

Sizing the Infrastructure and Architecture of Information for Risk Management

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ABSTRACT

In Costa Rica, there is an acceptable work in the area of risk management and an advanced system of emergency response. However, it is recognized and accepted the lack of a comprehensive shared approach to manage disaster risk that involves the prevention of disasters in the National System for Disaster Risk Management (SNGR in Spanish). One of the main needs is the lack of a shared and accessible national platform of timely and updated information for risk management. Considering this weakness, we submitted a proposal to the authorities of the University of Costa Rica (UCR) and the Consejo Superior Universitario Centroamericano (CSUCA) that was sponsored by the Swiss Agency for Development and Cooperation (SDC). The project seek to develop an information platform which uses a Content Management System with meta data, semantic, taxonomic and georeferenced information for local, regional and

national levels in Costa Rica. The system also serves as a network for data producers, analysts, users of public and private institutions, and of the population in general.

Keywords

Infrastructure, disaster risk management, information shared, open data, semantic, metadata, make decisions.

INTRODUCTION

Over the past 10 years, Costa Rica has developed a system for emergency response which is a model in the Central American region as a product of significant progress in the regulatory field at the national level. It is the creation of a new national law for risk management and emergency care (Legislative Assembly of Costa Rica), Law no. 8488, in 2006. However, that system has not had a holistic approach which conceives the integral risk management as a major corrective and prospective component of relevance importance in development strategic objectives preventive, emergency attention and resilience after an event.

To reach significant and sustained advances in national vulnerability reduction, the Costa Rican government must accelerate their investment in risk management and disaster prevention, mainly in three basic areas: 1. information infrastructure, 2. training in risk management, and, 3. consolidation of the SNGR. The proposal named “Sizing the infrastructure and architecture of information for risk management” (DIAGeR in Spanish) discuss the necessary requirements for the

design and operation of an integrated shared information platform for disaster risk management.

Specifically, the DIAGeR project aims to implement a national information platform that standardizes information addressed to local, regional, and national populations. This platform would also inform institutions or organizations that serve producers of data, analysts and users in public and private institutions. The standardization platform is designed for people, leaders, companies and organizations to make the best decisions possible during times of crisis and/or risk management.

This platform, currently in the process of development, is characterized by creating an integrated facility based on use of data, equipment and collaborative user network's protocols. This criterion enables emergency management supported by timely and accurate information. In addition, the platform provides information required for the analysis of public investments needed to reduce the most important vulnerabilities in the economic and social system of Costa Rica.

Regarding the paper organization, we first contextualize the motivator and current scenario that allows the implementation of this kind of project in Costa Rica. Secondly, we focused on the problem justified by the need for information that supports the decisions makers. Third, we exposed the required methodological mechanisms so that the DIAGeR can be available to the population of Costa Rica, and finally, we close with two sections: comparison with other international experiences and discussion and further work.

CONTEXT AND MOTIVATING SCENARIO

Approximately a decade ago, the SNGR started a strengthening of the disaster risk management. However, given the current state of Costa Rica's Risk management capacities, it is evident that the national information infrastructure is not adequate. There has not been full integration of the different areas of information needed to make relevant decisions in areas such as: economic issues, social issues, threats, alerts, demography, population, health, environment, land uses, aerial and satellite images, risk maps, publications, audiovisual material, as well as other aspects. The prior informational categories allow decision makers to identify and reduce

vulnerability, minimize human and economic losses and social and resilient actives at a national level. The proposed platform (standardized, open, timely and accessible) is one of the main needs on a national level. Its creation and implementation shall allow the Costa Rica to qualitatively and quantitatively improve the analysis of disaster risks given the inclusion of vulnerability, hazard and risk maps throughout a shared platform.

During the 2010 National Congress of disasters in Costa Rica, participants identified the absence of available and "share-able" information for decision-making. This concern was proposed by Adamson and Castillo (2012), who mentioned the need and importance of having a space where scientific documentation can be integrated with local, national, and institutional elements to create a comprehensive decision-making platform for the field of risk management.

The absence of a national platform, and spaces of interaction (not only information), it not allows the generation of planning mechanisms for appropriate risk management process. Uncertainty about the actions undertaken within the SNGR, obstruct to make accurate decisions, based on dispersed actions from different institutions also the use of empirical actions of who formulate the public policy (Turner, A. 1976).

ISSUE AND JUSTIFICATION

The absence of a risk management and information platform in Costa Rica triggered the DIAGeR project. The information system could give the scientific community of Costa Rica an opportunity to collaborate and create something relevant and extremely useful. Historically, Costa Rican public universities have been pioneers in generating scientific information on risk management. However, as the institutional name indicates, the universities have been designated to perform educational studies and research, eliminating the possibility for universal access users, as well as the consolidation of information and connectivity shared in one location.

Faced with this challenge, this project promotes continuous flow of information between risk management stakeholders, students, academics, risk managers, decision makers, Costa Rican government institutions and citizens in general. In theory, more individuals and entities will have the ability to monitor and reduce disaster risks in our country.

This project responds to the need of the Costa Rican society of mitigate and prevent disasters, a task that involves to all the public and private institutions and civil society. (Figure 1).

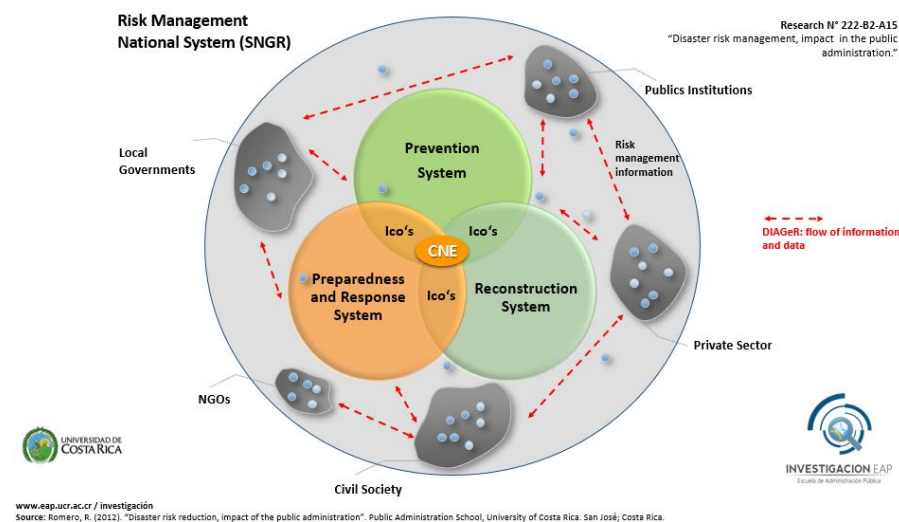


Figure 1. Risk Management National System

Related to the above graphic, the 329 public institutions in the country manage disaster risk within the everyday processes of governance. Therefore, the platform provides all the information they require for efficient work in this matter.

The figure 1 shows the SNGR interaction with stakeholders and how each generates information flows and specific data (dashed lines) between different subsystems of risk management for decision-making at national, institutional and local level. This information is supplied to the DIAGeR different users of the platform for risk management.

The development project has as main objective to significantly reduce the costs of disaster risk analysis as an input to the planning and governance regarding disaster risk management. During the period 2005-2011 the data recorded in emergency disaster economic losses (hydrometeorological and geotectonic) was approximately USD 1.130,09 million (Ministry of Planning and Economic Policy and Ministry of Agriculture and Livestock. 2013). This information indicated that the need to consider risk management was a governmental decision

As a social project, implementation and initial investment are determined by a cost-benefit analysis in order to establish the opportunity cost to implement the project. The social approach to enforcement requires a continuous process to qualitatively and quantitatively improve the vulnerability reduction within the country.

METHODOLOGY

The DIAGeR project is applied qualitative research, which lets it select the media that is most appropriate for achieving the objectives of the research. This selection enables a relationship between the subject (risk managers) and the object to be observed (risk management), i.e. obtaining results in social interaction spaces that surround the management of disaster risk and information generation for decision-making at local and national level.

This approach requires the collection of data to interpret social phenomena or processes. According to Hernandez, Fernandez and Baptista (2006), qualitative research is based more on an inductive process where it explores and describes to generate theoretical perspectives using unstructured techniques. This flexible method interprets the findings holistically, which is intended to raise the DIAGeR platform nationwide. For research purposes, the DIAGeR consists of a technical advisory committee raised by the request for information, and a project team,

responsible for directing and operationalizing these requirements in an information platform. See point [1] Figure 2 (Flowchart). The development of an information platform requires the creation of information processing spaces for disaster risk management.

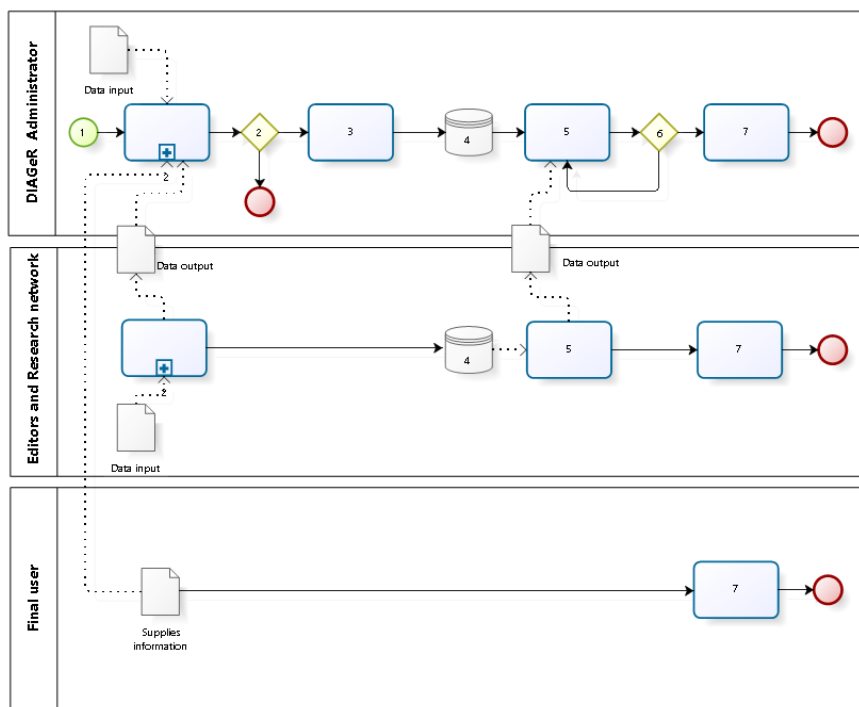


Figure 2. DIAGeR Flowchart

DIAGeR is specifically structured as follows:

1. For a documentary validation and analysis of information on the minimum and necessary requirements for the management platform DIAGeR.
2. Recording information rating to identify and reduce risk management of emergencies and disasters, and to access: geographic, temporal, institutional and functional dimensions.
3. The functional component designs and provides user profiles with their respective functions and scope in the management of information within the platform.
4. The information provided by users (5) is associated with other types of information available and validated in the system (6) to generate knowledge needed in decision-making in risk management (7) which helps prevent and mitigate the impact of disasters.

Information classification

The DIAGeR system has four access dimensions; *Geographic, Temporary, Institutional and Functional*. Each access dimension refers to a specific information process or product; this can be geographical process, for instance; location of the risk management process (county, district, etc.); also can be the moment of the process, for instance; *risks identification, risks reduction or emergency management*. Further, the system classifies information about institutional process as; *vulnerabilities identification, prevention, recovery*. Finally, the system classifies specific products as *maps, documents* and others. These products will be classified by its function. In order to classify these data, the system will use a taxonomy that is in developing process (Figure 3).

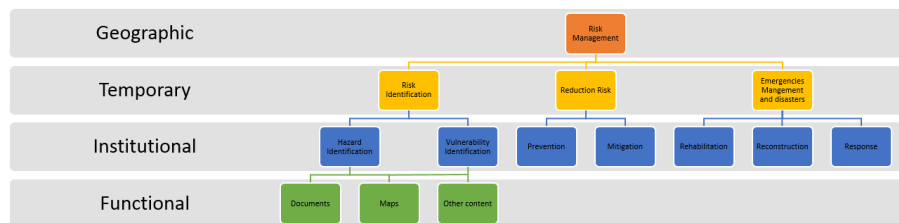


Figure 3. Information classification diagram

User roles

Into DIAGeR system the information generation process in risk management, requires different levels of accessibility and management. The “roles have always been a key part of any structured group communication process” (Turoff, Hiltz, , Bañuls, and Van den Eede, 2013), identified by the user in charge of supply and updating information (Turoff et al, 2013). The information access is directly related to the requirements of each applicant user profile.

Registered content management system registered users identified are classified roles according to their functions. They can be user: administrators, editors, maintenance, research network and final users. Information generators have access to information creation by participation in civil society, public or private sector, subcategorized by institution or individual risk managers. Last one type, are user who generates information and may publish information on the sector and institution to which it belongs.

According to needs, publishing information on the platform involves validating, approving and editing such information. The end user only has access to read and comment on the information published in the DIAGeR. The DIAGeR modeling take into account inserting, processing and sharing of data and information with URI's (Uniform Resource Identifier) and entities (nodes). The URI's and the entities are related each other so that the final user (takers decision) can use the products from different points of view or dimensions (taxonomic and semantic,

for example, special, temporary, institutional and functional about risk identification, risk reduction and emergency a disaster management).

Types of users	Functions			
	Manages information	Supplies information	Valid information	Visualize information
Administrator	✓	✓	✓	✓
Editors		✓	✓	✓
Research network		✓	✓	✓
Final user	✓			✓

Table 1. Types of users and functions

Programmatic development phases

The development model of DIAGeR is a linear framework, which includes the programmatic phases like: analysis, design, implementation, testing (validation), integration, and maintenance (Cataldi, Lage, Pessacq and García Martínez, 2014). It has been seen like the final phase the dissemination and socialization of information. Also, this model is complemented with the prototyping model to capture and evaluate the system, and verify if the functionalities were completed.

For the production and development of the DIAGeR platform, it will install and configure two separate hardware platforms: software development platform and another production platform. The software development platform consists of four servers: one for communications, one for database, one for a web server, and the other for server applications. In each development server have been installed with the SME Server 8.1 (distribution Linux with Red Hat + Centos hybrid) operating system to manage the domain server, the communications server, the web server (Apache 2.0), the database server (MySQL) and with the respective backup system.

In the case of the production platform, we will coordinate with the University Informatics Center to install and configure the system in a Data Center Tier III. Initially this will take place in a virtual web server with equal or better capacity than the development platform; a server with the SME Server 8.1 operating system as domain server and a Gateway with 2 GB RAM, 2.5 GHz processing speed and 160 GB hard drive storage.

Information management methodological phases

Methodologically the information phases and knowledge are separated in four, Figure 3: Phase I is the compilation; inventory and analysis of information on risk management available local and institutional levels, phase II is the validation of information; for the construction and the storage in the platform; phase III, socialization of the information.

The DIAGeR project involves an administration disclosure of the information collected, classified automatically and shared in order to turn it in new knowledge that will be shared through social media (Twitter, Facebook, syndication, internal bulletins and forums) aimed to registered platform partners. This process, along with classroom lectures, allows a collective participation in inherent responsibilities risk management.

Finally, phase IV, monitoring and control of DIAGeR that allows the identification and the fulfillment of the objectives and information requirements.

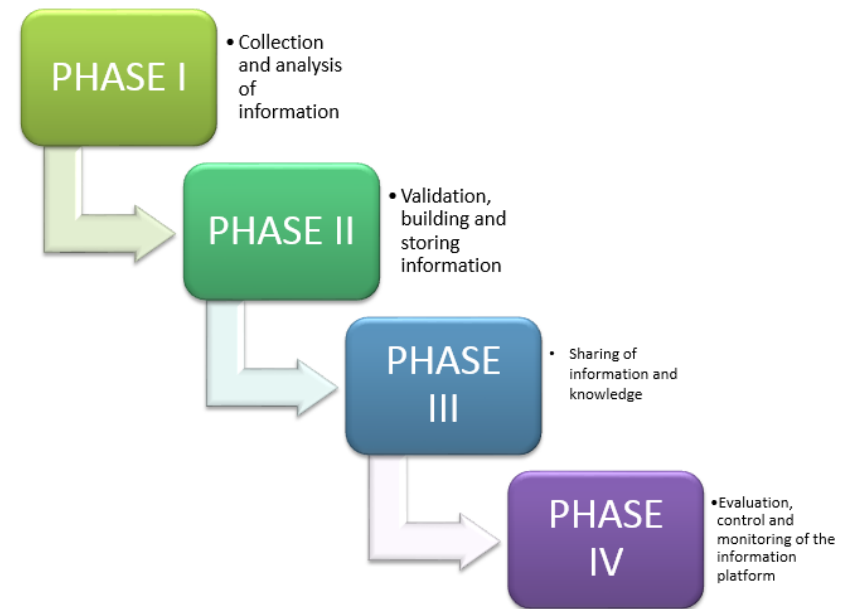


Figure 4. *Methodological research phases*

Gathering information requirements techniques

For the gathering of information, the research process requires different and specific techniques to make the analysis of the relation subject-object and allow the development and implementation of a disasters risk management information platform possible.

Technique	Usability
Observation:	This technique allows for the development process to involve an inductive component, as well as exploring spaces, identifying needs and understanding the environment development dynamics. This technique is essential to define the main national requirements in the risk management arena. The observation is a systemic process that helps obtain information about phenomena or events at the time that they occur (Barrantes, 2009. p. 202).
Interviews:	This technique is important for the project because it allows the exploration of different initiatives carried out at a national and local level. According to (Hernández et al, 2006. p.597) the qualitative interview is more intimate, flexible and open. This type of interview is a kind of meeting to exchange information between the interviewer and the interviewed.
Focus groups:	This technique is considered by (Hernández et al, 2006. p.597) as a kind of group interviews, where the main objective is generating a discussion space and validating information. These occur in group sessions to legitimize the information by risk management experts.

Table 2. Requirements techniques

Other experiences worldwide

The DIAGeR emerges as an example of platforms developed at the national level, which provide information for risk management. The following cases show the opportunity of success and acceptance by the different stakeholders in other countries.

The first case, is an IT based platform in the field of risks prevention and disaster management (DM) in Algeria (Benssam, Nouali-Taboudjemat, and Nouali, 2013). This national proposal involves different organizations to exchange

information in prevention and risk management. Additionally the system works as a control and regulation mechanism at the national level (Benssam et al, 2013).

In other hand, is a similar case but with a prior classification of users in Malaysia, it is the Community Emergency Management and Awareness System (CEMAS) (Murali, Magiswary, Saravanan and Maniam, 2014). This system displays three different spaces for sharing and viewing risk information, according to the needs required by the user.

In comparison with DIAGeR system, both experiences describe above, show the information flows for decision-making processes at national and institutional level. The main objective that pursue the three cases is, definite a meeting point for other stakeholders on the risk management arena.

DISCUSSION AND FUTURE WORK

The DIAGeR aims to become a continuous space of disclosure, validation and maintenance of information that covers the user information demands in the disaster management arena. This project requires the managers of the project to contribute responsibly and to strengthen the decision-making of all sectors that integrate the SNGR. This manager control shall be subject to the publication of usability indicators of the platform that would justify the cost-benefit ratio.

Finally, it is expected that the DIAGeR project promote the generation, exchange and updating of information between the various sectors of Costa Rica.

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