, the environment characteristics…).

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