The Need for Long-Term Disaster Recovery Systems

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ABSTRACT

Disasters are an inevitable part or our lives. Much of the work and tools used currently are intended to address the first stage to a disaster which is response. Work related to a later stage, long-term disaster recovery, is scarce and an attempt to offer a business case approach to the implementation of a web-based tool for this stage is discussed in this work. Stages to develop the tool, costs, and benefits are explained as well as some parts of the National Disaster Recovery Framework.

Keywords: Long-term Disaster Recovery, Business Case

1. INTRODUCTION

Disasters are inevitable and part of our lives but there can be a difference in the aftermath of a disaster depending on how prepared a community is to face a disaster and the planning done to recover from it. Preparedness activities contribute to the community's capacity to adapt to disasters and are the first steps that should be taken in order to turn a tragedy into an opportunity.

The stages to a disaster are response, mitigation, intermediate recovery and long-term recovery (National Voluntary Organizations Active in Disaster, 2004). In each stage different activities are performed and different goals are set. The National Disaster Recovery Framework (NDRF) is an approach done by the US government to enhance its actual disaster recovery plans. A web-based tool is proposed to serve non-profit organizations that are involved in the disaster recovery efforts in order to streamline some processes carried out by the organizations but mainly it can be used to recruit and manage volunteers with special skills.

The tool can also help the organizations in different ways by aligning some principles and concepts explained in the NDRF with the workflow. This paper presents an overview of the National Disaster Recovery Framework in section 2, a description of the tool in section 3, benefits of the tool in section 4, the stages for the implementation of the tool in section 5, a financial analysis is presented in section 6, a preview of a short term disaster recovery pattern is presented in section 7, and finally conclusions in section 8.

2. NATIONAL DISASTER RECOVERY FRAMEWORK (NDRF)

The National Disaster Recovery Framework (NDRF) (FEMA, 2010) reflects how recovery from a disaster of a community is supported on a national level. It describes the coordination of local, state, tribal and federal governments, the private sector, and voluntary, faith-based and community organizations that play vital roles in recovery, by assigning roles and responsibilities to each one of them. This initiative was charged to the

Department of Homeland Security and the Department of Housing and Urban Development by the president of the United States.

A Long-Term Disaster Recovery Working Group was created in order to improve the nation's approach to disaster recovery by having outreach sessions that involved a wide array of members from different backgrounds and organizations that provided important and valuable responses on ways to strengthen disaster recovery to the working group. The core principles of the NDRF were obtained by the recommendations made to the Long-Term Disaster Recovery Working Group and is presented next (Long-term Disaster Recovery Working Group, 2010):

- Individual and Family Empowerment – For a successful recovery effort, individuals and families should be able to rebound from their losses and sustain the physical, social, and economic well-being. Empowering people is a key objective for individuals and families to recover from disasters by assisting them with compassion and offering different avenues that contribute to the recovery effort.

- Leadership and Local Primacy – Local governments play the lead role for disaster recovery in their community. However, the federal government can assist when local government is overwhelmed by the disaster and does not have the resources in order to recover from it, or when the impacted area is of primary federal jurisdiction or national security.

- Preparation for Recovery – For a disaster recovery effort to be effective, preparing for it before it happens is critical. Pre-disaster planning is important and is for everyone, from individuals to families, businesses, and all levels of government.

- Partnerships and Inclusiveness – This principle helps ensure that all voices from all parties involved in a disaster recovery are heard. This aspect is critical at the local level as non-governmental and non-profit sectors are involved in the role of meeting the needs of those affected by the disaster.

- Communications – Leading roles in the disaster recovery effort should promote communication of critical recovery information in a clear and consistent way always remembering to be inclusive of the general public and other stakeholders involved.

- Unity of Effort – Resources intended for the recovery effort should be allocated to the priorities the community, in consensus, have pointed out. All in a transparent way using a planning process to fulfill the recovery effort.

- Timeliness and Flexibility – Timely recovery activities are keys to a successful recovery plan. These plans should be adaptable in order to meet unmet recovery needs.

- Resilience and Sustainability – The implementation of mitigation and resilience plans that can minimize the hazard of a community and strengthen its ability to withstand and recover from future disasters is important for a successful recovery after a disaster.

The building blocks for a successful recovery from a disaster is the combination of structure, leadership, and planning with the involvement of key stakeholders and a realistic plan of action and its final outcome.

The framework defines five elements that enhance the recovery effort which benefits the community by speeding up the process. These elements are (Long-term Disaster Recovery Working Group, 2010):

- Key recovery principles

- Roles and responsibilities of the recovery coordinators and other stakeholders

- Coordinating structures that facilitates communication and collaboration among all stakeholders

- Guidance for pre and post disaster recovery planning
- Overall process by which the nation can capitalize on opportunities to rebuild stronger, smarter, and safer communities

The framework sets a system intended to coordinate and manage operations aimed to recover from disasters in order to deliver recovery assistance to the impacted communities. This framework helps to unify the efforts in a coordinated way involving the different stakeholders in a disaster for an effective recovery. To unify efforts it is important to define clear roles and responsibilities among the participating stakeholders pre and post disaster. The framework advocates for pre-disaster preparedness as it is a way for communities to make the recovery process more efficient and the difference in turning a tragedy into an opportunity. Timely decisions and actions taken during the response stage influences the outcome of the long-term recovery effort in time and in money which are key resources for the recovery of a community therefore the importance of a guideline reflected in this framework.

Some essential concepts defined in the framework are intended to guide the participating stakeholders towards a successful recovery from a disaster. These concepts are (Long-term Disaster Recovery Working Group, 2010):

- Defining roles and responsibilities for all stakeholders and participants
- Providing a consistent recovery leadership for coordination and communication
- Establishing a scalable and flexible organizational structure for coordinating recovery assistance
- Promoting local economic recovery by striving to direct federal disaster funds to local businesses within the declared area when warranted
- Engaging in pre-disaster recovery planning and other recovery preparedness, mitigation, and community resilience-building work
- Engaging the public-private partnership under the National Infrastructure Protection Plan (NIPP) to facilitate broad coordination and information sharing among all levels of government and private sector owners and operators of critical infrastructure
- Facilitating post-disaster recovery planning, opportunities and resources to rebuild a strong, sustainable, and resilient community
- Developing and capturing best practices, tools and metrics for:
    - Impacted communities to develop recovery priorities and measure recovery progress and outcomes against their agreed upon objectives
    - Governments and voluntary, faith-based and community organizations providing assistance to track progress, ensure accountability, and make adjustments to ongoing assistance
- Establishing guidance for the transition from recovery back to steady-state, including the shift of roles and responsibilities.

This framework is applicable to all kind of disasters and recovery activities and can be adapted for different levels of needs and is a key guiding source for participants and stakeholders and the cooperation among them.

Some success factors that may affect in a positive way the recovery effort are listed next (Long-term Disaster Recovery Working Group, 2010):

- Citizen engagement, public participation, and public communications – This success factor

- Decision-making and coordination
- Coordination and integration of community recovery planning processes
- Recovery management
- Financial/Acquisition management
- Organizational flexibility

3. WEB-BASED LONG-TERM DISASTER RECOVERY TOOL

The tool is aimed to help, in first instance, a non-profit organization which plays a vital role in the recovery of impacted communities. An important aspect of the organization that is planning to implement this tool is the value of the work of its volunteers and the expertise of the organization in recovery planning, financial support, and recovery project implementation.

The non-profits can directly address local community's needs where government and resources are not able to reach. This type of organization is necessary to ensure the participation and inclusion of all those affected in the disaster and advocates for all those members of a community with needs such as children, elder people, and underserved populations.

The objective of the tool (web-based application) is to help recruit and manage high skilled volunteers to lead an effective and organized long term disaster recovery effort. A derived result of the tool is to use it as a clearing house for the resources available in the organization and to create an electronic infrastructure that the organization needs. Every family that the organization works with is a case and with the help of the infrastructure there can be an effective track of those cases. All this combined helps the organization bring more funding as an image of seriousness and responsibility towards the community starts to build and a more transparent accounting of actions is possible.

The idea of the project comes from a necessity the organization has. This project is described as "visionary" (Beckman, 2010) by the organization's Director as it would help streamline the actual process of assigning volunteers to specific jobs given the skill he or she has, and to accomplish this it is necessary to share information of the volunteers among the organization members through the use of the project tool.

A big challenge that the organization faces due to the lack of an optimized process to locate volunteers in jobs and a lack of an underlying framework is that volunteers leave as they see there is no work for them. With the use of the tool there can be a previous relationship with the volunteers and information of the skills they have is obtained so there is information before hand of what type of volunteers are available in order to optimize the process of assigning jobs depending on the skills and number of volunteers. This new process may replace the long lines of volunteers approaching a table to specify their skills and see if any job is available.

4. BENEFITS OF THE TOOL

The main purpose of the non-profit organizations is to rebuild and reconstruct after a disaster and to satisfy unmet needs of the most vulnerable population. With the help of the tool, the organization may optimize the money granted in order to aid more victims and in a better way after a disaster. This can be done by optimizing parts of the process of the Long Term Recovery Stage.

To start, after a disaster occurs and during the Recovery Stage, a planning phase is made by the organization and local government members. In this phase major decisions are taken regarding satisfying unmet needs and rebuilding and reconstruction based on the monitoring made during the Recovery Stage and the damage

assessment of the disaster. An action plan is built and estimates are calculated in order to face the Long Term Recovery Stage. With the use of the new tool, volunteers with special skills are contacted before the Long Term Recovery Stage starts in order to know if they are available to help. By knowing the number of volunteers available and their expertise before the rebuilding and reconstruction begins, time and money can be saved by assigning the volunteers to specific jobs before the volunteers even get to the place of the disaster.

The money saved by managing efficiently the volunteers can be redirected to other tasks for the recovery process. With a better allocation of the local resources a stimulus to the local economy begins which is fundamental after a disaster.

The tool offers also a new pool of talent for the recovery efforts that the organization does not have in the present. The first pool of talent comes from a consortium database which is a compendium of institutions and people (students, teachers, professionals) engineer-related and with engineering skills that are members of the consortium. As experience is gained and new partnerships are made the pool of talent may expand to incorporate volunteers with many different types of expertise.

As a disaster is addressed and the recovery plan is put into action and terminated, there is no apparent need can help and lead new volunteers as they are more prepared, saving more money and time in the Recovery Stage. This can be extended to incorporate the Federal government to grant scholarships to those recurrent volunteers which would help the government as a payback of the scholarship as most of the scholarships granted are not paid, hence creating a strong underlying infrastructure the Coalition needs to better address the community when in need.

5. WEB-BASED TOOL PROJECT STAGES

The project is divided into four stages: Domain Analysis, Analysis and Design, Implementation, and Deployment and Testing.

The Domain Analysis Stage serves to get familiarized with the organization's working environment. The purpose of this stage is to get all the understanding of how the organization manages the long term recovery efforts and to be able to pass all the concepts to an idea of how the web-based tool should work. In this stage the functional and not functional requirements are established. In this domain analysis it is important to get an insight of the actual systems the organization works with. In this process the presence of a knowledgeable member of the organization is highly needed.

This stage is important for the success of the project because it is here where the ideas, concerns, and basically all the project is conceived. Special care has to be taken into account when deciding the reach of the project, if requirements keep adding it is highly probable that the project will fail as the complexity may increase.

The Analysis and Design Stage is the part of the project where the technical details are defined. In this stage all the conceptual design of how the project should be implemented is decided.

The Implementation Stage is the actual process of turning the conceptual designs to the tangible tool. Following the guidelines from the previous stage the project is built taking into account the different parts the project is composed (code, database access, communication among components, data structure).

The Deployment and Testing Stage is the final part of the project. After implementation is finished the tool is deployed in an environment similar to where it's going to be used and tests are run in order to assure the quality of the tool. For the tests it is important that members of the organization are involved as they are the final users. Final corrections are made and the tool is deployed so it can be used.

6. FINANCIAL ANALYSIS OF THE PROJECT

Two types of students can be part of the project, those that will volunteer as the project may be part of some course initiative and the students fully dedicated to the project as part of their thesis. This second type of students

are likely to receive a grant which in the case of a MSc student, the maximum amount is 18000 usd a year and a PhD student is 22000 usd a year. Also a tuition waiver is added and overhead costs represent 25% of the student salary and tuition for using the facilities.

Table Domain Analysis

Stage 1-Domain Analysis			
	Cost (per year)		
Paid Students MSc	18,000		
Paid Students PhD	22,000		
Tuition Waiver	7,200		
Overhead	25%		
Executive Director Organization	50	USD/hr	Estimate
Number of hours Exec. Dir.	20		
Duration of stage (in years)	1.30		
Project Staff			
MSc	1		
PhD	0		
Volunteer	0		
Executive Director Organization	1		
Total cost			
Stage 1	42,250		

In Stage 1 the Executive Director of the organization will use approximately 20 hours of her time in order to explain how the coalition works and everything there is to know about it. The approximate duration of this stage is 1.3 years or one year and four months. Involved in this stage is an MSc student with a grant.

In this stage all the definitions and vocabulary are agreed upon and a document is created with the definitions, vocabulary, and requirements as to have an official agreement between the parts involved in the project with the reach the project is going to have and how it is going to be developed (timeline, members involved).

Table Web-based Project Analysis & Design

Stage 2-Web based project Analysis & Design			
	Cost (per year)		
Paid Students MSc	18,000		
Paid Students PhD	22,000		
Tuition Waiver	7,200		
Overhead	25%		
IT Specialist organization (yearly wage)	65,000	USD/y	Estimate

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Number of hours asigned to project (IT Specialist)	10
Duration of stage (in years)	0.4
Project Staff	
MSc	1
PhD	0
Volunteer	1
Executive Director Organization	0
IT Staff Organization	1
Total cost	
Stage 2	11,350

In Stage 2 an IT Specialist of the organization will use approximately 10 hours of his time in order to explain the technical details of the systems they uses in order to align the project with the organization's systems. The approximate duration of this stage is 0.4 years or five months. Involved in this stage is an MSc student with a grant and possibly an MSc volunteer student.

In this stage use cases are created according to the information collected in the previous stage. Another document containing class diagrams, use cases, data structure definition, logic relation among the components, time tables, database structure, connectivity diagrams, and other useful information is created.

Table Web-based Project Implementation

Stage 3-Web based project Implementation			
	Cost (per year)		
Paid Students MSc	18,000		
Paid Students PhD	22,000		
Tuition Waiver	7,200		
Overhead	25%		
IT Specialist Organization (yearly wage)	65,000	USD/yr	Estimate

Number of hours assigned to project (IT Specialist)	0
Duration of stage (in years)	2.5
Project Staff	
MSc	4
PhD	1
Volunteer	2
Executive Director Organization	0
IT Staff Organization	0
Total cost	
Stage 3	406,250

In Stage 3 four MSc students will be involved, one PhD student and possibly 2 volunteers.

Using the documentation from the previous stage the project is developed. For this particular type of project, given that it starts from zeros is going to be developed using SDLC in the context of an information system as a highly structured and formal process in the designing and development part.

Table Web-based Project Deployment & Testing

Stage 4-Web based project Deployment & Testing	
	Cost (per year)
Paid Students MSc	18,000
Paid Students PhD	22,000
Tuition Waiver	7,200
Overhead	25%

Executive Director Organization	50		
Number of hours Exec. Dir.	0		
IT Specialist Organization (yearly wage)	65,000	USD/yr	Estimate
Number of hours assigned to project (IT Specialist)	0		
Duration of stage (in years)	0.5		
Project Staff			
MSc	2		
PhD	0		
Volunteer	1		
Executive Director Organization	0		
IT Staff Organization	0		
Total cost			
Stage 4	31,500		

In Stage 4 two MSc students will be involved and possibly one volunteer. In this stage all the testing of the project is performed based on a guideline from the Organization and additional functional, integration, and stress tests.

Table Project Duration

Project Duration (Years)		(Cost)
Stage 1	1.3	42,250
Stage 2	0.4	11,350
Stage 3	2.5	406,250
Stage 4	0.5	31,500
Total	**4.7**	**491,350.0**

When estimating the duration of each stage several factors were taken into account. As the project is going to be developed by students, longer periods were estimated as students finish and are replaced by new ones. There has to be a process of training which takes time in order for the new member to get familiarized with the project. This time will be greatly reduced as documentation is available for all the stages plus students currently in the project.

In this analysis an estimate of the budget, with the inflation projection until 2024 over the amount estimated of budget, of the Organization is calculated based on the 2009 – 2010 Annual Report of the Organization. An analysis done of possible savings for the Organization using the web-based tool for recruiting and managing, and for certifications is around 4%. This savings are not for the Organization but are resources saved from the use of the application that can be allocated to other initiatives.

The Economic Benefits (Pearson, 2010) can be calculated by subtracting the savings from the TOC and by calculating the approximate Internal Rate of Return, 19%, the project is viable.

7. PREVIEW OF THE SHORT TERM DISASTER RECOVERY (STDR) PATTERN

Intent – Provide to the community actions and activities (life saving, life sustaining, and property protection) intended to reduce the threats to life and property after a disaster. These activities influence long term recovery efforts as it creates the environment for long term recovery activities to begin after immediate impacts are managed and contained.

Context – The pattern can be used in places and situations where a disaster occurs whether it is natural or man-made.

Problem – Just after a disaster occurs or even before it happens, several actions must be taken in order to reduce loss of lives and property. This problem is affected by the following forces:

- *Decision Making* – Decisions have to be made before, during, and after a disaster in order to minimize the impact of it. These decisions, taken by different actors involved in the response stage, are based on the unique characteristic of a disaster, the community affected, and all the available information at the moment.

- *Organizations* – Different organizations are involved in the response stage and have specific roles and tasks.

- *Coordination* – Coordination among different organizations that work in the response stage is vital to create a synergy between them in order to favor the preserving of lives and properties. Also, coordination is important between organizations that come after in the long term recovery stage and organizations in the response stage in order to create a viable plan for recovery.

Solution – Create a software system that can be used for decision making and coordination of the different individuals and organizations involved in disaster recovery, and tracking of the status of people, needs and resources.

Known Uses – Some software tools intended to address short term disaster recovery activities are available in the market. Some of these tools are:

- *EOC System* – Is a series of Microsoft Word and Excel files provided in a template form intended to be used as a manual process derived from FEMA's Emergency Support Functions and the Incident Command System. The main target of this tool is municipal and county emergency agencies.

- *E-Team* – A multi-user, network-based system that uses web browsers as client software. It is designed to deliver a wide range of features to plan and manage incident/event information.

- *WebEOC* – An application that offers a wide variety of features for planning and managing incident/event information in real time.

Consequences

The advantages of the pattern are:

- *Decision Making* – Information gathering helps different roles make sound decisions during the response stage and helps prepare long term recovery activities.

- *Coordination* – Different organizations in different stages can work smoothly and create synergies to benefit the impacted community.

This preview of the STDR pattern is the basis to create a long term disaster recovery (LTDR) pattern. The two patterns are complementary and are intended to be used as a guide for the recovery efforts after a disaster.

8. CONCLUSIONS

The NDRF is an initiative to enhance the actual disaster recovery plan the government has by providing guidance to the different participants in a disaster in order to assist the impacted communities. The web-based tool is a means to help organizations involved in a disaster recovery effort to align their actions to deliver faster results and it can also be used to integrate some of the principles and concepts explained in the NDRF to the organization's workflow.

As the numbers reflect the project is a good choice for the Organization. Even though the project comes from a necessity the advantages and benefits exceed the investment. More than benefits to the Organization, the real benefits will reflect on the community as the resources for rebuilding and reconstruction can be efficiently reallocated. Starting time for the recovery efforts will shorten and the volunteer pool talent will also help speed up the recovery efforts.

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