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Optimal Shelter Aid after a Disaster

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ABSTRACT:- Recent initiatives on efficient data gathering have resulted in programs as the UNHCR information management project. The program has a focus on mapping and optimizing data gathering when assessing after a disaster. Creating a uniform format that can be used by the various actors performing assessments and translating the results into maps and graphs are the results of this project.
In all sectors including post disaster shelter aid, the assessments however, can be used for decision making. Clear decision rules are then needed.
These rules can best be implemented by a machine, by military or when working with professionals with optimal training in aid and the insurance of optimal post disaster stress treatment.
In this paper we describe a decision making tool and a case study for military short stay housing. We conclude that a clear procedure, professional approach and discipline can be of aid in chaotic post disaster situations.

Keywords:- *post disaster; shelter; decision making.*

I. INTRODUCTION

The military are occasionally invited to contribute to post disaster emergency relief activities. As the military personnel need temporary shelters, the army has special logistics and shelter division for militaries stationed on mission locations.

Although the purpose of the activities and the users are totally different, post- disaster shelter relief has similarities with military shelter activities. The population of a military camp exits of single, young, mostly mail, healthy individuals, as in post disaster relief shelter activities, the population consists of a combination of healthy, young, elderly, sick, handicapped, male, female and children, families or individuals. This affects the requirements for post disaster emergency shelters. The current camp design in post disaster emergency shelter relief is similar to military camps. Recent initiatives by relief agencies investigate camp designs that are more focused on civilians and their family situation [1].

Scaling up the shelter capacity however remains a challenge for national relief agencies [2]. The absence of clear pre-positioning and preparedness strategy for shelter solutions including tents and shelter kits, have highlighted the inevitable delay in the provision of emergency shelter when procurement, and in many cases, production, has to take place after a disaster.

According to the IFRC annual shelter report, 2011, the IFRC explores open, flexible solutions based on locally available materials and the mobilization of the local economy and material suppliers rather than shelter product providers. As the IFRC has national and international bodies, a significant percentage of the donations have to be spent on the collecting body, the international body and the local Red Cross body. Optimization of relief process including shelter relief can contribute to more aid to the beneficiaries.

II. THE MILITARY APPROACH

In an interview with the author (11th April 2008), Mr Wim Vroom, chief of the energy systems, Shelters, Containers and Internal transport (ESCI) of the Defense Materiel Organization of the Netherlands Ministry of Defense on explains the shelter strategies of the Dutch military. The existing experiences, possibilities and solutions can be used in post-disaster shelter relief activities.

Both realizing shelter for the military in a mission and shelter relief in post disaster situations are whole processes where providing energy, water, sanitation, food supply, waste processing (including sanitary waste packaging), are involved. The aim is to provide an environment for the users to work, eat, live and relax. The Dutch military participate in occasions in post disaster shelter relief, as they did directly after the tsunami Indonesia, in 2004. In some cases they will build a total camp. A good example of a contemporary military camp is Tarin Koyt in Afghanistan, where a total village for ca.
2000 military has been realized by the Dutch army.

In the military organization, a project manager, technical experts and logistic experts are involved in preparation and realization of the activities. Each military operation starts with formulating the requirements and the functional requirements of the object. There are 5 phases in total:

1 Formulating the requirements, the following points will be considered:
- Standards NEN, ISO, MILT, or other relevant standards
- Function
- Location

2 Refinement of the program
- Investigating the possible solutions that offered by manufacturers

3 Realization phase
- Design
- Construction
- Production

4 Design review

5 Planning in the usage program
- Maintenance plan
- Storage of spare parts
- Training mechanics, technical experts

After the approval of the Dutch parliament of a mission, the Commander of the Dutch Forces (CDS) will choose the right section to realize the mission. Each section has its own materials, included shelters. Before the start of the operation, the local situation, as climate, culture, underground and the social parameters, is investigated by a military expert, and the exact parameters are briefed to the basis in the Netherlands. Based on these parameters the section and the materials, including shelters will be selected.

The Dutch army uses an Intranet Expert System. The system recognizes who is responsible for which activity. This way always the person with the most knowledge and information on a subject can easily be localized. The chief of ESCI for example, has a list of the manufacturers in different types of tents, containers and shelters (see below) in order to purchase the right product in each occasion. He attends international fairs to be updated.

A shelter in military terms mean a container with extra facilities: Energy, climate control, insulated against heath and electromagnetic fields.

As the international ISO standards are used consequently in the measurements of the containers and shelters, (20*8*8 (8.6), there is room for exchange of parts. Efficiency and lower transport costs are the main reasons for using ISO transport-container. Mostly the old shelters are sold to the armies of allied countries (reusability).

NATO Standards for protection against specific situations as chemical gasses are to guarantee the quality and facilitate exchangeability, within NATO. In addition to the international standards, the under comes for Dutch military have to meet the Dutch ARBO law , for example prescribes NEN 1010 for electric installation

The comparison between relief tents and the military solutions show that: In post-disaster shelter relief, the used tents are cheaper (round 200 dollar) and they are less durable, they cannot be stored for more than 3 years some tents are to be destroyed because of degradation if not used within three years, which means loss of capital. The military use high quality shelters which are stored under the optimal climatic conditions, and can be used for 15 years, the containers (they cost round 2000 dollars) and inflatable tents can be used for maybe 100 years.

The balance between the costs of a shelter/ shelter Items, the storage conditions, the reusability of the product has to be investigated within a total frame in order to reach the optimal shelter solution

Comparison between tents and containers used by the military, result in the following: The tents are light, have less packed volume and are cheaper. Three tents can be transported in the space needed for transporting one container. The usable surface for the three tents is 75 m² and the usable surface of a container is 15 m². The tents provide five times more space than the containers, with the same transport- volume. However

the tents are less durable, more fragile and offer less insulation than the containers or the solid shelters. Containers can be furnished and installed in advance which can save time on the spot. All the products are designed conform the international standards.

The military, sent to a mission are fully trained and have the insurance that there will be compensation in case of casualty or death and they receive a reasonable salary. In case of relief workers however, the experts are mostly hired for a short period of time, have had a training of a few months in addition to their field experience and there is no pension plan or compensation in case of post-traumatic stress for example. There is a possibility to talk to a consultant and in occasion a desk job at the Shelter Research Unit (SRU) for example can be offered to a shelter expert with problems.

III. DECISION MAKING IN POST DISASTER SHELTER AID

UN report, Temporary Human Settlement Planning for Displaced Populations [3], emphasize the long-term effects of immediate shelter aid and the impact of emergency shelter. The 'assessments' are performed by specialists, the so called 'shelter experts' who do have knowledge of past practice, and are well-informed about some available solutions, as far as their personal knowledge and experience allows them to. As a central open information source about solutions is not available, fast decision- making on site depends on the personal judgment of the shelter experts and/or relief workers involved. This results in less optimal shelter solutions in terms of costs and quality. Moreover, the communication process that entails the making of assessments and the taking of decisions by headquarters, based on these assessments, tends to take more time than is desirable.

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In an interview with the author Dr. James Kennedy[1] summarizes, the start of a mission for a shelter expert as follows: Before a mission starts, a call comes in with the question if you are interested in a

[1]A senior shelter consultant, independent. He has studied Japanese and Chinese and has a dr. degree in camp design and management (TU Delft). He has been working as a shelter specialist with NRC, CARE, OXFAM, CHF and UN HABITAT. He has been participating in various relief activities as in Sri Lanka, Tsunami 2005, where 5000 shelter kits were offered, Pakistan earthquake 2005, Ache Tsunami 2006, Kenia Dadaab, after the war in mission. After getting to know the camp director, and announce your interest in the mission, the shelter expert takes the minimum needed items as 7 pairs of socks, 7 T-shirts, toilet articles and water and leave for the destination.

If possible and depending on the relief organization coordinating the mission, there will be a briefing on the headquarters before departure. After arrival a local driver picks you up at the airport and after meeting the colleagues at the office, you try to find the other relief advisors and an expert meeting will be organized. Per sector only one relief expert is available. In the expert meeting, an assessment is formulated and within a few hours a report of the needed items is communicated back to the head office.

In this hectic environment and under high pressure, a decision making tool can be of assistance.

To be able to provide optimal advice, a decision support system needs to provide tailored solution for each situation and leave the possibility for relief specialists to set priorities according to their judgment.

IV. THE STRUCTURE OF THE DECISION SUPPORT SYSTEM

The decision support system consists of two essential parts: A Input Collect variables in user screens.

Set up data structures to store information about disaster. Set up data structures to store information about Location. Set up data structures to store information about Situation.

Set up data structures to store information about materials/Techniques. Record shelter with variables information.

Set up admin functionality to maintain data: User administration Shelter data

Disaster data Location data B Output

Set up calculations. Generate shelter advice. Generate report presenting conclusions.

System specifications, system structure and system rules make the final decision making process possible. Technical specifications for the DSS for post disaster emergency shelters are standard specifications: ICT

specialists, tailored physical infrastructure (web browser, server, and engine) and data.

The strategy in decision making that combines the demand side of the infrastructure to the solution side, needs to have the capacity to cope with diversity of supply, in a broad crosscutting environment. System and data security are in addition to infrastructure capacity primary requirements for an optimal functioning of the DSS.

Data management is divided in Master data management and Meta data management. Data gathering in the current prototype DSS is realized by the system administrator, on line and via service calls. Data 2007, Georgia, after the war 2008, Uganda IDP returnees, 2008, Goma and DRC housing and schools for returnees, 2009. Modeling and content management in the DSS need to be realized and maintained in a controlled, secured environment.

The prototype DSS provides advice in type and quantity of shelters/ shelter items and offers suggestions/ advice, regarding aspects that are not included in the shelter solutions, but influence shelter aid, as healthcare. The structure of the DSS needs the possibility that the system can be expanded with additional abilities as advice on policy level, shelter materials, shelter parts, rubble management, waste management, logistics advice, domestic items, energy, water and sanitation. The DSS presents a structured overview of needs for a shelter in a specific situation. The DSS needs accurate data on solutions, including local solutions to provide advice for optimal, tailored post- disaster shelters.

As commercial interests hamper objective advice regarding the optimal shelter solutions after a disaster, the Decision Support System needs to be non-commercial.

The DSS is required to be able to adjust advices. For choosing the most optimal shelter regarding logistics aspects of shelter aid for example, the system needs to make a loop. As Figure 1 shows creating a loop/ going forth and back are only possible with an extra rule that makes the program more complicated that needs a more powerful engine and is slower in usage.

Fig. 1 creating a loop

In this model we add sub decision rules. As in post- disaster shelter aid the structure can become complex, a large tree of connected decision rules will appear. If maintenance of the tree cannot be realized in programming level, a time consuming process will occur. The need for system flexibility and easy maintenance becomes clear by this model.

The optimal shelter can be defined as the optimal shelter regarding absolute functionalities or the optimal shelter including extra parameters as delivery time, environmental and local economy parameters. The DSS needs the abilityto switch forth and back between these options.

In addition to logistics module, additional modules as water and sanitation module, a design module, energy module, waste module and a rubble module the affect the quality of shelter aid, are to be implemented in the DSS. These modules need to be connected to the DSS and need to be tuned into the system. This means that system flexibility and system capacity to handle complex tasks are to be included in the list of characteristics for a DSS.

V. DATA CONNECTION- ENTITY RELATION DIAGRAM

To create the prototype DSS, we use an Entity-Relationship Model (ERM), an abstract and conceptual representation of data, that produces a conceptual scheme or semantic data model of a system, often a relational database, and its requirements in a top-down way. Diagrams created by this process, Entity-Relationship Diagrams (ERDs), are the blueprint that explains motivation for the advices that the DSS suggests.. While developing the DSS we formulate the characteristics of the ideal DSS. Discovering the imperfections in the prototype DSS while developing and testing the system, is used to formulate the characteristics and the requirements for the Decision Support System.

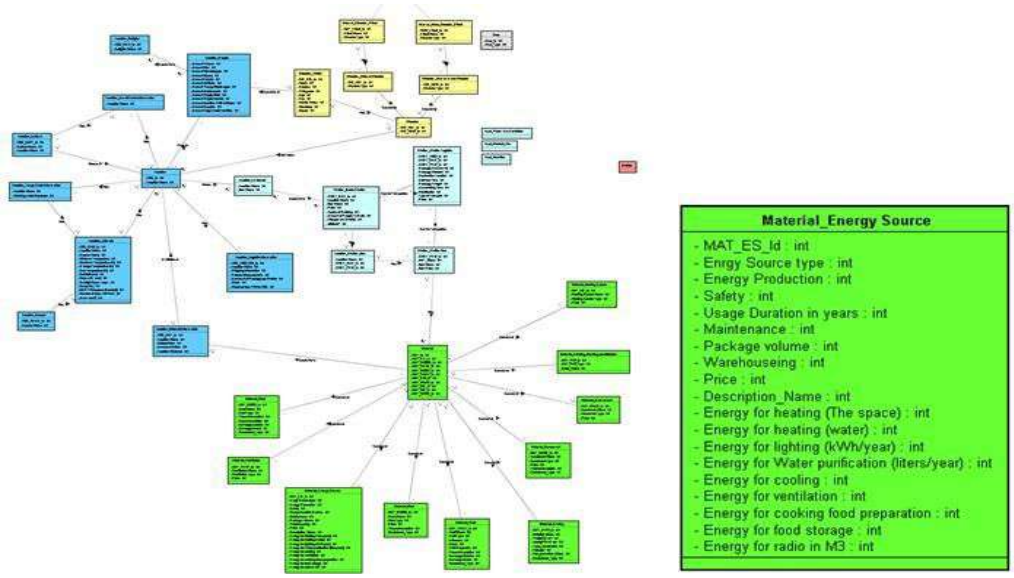

Fig.3

The section "Location" refers to all geographic information, the user can decide how detailed the data need to be. The tables "Location_Small_Scale_Information" and Large scale information can be used for implementation of GPS functions or other links with usable data in the DSS. In case of location data the data concern master data, available directly at any time while using the DSS.

The section "Disaster" refers to the information regarding the disaster. The database distinguishes between "natural" and "man- made" disasters. Relief organizations participating in relief activities are in most cases defined by the type of disaster: Man-made disasters are mostly handled by the UNHCR as the IFRC mostly is involved in natural disasters for example.

The disaster and disaster type entities are used to define the type of disaster, which can matter in the creation of the final solution. A different type of shelter is needed after a nuclear disaster, than after flood for example. Knowing the kind of disaster assists the DSS to provide more tailored decision encountering the "After- Disaster-Effects" as broken roads and aftershocks (the need to sleep outside) directly after an earthquake or periodic reoccurring and inaccessible roads due to floods. The different kinds of disasters are saved in the disaster entity.

Data about the beneficiaries is gathered in the section called "Disaster_Benificiary". Different questions are to be asked by the DSS when the user is a beneficiary or when a user is a professional shelter expert.

The solutions will be structured in solution section. The shelters are to be registered with all the relevant technical specifications. On the level of shelter parts and materials the material specifications will be gathered. Local (construction-) materials, shelter items are available via section local materials.

A log-on system creates different levels of access as administrator, user|buyer/ shelter expert/ beneficiary and user| vendor/manufacturer/designer.

The basic elements in the DSS design ERD are:

- Region information (continent, country, region, temp_details).

- Questions and the provided set of answers (example: questions, answer_electricity, answer_help, answer_policy, answer_provided, answer_refugees).

- Sessions and session answers (solution_temp, sessions, answers, disaster_type, disaster).
- User information and permissions (organization, user, level).
- Sections that have no direct connection with other entities, except for the shelter entity, these sections are used in specific processes in the DSS and serve for data storage and retrieval.

In the current prototype DSS, certain regions can be updated automatically through the administration panel, using information from the Netherlands weather service (KNMI). This call will be realized through an API. The system can work with temp_details entity, which contains the specific temperature information for a certain period. Currently only the mean temperature is used in calculations in the DSS.

The decision rules

The DSS makes decisions based on the disaster and location data, if A then B and if A and C then F for example.

In the current version of the system the decision rules are hard-coded. These rules determine whether the system suggests shelter solution A and not shelter solution B.

The advantages and disadvantages of hard coded or dynamic decision rules, in case of nested rules for example, are to be investigated and balanced by the IT specialists while developing the final DSS. The need for flexible rules has been expressed by the current developers.

Business Process Modeling Notation

In the Business Process Modeling Notation (BPMN), the decision making of the system is structured. Figure 3 is an example how the workflow structures the steps that are taken by the DSS. In this example, the logistics workflow, once the disaster location and the most suitable shelters are identified, stock location and the package size will be determined. This information will be used by the DSS to define the optimal logistics for the distribution of the shelter.

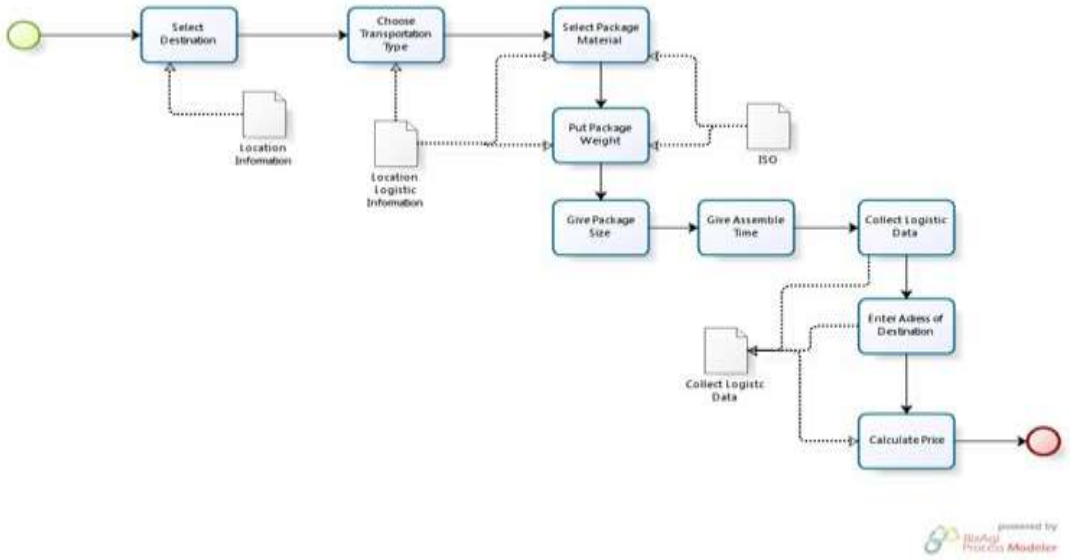

Fig.3 sample workflow

In addition to a report of the effects of the disaster provides advice on the measurements that are to be taken and provides the specifications that the shelters have to meet to be chosen as shelter solutions for each specific situation.

As a logical consequence of this approach, all relief agencies will be provided with the same shelter advice. The organizations will be able to choose the optimal shelters for each situation. However the stock of the 100% optimal shelter for a disaster is not unlimited. In case of shortage of stock, the organizations have to accept second best choices, rating approach. The DSS cannot solve the problem of competing relief organizations to be the first or the best. A DSS with an on- demand design module can address this problem by offering the possibility of assembling tailored shelters and ranking possibilities.

In the evaluations phase, the reports provided by the DSS will transparently provide an overall report of the disaster. In addition to an increase of efficiency and time saving producing a report by the DSS prevents the competition among relief organizations to be the fastest and the best, and therefore the price augmentation.

System data

Reliable data gathering, data storage, data analysis, data connection, and data security are the key words in the DSS. The DSS needs broad cross cutting data to base the decision advice on. Data gathering, data storage and data security are three key elements. Data accuracy both on-demand and supply side of the infrastructure is crucial for tailored solutions, secure diversity of supply and reduce costs. Fast track analysis is needed to secure supply. Infrastructure capacity and preventing infrastructure Failure are needed for optimal functioning of the DSS. Data management has been recognized as a key factor in optimal post disaster aid by the UN. In the webinar at disaster ready 20 November,2013 Edouard Legoupil and Jad Ghosn of UNHCR presented the results of uniform format in data gathering from the more than thirty NGO's in the field in Syrie. One format optimizes data gathering in time and data accuracy. The results are translated in maps and diagrams. The information management in Syria model can be used in the DSS.

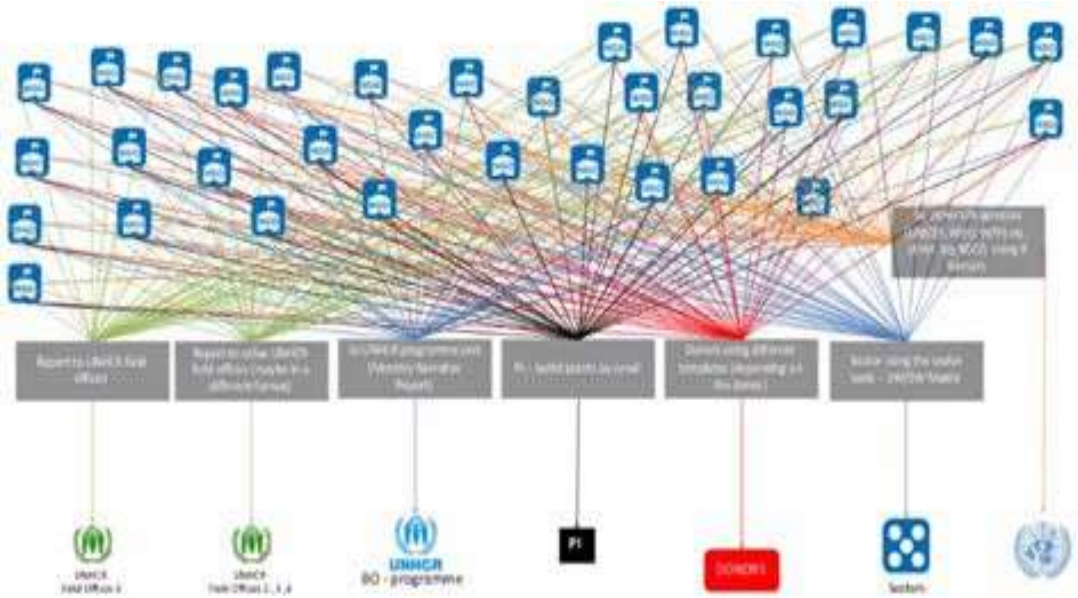

Fig. 4 data from un partners in Libanon, Edouard Legoupil and Jad Ghosn- UNHCR

VI. CONCLUSIONS

Data availability in decision making, finding data that are needed for decision making, finding data that is free for use, or paying for data, identifying useful data and converting data into value are key elements in the a DSS for post disaster (shelter aid). Data can be not free for use for the reason of security, competitiveness or political gain. Open data offer compete, timely, primary, accessible machine processible data for reasonably reproduction costs, however the legal aspects of privacy and security are to be investigated.

Objective data gathering, reliable data storage and Data security are the key elements for optimal functioning of the DSS. In addition, in specific case of post disaster shelter aid, data uniformity is vital for uniform shelter advice. Challenges of information management and unifying various data gathering systems are currently being investigated by the UNHCR [4].

The basic needs for a DSS are the correct engine, data and infrastructure. When the correct engine is chosen, the DSS needs strategy and data; structured information on the needs and the solutions. Location data, disaster data and solution data are the sources that are consulted by the DSS. A profound maintenance of the system and the accessibility of the DSS for the users are the key elements for acceptance of the DSS as a tool by the users. This includes a reliable infrastructure. Clear rules that connect the needs and the solutions together and performance standards [5] are crucial for providing uniform decision making and creating a universal DSS. The DSS breaks the complex variables in post- disaster emergency shelters down into simple rules, and is able to combine the results into complex decision advice that is needed to provide a tailored solution for each disaster.

In addition to the preliminary requirements that evolve in the process of developing the DSS that provides optimal shelter advice for each post disaster situation the DSS needs strategy to connect the data and human resources-specialists: Designers, ICT and shelter specialists and specialists that is able to formulate the strategy, to make rules, to convert data into value.

As the DSS is to optimize the quality of shelter aid for the beneficiary, the understanding of the local

culture is a major factor in Post disaster emergency shelter relief. In addition we need clear standards and a framework to work with.

In all cases a DSS is limited to being a tool to assist in decision making. Education of the beneficiary and training the shelter experts are vital for optimal post disaster aid. The involvement of untrained volunteers can hamper the efficiency of the rescue teams. The DSS needs data on alternative approaches. Reduction of the amount of NGO's for example can be a result of implementing a DSS. The DSS can choose for military assistance in occasion:

In joint humanitarian operations, the civil and the military organizations need to cooperate under hectic situations. The discussion if the military are to be involved in the direct aftermath of a disaster as they are well trained and can react efficiently is a political discussion that is related to autonomy and security of the affected country. However, in rubble management for example the military can contribute to a fast and efficient start of the aid operations. Professionalism and preparedness in post disaster relief and in specific post disaster emergency shelter relief are the key elements for optimal post disaster aid. In addition, approaching disasters as catalyst for changes and innovation in the affected communities to increase preparedness is to be seen in relation with timesaving, cost efficiency and higher quality [6]. As the military are trained and are professionals, and as they have a secure source of income and casualty insurance, the military participation can be investigated as a cost- reducing factor that contributes to the increase of professionalism of post disaster shelter aid. Efficient rubble management in combination with educating and involvement of local population can result in a sustainable post disaster shelter solution.

REFERENCES

[1]. Kennedy , J (2008). Dissartation Delft University of technology.
[2]. IFRC, (2011). Annual report Shelter and Settlements.
[3]. Chalinder, A. (1998). Temporary Human Settlement Planning for Displaced Populations.
[4]. Edouard Legoupil, E; Ghosn J. , UNHCR, (2013, 20 Nov.) DisasterReady.org webinar .
[5]. Tafahomi, M. Egyedi, T, Defining Flexible Standards for Post-Disaster Emergency Sheltering, Euras 2008.
[6]. Leon, E. (2008), UN OCHA.