PhD Proposal 2016

School: Ecole Centrale de Lille
Laboratory: CRIStAL
Team: OSL
Head of the team: Pr. Slim HAMMADI
Supervisor: Pr. Slim HAMMADI
Email: slim.hammadi@ec-lille.fr
Collaboration with other partner during this PhD:
In France: Co-Supervisor: Sarah BEN OTHMAN
In China:

Title: Collaborative optimization for crisis management supply chain

Scientific field: Optimization, crisis management supply chain
Key words: Crisis management supply chain, resources delivery, scheduling, optimization, multi-agent systems, modeling, logistics

Background, Context:
This subject is the continuity of several research works on Emergency Supply Chain (ESC) management. A first version of an agent-based software tool called OBAC (Optimization Based on Agents Communication) was developed and used to improve logistics planning in cooperation with the logistics department of Airbus Defense and Space (previously called CASSIDIAN), a division of the European Aeronautic Defense and Space Company group now rebranded into Airbus Group.

Research subject, work plan:
Recent natural disasters such as hurricane Katrina in Louisiana (2005), the earthquake in Haiti (2010), or the tsunami in Japan (2011) have revealed that disruptions in the management of these crises may result in the catastrophic inability to provide rapid assistance to affected populations. Regardless of the type of disaster (natural, such as earthquakes, floods, tsunami,
etc., or man-made, e.g., wars), before calamity strikes, detailed plans should be established for people at risk, so that, under emergency circumstances, logistics operators are able to answer the needs of survivors in the affected areas. These operations are called emergency logistics and aim at providing the needed supplies with the minimum cost and time. Hence, emergency logistics refers to a set of interacting and coordinating logistics actors aiming at accomplishing emergency logistics requirements. With respect to classical logistics, emergency logistics is characterized by several distinctive features. First, in the aftermath of a crisis, responsive (or automated) emergency logistics systems are needed in the affected areas for efficient disaster relief supply and recovery. Second, an assessment of supply resources and workforce should be conducted to adjust to the unexpected difficult circumstances. Third, since the crisis environment is typically uncertain, traditional centralized systems cannot deal with the sudden unexpected variations of needs. Hence, the objectives of an ESC for crisis management are:

- the optimal deployment of military units, resources and associated equipment (personnel, vehicles, planes, etc.);
- the supply of water, food, clothing, etc.;
- the infrastructure reconstruction;
- the medical support.

This PhD project will consider the first two objectives of an ESC, i.e., the optimal allocation of its resources for the supply management during the crisis. In the case of a security threat, immediate operations must be implemented, including the development and maintenance of the supply chain to provide logistics support functions. The issue is to implement a suitable procurement policy to deliver the resources avoiding stock-outs that can paralyze the functioning of the whole chain. Therefore, we have to take into consideration objectives like costs minimizing and constraints such as delivery delays as well as the complexity of the environment characterized by uncertainty and a large number of actors that make the scheduling task highly complex. The described context shows the relevance of developing an automatic tool to model and optimize logistics solutions to meet emergencies and help logistics decision-makers or authorities make the right choices in real time.

The work plan will be as follow:

- State of the art of Crisis Management Supply Chain and optimization methods,
- Study and develop collaborative optimization for resources scheduling and logistics areas positioning,
- Integrate the developed methods in OBAC.

References: